Change toolkit for digital building permit

Deliverable number	D1.5
Deliverable name	Testing phase – final results
Work package number	WP1 The DBP process and changing strategy
Deliverable leader	Fraunhofer Italia Research
Dissemination Level	Public

Status	Final
Version Number	V1.0
Due date	M30
Submission date	01/04/2025

Project no. 101058559

Start date of project: 1 October 2022

Duration: 36 months

File name: CHEK_101058559_D1.5-Testing phase-final results Final

Funded by the European Union

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101058559).

Authors and contributors

Author	Organisation	E-mail
Orjola Braholli	FHI	orjola.braholli@fraunhofer.it
Mariana Ataide	FHI	mariana.ataide@fraunhofer.it
Dietmar Siegele	FHI	dietmar.siegele@fraunhofer.it

Quality control

Author	Organisation	Role	Date
Dietmar Siegele	FHI	WP leader	03/03/2025
Angelo Ciribini	UBS	Reviewer	17/03/2025
Francesca Noardo	OGC	Coordinator	18/03/2025
Silvia Mastrolembo Ventura	UBS	Reviewer	31/03/2025

Document history

Release	Description	Date	Author
V0.1	First draft version	10/03/2025	FHI
V0.2	Second draft after review	18/03/2025	FHI
V1.0	Final Version	01/04/2025	FHI

Contents

1 Executive summary

The present deliverable presents the final results from the comprehensive testing and validation phase within Work Package 1 (WP1) of the CHEK project, dedicated to evaluating and enhancing the digital maturity of building permit processes in local authorities. One of the WP's objectives is to develop a scalable, efficient, and accurate set of tools to allow Municipalities to craft their digital transformation strategies. WP1 encompasses the creation and validation of four primary tools: the CHEK DBP Process Map, the CHEK Digital Building Permit (DBP) Maturity Model (CHEK MM), the CHEK Roadmap, and the CHEK Virtual Assistant (VA). While the Process Map sets an idealised vision for digital permit workflows, the Maturity Model provides municipalities with a structured framework to assess their current digital capabilities and outlines practical pathways toward future DBP digital maturity.

The primary testing focuses on the VA due to its potential to integrate all previously developed WP1 tools into a cohesive, accessible, and comprehensive interface. Testing the VA allowed for practical evaluation of the maturity model's applicability in the municipalities' case-study scenarios, facilitating an understanding of how the users interact with and utilize the model in an operational context. Thus, the VA became the central element for assessing scalability, usability, and practical effectiveness of the maturity assessment methodology developed in WP1.

This deliverable (D1.5) builds upon prior outcomes from D1.4 and extends the testing and validation to include expert-led assessments, expert-assisted use of the CHEK VA, and independent VA usage by municipal representatives from Ascoli Piceno (Italy), Lisbon and Vila Nova de Gaia (Portugal), and Prague (Czech Republic).

Testing results demonstrate the strengths and challenges associated with each assessment method. The traditional expert-led assessments provided nuanced insights into process and organisations, especially beneficial for municipalities with more complex and mature processes such as Lisbon and Vila Nova de Gaia. In contrast, the CHEK VA methods (both expert-assisted and independent) consistently delivered structured and uniform assessments in technology and information domains due to their more objective and clearly defined nature.

The CHEK Virtual Assistant (VA) produced consistent results when expert-assisted, aligning closely with the traditional assessments. However, independent use of the VA revealed challenges, particularly regarding users' ability to accurately draw their own building permitting process and interact with the VA tool. Meanwhile, Independent VA use highlighted the need for improved user guidance, clearer instructions, and enhanced intuitiveness within the VA interface, particularly with the use of BPMN (Business Process Model and Notation) tools. Despite these challenges, participants acknowledged the tool's significant potential while suggested enhancements to better support real-world applications and adoption. Recommendations emphasise a hybrid approach, combining AI-driven scalability with expert-guided accuracy to optimise municipal digital maturity assessments.

This deliverable validates the VA's potential to facilitate standardised, efficient, and scalable assessment of the CHEK Maturity Model. Continuous improvement in user guidance, process mapping functionalities, and integration of expert inputs will further enhance its effectiveness, supporting municipalities in transitioning toward digitally mature, transparent, and efficient building permit processes.

2 Introduction

The digital transformation of local building authorities has become a critical priority across Europe as they strive to streamline services, improve transparency, and enhance citizen engagement. One of the key areas of focus has been the digitalisation of building permit processes, which traditionally involve complex, paper-based workflows and coordination across multiple stakeholders. The starting point of digital transformation often relies on knowing the current state of digitalisation, to be able to have a clear understanding of the limitations and possibilities of the future paths. A maturity model is a structured framework that assesses an organisation's current digital capabilities and outlines future stages; therefore, being a powerful tool that can guide the path for the digital transformation.

The CHEK project[1] is part of a broader initiative to support municipalities in adopting digital solutions to manage digital building permit workflows more effectively. Work Package 1 - The DBP process and changing strategy aims to provide tools to assess the digital maturity and guide building permit process digitalisation. The results of WP1 started with deliverable D1.1[2] that describes the proposed CHEK DBP Process Map (Braholli et al., 2023). This process is the vision for the digital building permit workflow that was used as base for all following activities of the work package, as well as was used as foundation for other work packages of CHEK project (such as WP4).

Further result of WP1 is the CHEK DBP Maturity Model (Ataide et al., 2023), a tool that allows municipalities to assess their digital maturity in the realm of the digital building permit process. The CHEK MM is divided in 35 Key Maturity Areas (KMAs) across the four categories (process, organisation, information, technology) related to the digital building permit process. The development of the CHEK MM is detailed on deliverable D1.2[3]. The creation of the maturity model took in consideration several sources of data and input from professionals in different areas of knowledge, arriving in a consistent tool that was used as the basis for the testing made in deliverable D1.4, and consequently, here in deliverable D1.5. The levels of maturity and their evolution through the KMA take into consideration the ideal digitalised scenario of the CHEK DBP Process Map.

During the creation of the CHEK MM, several professionals gave their input on the content of the model. Consortium partners from the municipalities, software companies, academic institutes, and domain professionals were asked to evaluate the model on the basis of its structure and content. Professionals from the advisory board and Community of practice also had the chance to review and comment on the early versions of the model. The CHEK MM was published after all the comments and inputs were addressed. Further iterations and advancements on the published version are currently under development together with partners from the CHEK consortium and the “European Network for Digital Building Permits” (EUnet4DBP)[4].

The CHEK Roadmap was also developed on deliverable D1.2. By setting the maturity levels that CHEK tools desired to achieve and crossing each goal with the toolkit under development on the project, a list of possible actions municipalities can take to implement the tools and increase their digital maturity with the help of CHEK tools. Similarly to the CHEK MM the CHEK Roadmap also was shared with CHEK partners that reviewed and gave their input on the final product. The CHEK Roadmap is a list of possible actions that can increase the digital maturity of a municipality by using the CHEK toolkit; the toolkit does not include economical or legal recommendations, as they are out of scope

[1] https://chekdbp.eu/
[2] Available at: CHEK_101058559_D1.1_CHEK-DBP-process-map
[3] Available at: CHEK_101058559_D1.2_Maturity-Model-and-Roadmap
[4] Home - eu4dbp.net

from CHEK project. The CHEK toolkit are under the condition that governance and legal aspects facilitate the implementation of a digital building permit process.

Having all three tools from WP1 developed and validated by peers, the next steps to the work on this WP was to create a fourth tool that would combine the previous results in an accessible and friendly manner. For that, the CHEK Virtual Assistant (VA) was conceptualized to allow municipalities to: (1) create their own process maps of the building permit process, analyse the process based on the levels of digitalisation, (2) retrieve the levels of digital maturity using the CHEK MM as a framework, (3) access the CHEK Roadmap with the suggested actions and tools from CHEK toolkit, and (4) have a detailed report of their current levels of maturity. The description of the VA together with the development process are included in deliverable D1.3[5]. The VA was initially though as a digital web-based tool to support Municipalities in setting up their own strategy and implementation plan towards the digital transformation. However, the scope of the WP1 was expanded by combining an Artificial Intelligence (AI) based assistant to fulfil the initial goals of the project together with an innovative solution.

During the development of T1.1 and 1.2, Municipalities had the chance to test and give their structured feedback to the results thus far achieved. The final task of T1.4 stretched this testing to the VA, in order to compare the efficacy and user-friendliness of the tool. This deliverable (D1.5) presents the final outcomes of WP1, meaning the final testing on the tools developed on the work package, more specifically the CHEK VA that uses the CHEK MM as framework. The tests were made using different methods to assess the levels of maturity from the CHEK MM. All the rounds of testing were conducted with four CHEK municipalities: Ascoli Piceno (Italy), Lisbon and Vila Nova de Gaia (Portugal), and Prague (Czech Republic).

The primary objective of Task 1.4 is to test and validate the application of the CHEK DBP Maturity Model using three methods: traditional expert-led assessments; the use of the AI-driven tool — CHEK Virtual Assistant (VA) — by the experts; and the independent use of the VA by the municipalities' users. This combined approach aims to establish a comprehensive understanding of the outcomes and usability of the CHEK MM by exploring how AI-based methodologies can support the evaluation process of the Municipalities' digital maturity.

The traditional expert-led assessment provides a baseline, offering the qualitative insights of the assessment of levels of maturity for each KMA based on the experts' judgment and knowledge of the maturity model. On the other side, the CHEK VA leverages the use of Large Language Models (LLMs)[6] to possibly deliver a more scalable and objective assessment. Discussions on future work related to the CHEK VA will be presented throughout this report.

This report covers the final results of the task's testing and validation activities, continuing the work of the preliminary results presented on D1.4[7]. The methodology adopted for this phase includes semi-structured interviews with municipal technicians intermediated by the FHI experts in one round of testing the use of the VA assistant, while the last round includes the independent use of the VA by municipalities experts. For the independent assessment, users were presented with detailed instructions on how to use the CHEK VA, and their structured feedback was collected to provide user friendliness review. The deliverable presents the detailed results from rounds two and three of testing and discusses the results of round one, two, and three. The three methods to assess the CHEK MM provide results of the maturity assessment of the current building permit process of the four-case study municipalities in the four categories of the CHEK MM (Process, Organisation, Technology and Information). The scores given on the categories with all

[5] CHEK Virtual Assistant is part of a parallel task T1.3 presented at deliverable D1.3.
[6] OpenAI (OpenAI (2024). Available online: OpenAI Platform) models were used on the creation of the CHEK VA, the detail report are presented in deliverable D1.3.
[7] Available at: CHEK_101058559_D1.4_Testing phase preliminary

three method is the quantifiable data that allows the comparison between the proposed testing methods. Thus, elaborating a reasoning to evaluate the efficacy, accuracy, scalability, and user friendliness of the presented tools.

This deliverable presents the methodology of the testing for phases 2 and 3 on Section 3. Section 4 and Section 5 show the results and validation from phases 2 and 3 of testing conducted with the four case study municipalities. Section 6 discusses the findings and establishes a comparison with all the three phases of testing (combining the result of deliverable D1.4). These findings present the final results and insights gained from the complete testing phases of WP1 of the CHEK project. Section 7 concludes the document.

2.1 Scope

This deliverable is part of Task 1.4 – Testing, Validation, and Optimisation, which runs from M18 to M30 of CHEK project (Figure 1). The current deliverable (D1.5) provides outcomes from the testing phase in WP1 that were initiated in the deliverable D1.4. This report covers activities completed thus far in the CHEK project and WP1. The preliminary findings are based on phase 1 testing (D1.4), which includes results from interviews with the four municipalities using the traditional manual-based maturity assessment. The work of T1.4 concludes with the present deliverable, concluding all the tools and testing developed during the work package. The presentation of CHEK VA, the process of development and implementation was done in Task 1.3 and is described in deliverable D1.3.

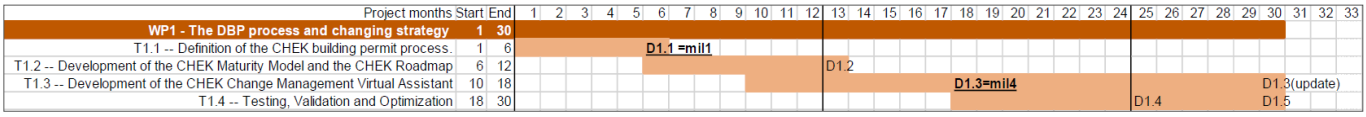


Figure 1 WP1 Timeline

Initially, the goal of Task 1.4 in Work Package 1 (WP1) was to test all four tools developed within this package: process map, maturity model, roadmap, and virtual assistant. However, during the development phase, it became clear that the process map primarily represents an idealised vision for a digital building permit process. Although this vision has effectively guided the consortium's overall efforts, it does not present a tangible product suitable for direct testing. Conversely, the maturity model offers a structured and actionable framework, clearly defining various maturity levels and illustrating an optimal future scenario. This framework can support municipalities in developing strategic plans in a more practical manner. Consequently, the scope of the testing shifted toward identifying a scalable solution that leverages collective insights from WP1 using artificial intelligence. The AI component was not initially within the goals of the CHEK project but emerged as highly relevant due to its potential to drive innovative solutions within the virtual assistant (VA). The revised objective thus became to provide municipalities with an integrated overview, empowering them to strategically plan and effectively achieve the vision outlined by the process map.

3 Methodology

Chapter summary

This chapter outlines the methodology, execution, and analysis of the three-phase testing process conducted in Task 1.4 to validate the CHEK DBP Maturity Model and its AI-supported application through the CHEK Virtual Assistant (VA). The testing involved four municipalities—Ascoli Piceno, Lisbon, Vila Nova de Gaia, and Prague—and employed three different methods: expert-led interviews (Phase 1), expert-assisted VA use (Phase 2), and independent VA use by municipalities (Phase 3). Each phase focused on evaluating accuracy, consistency, scalability, and usability of the VA compared to traditional methods. The data collection included structured interviews, workshops, self-assessments, and usability questionnaires. The methodology for results used both quantitatively and qualitatively analysis to assess the tool's performance, maturity scoring alignment, and user experience, providing a comprehensive validation of the VA's potential to support scalable and standardised digital maturity assessments in diverse municipal contexts.

Following the work done during Tasks 1.1 and 1.2, and the resulting CHEK DBP Process Map[8] (Braholli et al., 2023), CHEK DBP Maturity Model[9], and CHEK Roadmap (Ataide et al., 2023). And after the preliminary results presented in the Deliverable D1.4, this deliverable aims to present the results of the tests conducted on the conclusion of the Work Package 1. These tests validate the outcomes of WP1 and provide an overview of the achievable KPIs using these tools. Task 1.5, centred around the CHEK DBP Maturity Model, aims to test these frameworks in an AI-supported environment. The maturity assessment is conducted using the "as-is" process map as a baseline and comparing it against the CHEK "to-be" process, serving as the benchmark.

3.1 Methodology and phases of testing

The methodology for this task is based on comparing the results of different testing scenarios. Each scenario represents a phase of testing that uses the same data (the current building permit process of the municipalities) but is collected in a different manner. The three phases will use different methods for the collection of the data from the municipality (interview, VA assisted and VA independently), and the maturity results of each phase will be compared to understand the validation of different methods to assess maturity of an organisation. As explained in Deliverable D1.4, each phase was conducted with all four municipalities partnered with CHEK: Ascoli Piceno, Lisbon, Vila Nova de Gaia, and Prague. Once all municipalities completed one phase, the process moved to the next phase, until all three phases were completed for all municipalities. The methodology involves a structured approach that includes defining the testing criteria, establishing the test scenarios, executing the tests, and finally, analysing the results.

Building on the results from previous tasks in WP1, the testing criteria were defined by selecting the most relevant aspects for evaluation during this phase. These criteria are focused on the needs of end-users of a digital building permit (DBP), particularly municipalities and applicants. As the digital maturity of municipalities remains a bottleneck in DBP implementation, the primary focus is on assessing their maturity and developing a scalable, reliable method to help municipalities assess their maturity and create effective implementation strategies.

The tests focus using different method to assess the CHEK MM. In particular, using the CHEK Change Management Virtual Assistant (CHEK VA), presented in D1.3, to evaluate the potential of an AI-driven solution to optimise maturity assessments compared to traditional expert-driven methods.

[8] Available at: https://zenodo.org/record/7789035
[9] Available at: https://zenodo.org/doi/10.5281/zenodo.10277474

Defining the testing scenarios and conducting the tests

The testing scenarios presented in this deliverable are divided into three rounds:

1. Maturity Model assessment of municipalities using the traditional method (Expert-led) (Presented in Deliverable D1.4) – In this phase, the traditional method of assessing maturity was conducted by an expert on the maturity model and digital building permit. This serves as a baseline for the comparison, establishing a benchmark for assessing how municipalities are performing in their current state of digital maturity. The experts conducted semi-structured interviews with a set of questions that gave data necessary for a detailed assessment of the municipalities' maturity using conventional assessment techniques.
2. Maturity Model assessment of municipalities using the CHEK Virtual Assistant, assisted by an expert (Presented in Section 4) – In this phase, municipalities will provide input regarding their current processes, and the expert will use the CHEK VA to assess their maturity. The goal here is to evaluate how effectively the assistant can process the information provided by the municipalities and generate results that align with the traditional expert-led assessment. This phase will evaluate the efficiency and accuracy of the VA method when handled by a domain expert. The expert, using the municipalities' input, will conduct the maturity assessment through the CHEK VA. The results will be compared to the expert-led traditional method to evaluate the accuracy and efficiency of the assistant in supporting the maturity assessment process.
3. Maturity Model assessment of municipalities using the CHEK Virtual Assistant independently (Presented in Section 5) – This scenario will test the municipalities' maturity assessment independently using the CHEK VA without expert intervention. The goal is to compare the results from this independent VA-based assessment with those obtained in the expert-driven and VA-assisted phases, measuring how well the VA performs in a real-world, autonomous application by non-expert users and to gauge the VA's reliability when used autonomously by non-expert users. After completing the self-assessment with the VA, the users will be asked to complete a survey with a questionnaire to understand their experience while using the tool, the questions will give an overview of the user friendliness of the tool.

Analysing the results

Once the tests are completed, those results will be analysed across several dimensions:

- Accuracy – The results of the VA-based assessments (both expert-assisted and independent) will be compared with the traditional expert-led assessments. This comparison will evaluate how well the VA replicates or improves upon the accuracy of the manual assessment process.
- Consistency of results – This will be measured by comparing the results across the four municipalities using both expert-led and VA-based methods. This comparison will analyse the degree to which the VA provides standardised and reliable outputs, both with and without expert input. The consistency will be determined by evaluating the variation between the results, ensuring that the VA can replicate expert judgments and reduce subjectivity across similar inputs.
- Scalability – It will be measured by the VA's ability to deliver accurate and reliable assessments across the four municipalities, producing consistent results both with and without expert input. Demonstrating the tool's

capacity to scale and be applied across a broader range of municipalities and regulatory environments. This can confirm the VA's ability to maintain consistency and accuracy when deployed on a larger scale.

- Usability and User friendliness – The user friendliness will be measured in a subjective manner to understand the experiences of the users while navigating the tools, how likely they are to use again or recommend the tool. The goal is to gain feedback that could potentially be further improved in the CHEK VA, making a powerful and useful tool for assessing digital maturity.

Each phase of testing had its own structure for data collection and processing that was followed by all 4 municipalities of CHEK consortium. The methodology for phase 1 was described in deliverable D1.4. In the following sections there is the detailed plan for data collection, analysis and processing of phases 2 and 3. The results of all three phases of testing will be discussed on the results of the present document.

3.2 Phase 2 – VA assessment with expert's assistance

For Phase 2 of testing, the data was collected with the use of the CHEK VA assistant, guided by a domain expert. The expert led a semi-structured workshop with municipality technicians, the VA was used by the expert with the inputs from the technicians. The workshop followed the same structure with all four municipalities, for assuring the consistency of results within the same phase of tests.

3.2.1 CHEK Virtual Assistant

The CHEK Virtual Assistant (VA) is an interactive, AI-powered tool designed to facilitate digital transformation assessments for municipalities focused on building permit processes. It combines process mapping, real-time feedback, and maturity model assessment capabilities to provide a comprehensive evaluation and roadmap to each municipality's current digitalisation status.

Some key features and functions of the VA are described below:

- **Interactive process mapping:** The CHEK VA includes an integrated BPMN (Business Process Model and Notation) editor, which enables users to map the AS-IS process of building permit applications in detail. The VA's chatbot, IntelliCHEK, enhances this mapping by prompting users to provide additional details, ensuring accuracy and comprehensiveness in each action mapped. The user is asked to draw their own process map based on the BMPN features, while the AI analyses the content of each action inserted by the user.
- **IntelliCHEK Chatbot for enhanced data collection:** At each step of the process mapping, the IntelliCHEK chatbot assists by analysing the process map, suggesting improvements in terminology, and prompting for critical details, such as the type of action, automation levels, and data flow. This dynamic interaction allows users to refine the process map thoroughly, ensuring the captured information supports a robust maturity assessment.
- **Maturity Model assessment**: Once the process mapping is complete, the VA conducts a maturity assessment based on the process map, chat interactions, and supplementary questionnaires completed by the municipality. This assessment includes multiple-choice questions that cover organisational, informational, and digitalisation factors related to the building permit process. The VA generates spider graphs to visually

represent the municipality's maturity across four key categories, helping to identify strengths and areas for improvement.

- **Benchmarking and automated roadmap generation**: The VA compares the municipality's current maturity levels with predefined benchmarks from the CHEK toolkit, identifying gaps and opportunities for advancement. Based on this analysis, the tool automatically generates a detailed roadmap. This roadmap outlines specific steps and milestones, helping municipalities progress from their current state toward the desirable maturity level defined by CHEK toolkit.
- **Automated reporting**: To provide a comprehensive summary of the assessment, the VA can compile an automatically generated report in PDF format. This report includes the finalized process map, maturity assessment results, benchmarking analysis, and the generated roadmap, offering municipalities a complete record of their current status and a guide for future improvements.
- **Usability and expert facilitation**: Designed to be user-friendly, the VA supports FHI (the tool's creators and process experts) as facilitators during initial assessments, especially in testing phases. The VA's intuitive design allows both experienced users and municipal representatives to collaborate effectively, gathering meaningful insights and providing feedback in real time. During the assessment workshops, experienced users from FHI operate the tool, ensuring precise data entry and interpretation, while also helping municipalities understand the feedback and results generated by the VA.
- **Comparison with traditional assessment methods:** The VA intention is to give an alternative to manual tools such as Excel-based maturity matrices by streamlining the process with automated features, real-time interaction, and intelligent suggestions.

3.2.2 Data collection

The use of the VA during the workshop was mediated by a FHI expert, that followed the workflow of the tool. During interactive workshops, the VA allows municipalities to observe the mapping of their process on-screen, providing real-time feedback on each step. The maturity assessment results will then be compared to those from a prior testing phase, during which a traditional assessment tool (an Excel sheet matrix) was used. This comparison will allow FHI to evaluate the VA's impact on assessment accuracy and user experience in contrast to traditional tools.

FHI will guide the municipality technician through a workshop to map their current building permit process. As FHI inputs information, the VA tool will display the evolving process map, allowing the municipality representatives to review and provide immediate feedback. The interviewer (FHI) will adjust the map according to the municipality's input, ensuring the process accurately reflects the current workflow. During the mapping, FHI will interact with IntelliCHEK, a component of the VA that provides prompts and requests additional detail as needed. Since the human machine interface is a key issue within the AI field, the VA tries to use this interaction to help ensure that each process action is thoroughly documented and evaluated, providing robust input for the further maturity assessment.

After finalizing the process map, FHI will ask additional questions concerning organisational practices and regulations, filling out a questionnaire that supplements the process map data. This questionnaire gathers insights on areas the VA tool cannot automatically assess, such as organisational policies and regulatory considerations specific to each municipality.

Since the first phase of tests were made by one expert interviewing one municipality, there was an attempt to minimize potential biases in the results. The expert that conducted the previous phase of testing in one municipality were rotated

between municipalities to be assessed using the VA. This rotation ensures that varied perspectives are incorporated, supporting objectivity and consistency in the assessment process, this way one expert is less affected by the previous results they already know from the municipalities maturity model access. On Phase 2, Expert A made the workshops with Ascoli Piceno, Lisbon, and Vila Nova de Gaia, while Expert 2 guided the interview with Prague.

3.2.2.1 Workshop structure

Phase 2 - Testing the maturity assessment with the VA assisted by an expert.

Introduction: Explain the interview structure and goals (5 min)

- Brief the participants on how to answer the questions
- Introduce the VA tool and outline the workshop's goals.
- Provide a brief overview of the VA, explaining the importance of mapping the AS-IS process accurately and responding to the chatbot's questions.

VA-assisted use: Share the screen and follow the VA workflow (110 min)

1. Log in to the VA: Begin by logging into the CHEK Virtual Assistant (VA) platform.
2. Start a new project
3. Initial description and guiding questions: The VA asks for a general description of the municipality's building permit process. To clarify foundational details of the municipality's current process, FHI will begin with a series of essential questions, gathering initial information from the representatives. These questions cover basic aspects of the workflow, such as:
   - Is the process fully digitised, or are physical files (paper) still in use?
   - Are in-person meetings part of the process, or is it conducted primarily online?
   - What is the most common method of communication (e.g., digital platforms, email)?
   - What types of documentation are typically submitted?
   - Where and how is data stored?
4. Process map editing based on municipality's input: FHI will use the information provided by the municipality to edit and complete the process map in real-time. Representatives from the municipality will observe the mapping on-screen, giving direct feedback that will be integrated into the map as it is constructed.
5. Information to provide to IntelliCHEK for effective maturity assessment: For a robust maturity assessment and a detailed process map, FHI and the municipality technician will provide the following specific information to IntelliCHEK:
   - Action Description: A clear, concise description of each action in the process.
   - Actor Identification: The role or department responsible for performing each action.
   - Supporting Infrastructure: Details about the infrastructure (such as software platforms or physical resources) that enables or supports each action.
   - Automation Level: Identification of whether each action is manual or automated.
   - Documentation Format and Type: Specification of documentation formats involved in each action (digital, physical, etc.).
   - Information Delivery Method: How information is delivered to the next step or stakeholder.

- Information Reception Method: How information is received and processed in the action.
- This information will guide the IntelliCHEK chatbot in making accurate assessments of process maturity.

6. Maturity Model assessment questionnaire: Municipality representatives respond to the final set of questions posed by the chatbot and complete a supplementary questionnaire focused on evaluating their organisational and informational maturity.
7. Finish screen sharing: The screen sharing finishes before the creating of the assessments.
8. Generate maturity assessment: The VA will automatically generate the Maturity assessment for the municipality's process. This will not be shared with the municipalities at this moment, to not influence their answers on future phases of testing.

Wrap up: Explain the next steps and dismiss all the participants (5 min)

- Explain the next steps (phases 3), after all workshops are completed
- Explain the sharing of results that will be done only after all steps are completed by all municipalities
- Answer possible questions by the participants
- Thank for their participation and close the interview

After workshop: Done only by the experts

- Process the interview results for each municipality
- Analyse the answers and compare with Phase 1 results.
- Produce the report of the workshop with the detailed results.
- Documented possible feedback on the user experience and tool usability.

3.2.3 Data processing

Upon completing the assessment, a report will be generated for each municipality. The report will include each maturity level for each KMA, given by the CHEK VA, the spider graphs for each category (Process, Organisation, Technology and Information), and the roadmap according to what was created by the VA.

The information for each municipality was imported to the data resulting from phase 1 of testing and the data from all 3 phases was compared. The full Excel files containing the detailed assessment for each municipality can be found in Annex I (attached excel files) of this deliverable. On the Excel files is possible to see the full maturity model with all detailed KMAs scores, and, the "Current Maturity" (in red), "VA Expert" (in yellow), "VA Self" (in blue) and "CHEK benchmark maturity" (in cyan). The full report of each municipality is found in Section 4 of this document.

3.3 Phase 3 – VA with independent assessment

The third phase of testing focused on evaluating the CHEK Virtual Assistant (VA) in an autonomous setting, where municipalities independently used the tool without expert guidance. The objective of this phase was to assess the effectiveness of the VA when used without external facilitation, measuring its usability, accuracy, and reliability in assessing digital maturity.

This phase provided valuable insights into how well municipalities could interact with the VA on their own, whether they encountered difficulties in navigating the system, and how well the generated maturity assessments aligned with previous expert-assisted assessments.

3.3.1 Data collection

The data collection process for this phase was structured to evaluate both quantitative and qualitative aspects of the VA's performance.

Municipalities participated independently, meaning they:

1. Accessed the VA platform via a provided weblink.
2. Created an account to log in and begin their assessment.
3. Built their process maps using the VA's BPMN editor.
4. Completed the automated maturity assessment, allowing the VA to evaluate their processes across the four key categories: Process, Organisation, Technology, and Information.
5. Generated and downloaded reports, including:
   - The finalized BPMN process map.
6. The automated maturity assessment report, contained the results of the MM autonomously generated by the AI.
   - The improvement roadmap and recommendations.
7. Uploaded their results to a shared repository.
8. Completed a structured questionnaire regarding their user experience with the VA, providing insights into usability, accuracy, and perceived value.

Unlike previous phases, this phase did not involve live workshops or facilitated guidance. Instead, municipalities were given the necessary materials to conduct the assessment independently at their own pace. By the end of their tests, the users were instructed to upload the results in an online repository, including the BPMN process map and the final report in PDF, both exported from the VA.

Upon starting the tests, each municipality received:

1. A weblink to access the CHEK Virtual Assistant.
2. A PDF guide instructing on how to use the VA, navigate the interface, and complete the assessment. (Annex IV of this deliverable)
3. A Microsoft Forms questionnaire, which captured:
   - Feedback on ease of use.
   - The clarity of instructions and process mapping.
   - The accuracy of the VA's assessment compared to their expectations.
   - Any challenges or technical difficulties faced.

By allowing municipalities to self-manage their participation, this phase aimed to simulate real-world deployment scenarios, assessing how well the VA functioned without direct intervention from experts. The collected data from all four municipalities (Ascoli Piceno, Lisbon, Vila Nova de Gaia, and Prague) was analysed and compared to previous traditional and VA with expert-led assessments.

3.3.1.1 Usability questionnaire

For surveying the user experience and gather further insights to improve the usability of the CHEK VA, a questionnaire with 34 questions was provided to the municipality users. They answered the questions after finishing the use with the VA.

Phase 3 – Questionnaire on usability.

Usability, navigation and layout

This section assesses the ease of use and clarity of the CHEK Virtual Assistant (VA) interface and tutorial. Participants will provide feedback on navigation, intuitiveness, and the effectiveness of instructions. The insights gathered will help identify areas for improvement to enhance the user experience.

1. On a scale of 1-5, how would you rate the overall ease of navigating the CHEK VA interface?

- 1 Very Easy – Navigation is intuitive and effortless; all features are easy to find and use without assistance.
- 2 Easy – Navigation is mostly straightforward, with minor challenges that do not significantly impact usability.
- 3 Neutral – Navigation is somewhat clear, but some features require effort to locate or understand.
- 4 Difficult – Navigation is confusing, requiring guidance or repeated attempts to find and use features effectively.
- 5 Very Difficult – Navigation is frustrating and unclear, making it hard to complete tasks without extensive help.

2. What specific aspects of the interface made navigation easy or difficult for you? Please share any suggestions for improvement. (Open-ended)

3. On a scale of 1-5, how intuitive was the layout of the tool (e.g., locating the project tabs, BPMN editor, and message bar)?

- 1 Very Unintuitive – The layout was confusing, and I had difficulty finding key features.
- 2 Unintuitive – The layout was somewhat confusing, and I had trouble locating some features.
- 3 Neutral – The layout was okay, but I had to spend some time locating features.
- 4 Intuitive – The layout was generally easy to understand, and I could locate features without difficulty.
- 5 Very Intuitive – The layout was clear and well-organised, making it easy to locate all features right away.

4. Did you experience any difficulties finding or using any of the features?

- Yes
- No
- Other

5. If yes, please explain. (Open-ended)

Relevance & Content

This section assesses the relevance of the CHEK Virtual Assistant (VA) tool in supporting your municipality's digitalisation efforts. It covers the applicability of the process mapping template, the digital maturity assessment, and the generated CHEK roadmap. The questions focus on how well these components align with your building permit process and the digital maturity of your municipality. Feedback will help determine how well the tool addresses your needs, aids in achieving CHEK benchmarks, and provides actionable insights for improvement in the building permit process.

6. On a scale of 1-5, how relevant was the process mapping template to your municipality's Building Permit process?

- 1 Very Relevant – The template closely matched our process, requiring little to no modifications.
- 2 Relevant – Mostly aligned with our process, with only minor adjustments needed.
- 3 Neutral – Somewhat relevant, but required significant customisation to fit our needs.
- 4 Not Very Relevant – Did not align well with our process and required major modifications.
- 5 Not Relevant at All – The template was not applicable to our process.

7. On a scale of 1-5, how well did the tool address your needs for mapping your building permit process?

- 1 Very Well – Fully met our needs, providing clear structure and valuable insights.
- 2 Well – Mostly met our needs, with only minor adjustments or improvements needed.
- 3 Neutral – Somewhat useful, but required additional effort or external tools for a complete mapping.
- 4 Not Very Well – Did not fully address our needs, missing key aspects of the process.
- 5 Not at All – Did not meet our needs and was not useful for mapping our building permit process.

8. On a scale of 1-5, how easy was it to complete your process map using the provided template and editing tools?

- 1 Very Difficult – I had a lot of trouble completing the process map with the tools provided.
- 2 Difficult – It was somewhat challenging to complete the process map, and I encountered several issues.
- 3 Neutral – The process map was easy to complete, but I faced some minor difficulties.
- 4 Easy – I found it straightforward to complete the process map using the provided template and tools.
- 5 Very Easy – The process map was quick and easy to complete with the provided template and tools.

9. What aspects of the tool were most helpful for mapping your process, and what improvements would make it more effective for mapping your building permit process? (Open-ended)

10. Were the steps to start a new project and finish the process map clearly defined?

- Yes
- No

11. If no, what was missing? (Open-ended)

12. On a scale of 1-5, how well did the tool address your needs for assessing digital maturity?

- 1 Very Well – Fully met our needs, providing clear insights and valuable assessments.

- 2 Well – Mostly met our needs, with only minor gaps or improvements needed.
- 3 Neutral – Somewhat useful, but required additional effort or external tools for a complete assessment.
- 4 Not Very Well – Did not fully address our needs, missing key aspects of digital maturity assessment.
- 5 Not at All – Did not meet our needs and was not useful for assessing digital maturity.

13. On a scale of 1 to 5, how well do the results of the digital maturity assessment (Technology, Process, Organisation, Information) match your building permit process?

- 1 Not at all – The maturity assessment does not match the maturity of our actual process in any way.
- 2 Slightly – The assessment partially aligns but has significant discrepancies.
- 3 Moderately – The assessment is somewhat accurate but needs adjustments to fully match the actual maturity of our process.
- 4 Mostly – The assessment is mostly aligned, with only minor gaps.
- 5 Completely – The assessment fully reflects the maturity of our building permit process.

14. If the maturity assessment did not fully match, please explain which aspects of Technology, Process, Organisation, or Information did not align with the maturity of your actual process. (Open-ended)

15. On a scale of 1 to 5, how clear and easy to understand did you find the CHEK roadmap generated by the CHEK Virtual Assistant (VA)?

- 1 Very Clear – The roadmap was very easy to understand and follow.
- 2 Clear – The roadmap was mostly clear, with minor areas needing clarification.
- 3 Neutral – Some parts of the roadmap were clear, but others were harder to follow.
- 4 Confusing – The roadmap was difficult to understand, and some parts were unclear.
- 5 Very Confusing – The roadmap was very unclear, making it hard to understand and follow.

16. What aspects of the roadmap were difficult to understand, and how can it be improved to make it clearer? (Open-ended)

17. On a scale of 1 to 5, how useful do you find the CHEK roadmap in supporting your municipality's path to digitalise the building permit process and reach CHEK benchmarks?

- 1 Not Useful at All – The roadmap does not provide any value in our digitalisation efforts.
- 2 Slightly Useful – The roadmap offers limited support but could be more relevant.
- 3 Moderately Useful – The roadmap is somewhat helpful, though additional resources may be needed.
- 4 Very Useful – The roadmap is quite helpful and provides clear guidance for reaching the CHEK benchmarks.
- 5 Extremely Useful – The roadmap is very valuable and directly supports our efforts to achieve the CHEK benchmarks.

18. What specific elements of the roadmap would be most helpful for your municipality in achieving the CHEK benchmarks, and what additional features would enhance its usefulness? (Open-ended)

Interaction with the CHEK Virtual Assistant

This section assesses the effectiveness and relevance of the VA throughout your interaction with the tool. It explores how helpful, clear, and relevant the chatbot's prompts, feedback, and questions were in guiding you through the process. Your responses will provide valuable insights into the chatbot's ability to support users in achieving their goals, ensuring that the tool's interactions align with user needs and contribute to a positive experience. By understanding the interaction with the VA, we can improve the overall user experience and refine its ability to assist with future tasks.

19. Were the interactions and questions from the CHEK Virtual Assistant (VA) helpful and relevant to your process?

- Yes, the interactions and questions were very helpful and directly relevant to my process.
- No, the interactions and questions were not helpful or relevant to my process.
- Other

20. How clear and understandable were the questions posed by the CHEK Virtual Assistant (VA)?

- Very clear and understandable
- Somewhat clear, but could be improved
- Not clear or understandable
- Not sure / I did not engage enough to judge
- Other

21. Did the CHEK Virtual Assistant (VA) guide you through the process in a way that made sense?

- Yes, the guidance was clear and logical throughout.
- Yes, but sometimes the guidance was unclear or confusing.
- No, the guidance was difficult to follow or inconsistent.
- Not sure / I did not engage enough with the assistant to judge.
- No, it only asked questions sometimes with no reason

22. How would you rate the overall effectiveness of the CHEK Virtual Assistant (VA) in helping you map your building permit process?

- Very effective
- Somewhat effective
- Not effective
- Not sure
- Other

23. Did you feel that the CHEK Virtual Assistant (VA) asked the right questions at the right time during the process mapping?

- Yes, the questions were well-timed and appropriate.
- Sometimes, the timing or relevance of the questions could have been improved.
- No, the questions were poorly timed or not appropriate.
- Not sure
- Other

24. On a scale of 1 to 5, how would you rate the responsiveness of the VA during the process mapping?

- 1 Very Poor – The VA was very slow or unresponsive throughout the process.
- 2 Poor – The VA had noticeable delays in responses.
- 3 Neutral – The VA was somewhat responsive, with occasional delays.
- 4 Good – The VA responded quickly with only minor delays.
- 5 Excellent – The VA was very responsive and prompt throughout the process.

25. Did the VA's prompts and feedback help you understand what actions to take?

- Yes
- No

26. What suggestions do you have to improve the CHEK VA's interaction with the user? (Open-ended)

Likability & future use

This section explores your satisfaction with the overall experience of using the CHEK Virtual Assistant (VA) tool and your likelihood of recommending it to other municipalities. It evaluates your willingness to continue using the tool for future process evaluations and assesses its potential value for other municipalities. Your feedback helps identify areas of strength and areas for improvement, ensuring that the tool continues to meet the needs of users like yourself. This section also provides insight into the tool's overall appeal and its potential role in future digitalisation efforts.

27. On a scale of 1-5, how likely are you to use the CHEK VA tool for future process evaluations?

- 1 Not Likely at All – We would not consider using the tool for future evaluations.
- 2 Slightly Likely – We may use the tool in some cases, but not regularly.
- 3 Moderately Likely – We are somewhat likely to use the tool for future evaluations.
- 4 Very Likely – We would likely use the tool regularly for future evaluations.
- 5 Extremely Likely – We would definitely use the tool for all future process evaluations.

28. If you answered, "Not Likely at All" (1), we would appreciate your feedback to understand whether this reflects a reluctance to use this specific tool or any tool of this kind. Was this due to challenges you faced with the tool's usability, or do you feel that tools like this do not align with your municipality's needs for process evaluations? Please provide any insights or additional reasons that influenced your response.

- No Need for Such Tools – We do not foresee a need for this type of tool in our process evaluations.

- Usability Challenges – The tool's difficulty or complexity made it less likely for us to use it.
- Other

29. If you selected "Other Reasons," please kindly specify them here. (Open-ended)

30. On a scale of 1 to 5, how likely are you to recommend this tool to another municipality?

- 1 Not Likely at All – I would not recommend this tool to another municipality.
- 2 Slightly Likely – I might consider recommending it in certain circumstances.
- 3 Moderately Likely – I would be somewhat likely to recommend it.
- 4 Very Likely – I would likely recommend it.
- 5 Extremely Likely – I would definitely recommend this tool.

31. On a scale of 1 to 5, how satisfied are you with the overall experience of using the CHEK VA tool?

- 1 Very Dissatisfied – I was very dissatisfied with the tool's overall experience.
- 2 Dissatisfied – I was somewhat dissatisfied with the tool's overall experience.
- 3 Neutral – I had a neutral experience with the tool, neither satisfied nor dissatisfied.
- 4 Satisfied – I was satisfied with the tool's overall experience.
- 5 Very Satisfied – I was very satisfied with the tool's overall experience.

32. On a scale from 1 to 5, how satisfied are you with your overall experience using the CHEK Virtual Assistant?

- 1 Very Dissatisfied
- 2 Dissatisfied
- 3 Neutral
- 4 Satisfied
- 5 Very Satisfied

33. What aspects of the VA did you find most valuable or useful? (Open-ended)

34. What improvements or changes would you suggest to enhance the overall user experience and provided content? (Open-ended)

35. Please add here any other comments or suggestions you might have regarding your experience with the CHEK VA. (Open-ended)

Clarity of instructions

This section focuses on evaluating the clarity and effectiveness of the document guide provided before using the tool. It aims to assess how well the guide helped users understand how to navigate and use the tool effectively. The responses will offer insights into whether the instructions were clear, easy to follow, and sufficient to prepare users for the tool's functionalities. By identifying areas that may require further clarification, this sec-tion helps improve the guide, ensuring that users can confidently start using the tool with minimal confusion.

36. On a scale from 1 to 5, how clear and easy to follow were the instructions provided in the guide document?

- 1 Very Unclear and Difficult – The instructions were very unclear and hard to follow.
- 2 Unclear and Difficult – The instructions were somewhat unclear and challenging to follow.
- 3 Neutral – The instructions were okay, but could have been clearer or easier to follow.
- 4 Clear and Easy to Follow – The instructions were clear and mostly easy to follow.
- 5 Very Clear and Easy to Follow – The instructions were very clear, well-organised, and easy to follow without any confusion.

37. If the instructions were not clear, where did you feel the need for more guidance or clarification? (Open-ended)

3.3.2 Data processing

Upon completing the assessment, a report by the VA will be automatically generated for each municipality, containing all the assessed KMAs and the roadmap. Besides, the usability questionnaire will be analysed in order to give feedback on the user friendliness of the tool.

The MM information for each municipality was imported to the data resulting from phase 1 and phase 2 of testing to allow the comparison of the results. The full Excel files containing the detailed assessment for each municipality can be found in Annex I (attached excel files) of this deliverable. On the Excel files is possible to see the full maturity model with all detailed KMAs scores, and, the “Current Maturity” (in red), “VA Expert” (in yellow), “VA Self” (in blue) and “CHEK benchmark maturity” (in cyan). The full report of each municipality is found in in Section 5 of this document.

3.4 Data analysis and results

The analysis was structured into four key evaluation dimensions, each designed to measure different aspects of the compared methods:

Accuracy Assessment: The results obtained from the independent use of the VA were compared with:

- The expert-led assessments (Phase 1), which serve as a baseline measurement.
- The VA-assisted assessments (Phase 2), where experts facilitated the use of the tool.

The goal was to determine whether the maturity levels identified by municipalities themselves aligned with those established through expert evaluation.

Key indicators:

- Degree of variation in maturity scores between the three phases.
- Deviation analysis to identify patterns of overestimation or underestimation by municipalities.

Consistency of Results: This evaluation focused on whether municipalities and experts produced stable and repeatable results when using the VA across different testing environments, when compared to the traditional method of evaluation.

Key indicators:

- Comparison of responses from different municipalities to identify trends and patterns in how the VA processes similar data.

- Analysis of internal consistency in each municipality's assessment, ensuring that responses remained logical and aligned across different sections of the tool.

Scalability and Adaptability: The ability of the VA to function effectively across users with different levels of digital maturity was analysed.

Key indicators:

- Performance in highly digitalised vs. less digitalised municipalities (e.g., Vila Nova de Gaia vs. Prague).
- Whether the VA was adaptable enough to provide meaningful results in different organisational contexts.
- Identification of any limitations or barriers in the VA's capability to assess municipalities with limited prior digitalisation experience.

Usability and User Experience: Since the last phase involved self-guided interaction with the VA, the municipalities' experiences in using the tool were critical in evaluating its ease of use. The questionnaire responses from municipal representatives detailing their experiences were analysed.

Key indicators:

- Feedback on the clarity of instructions, ease of navigation, and interaction with the chatbot (IntelliCHEK).
- Identification of any technical difficulties or challenges in process mapping and report generation.

All the results were analysed both qualitatively and quantitatively. Descriptive statistics and comparative analysis were used to measure the level of agreement between VA-generated results and expert-led assessments. Findings were synthesised into key observations, forming the basis for conclusions and recommendations.

This methodological framework ensured that the final analysis was objective, structured, and capable of identifying both the strengths and weaknesses of an AI-based methodology to measure the maturity model in a real-world scenario, both with expert-assisted or independent application setting. The results of this analysis are presented in following sections (see Section 6).

4 Testing results – Phase 2

Chapter Summary

The chapter is structured around the expert-assisted testing phase (Phase 2) of the CHEK Virtual Assistant (VA), conducted through workshops with four partner municipalities: Ascoli Piceno, Lisbon, Vila Nova de Gaia, and Prague. Each subsection follows a consistent format, beginning with a workshop report detailing the session setup, the collaborative process mapping exercise, and the interaction with the VA's chatbot and questionnaire. This is followed by a description of the municipality's process map, a comprehensive maturity assessment broken down by category (Process, Organisation, Technology, and Information), and finally, a summary of the automated roadmap and final report generated by the VA.

4.1 Ascoli Piceno

4.1.1 Workshop report

In this phase of testing, FHI used the CHEK Virtual Assistant (VA) tool to map the current (as-is) building permit process for the municipality of Ascoli Piceno. The process mapping involved a virtual workshop, with one representative from the municipality providing direct insights into their existing workflow. This report details the steps undertaken during the workshop, the process map construction, and the subsequent stages of evaluation using the VA tool.

Workshop Setup and Execution

The workshop was conducted via videoconference, with FHI sharing the VA tool screen to facilitate real-time collaboration. The session was designed to last two hours, during which the as-is process map was constructed. Throughout the workshop, the FHI facilitator guided the municipality representative through each process step, asking clarifying questions from IntelliCHEK, and, at the conclusion, assisting with a final questionnaire. This session remained within the planned duration, allowing all intended objectives to be addressed efficiently.

Initial Process Setup in VA

At the beginning of the workshop, FHI logged into the VA and set up a new project for mapping the building permit process. The municipality's technician then provided a brief description of the process, covering four essential elements:

- *Dematerialisation: The building permit process is entirely digitised from start to finish, with no physical paper documents involved.*
- *Documentation Format: All documents are in digital format only.*
- *Communication Channel: All interactions between the municipality and applicants are managed through the municipality's digital platform, with in-person meetings available only in exceptional cases.*
- *Data Storage: All data and documents are stored on the municipality's platform, "Piattaforma SUE."*

This information served as initial input to the VA tool to ensure an accurate foundation for further process mapping and analysis.

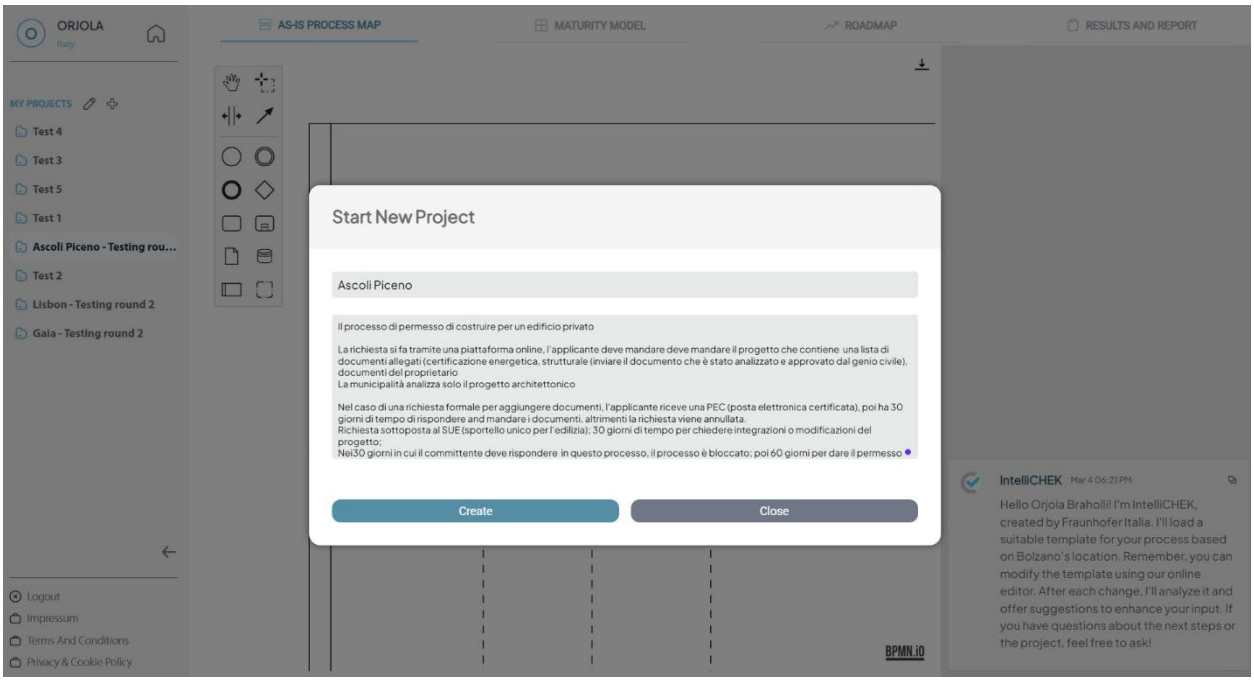


Figure 2 Starting the project with Ascoli Piceno

Process Mapping with the VA Tool

Following the initial setup, FHI and the municipality representative worked together to construct the building permit process map using the VA tool's default BP process template, which could be modified within the bpmn.io visual editor. The FHI user adjusted the process map based on the municipality's input, ensuring that each step accurately represented the current procedures.

For each action added or modified in the map, IntelliCHEK's chatbot was activated, providing immediate analysis and feedback. The chatbot offered suggestions for naming conventions and requested additional details as needed to clarify each action. Key details requested by the chatbot included action types, executors, information exchange methods, and communication protocols. An example prompt from the chatbot was:

"Could you kindly describe in detail how the action of checking administrative requirements is typically carried out in the workflow? Your insights will be invaluable for evaluating the building permit process according to the maturity model."

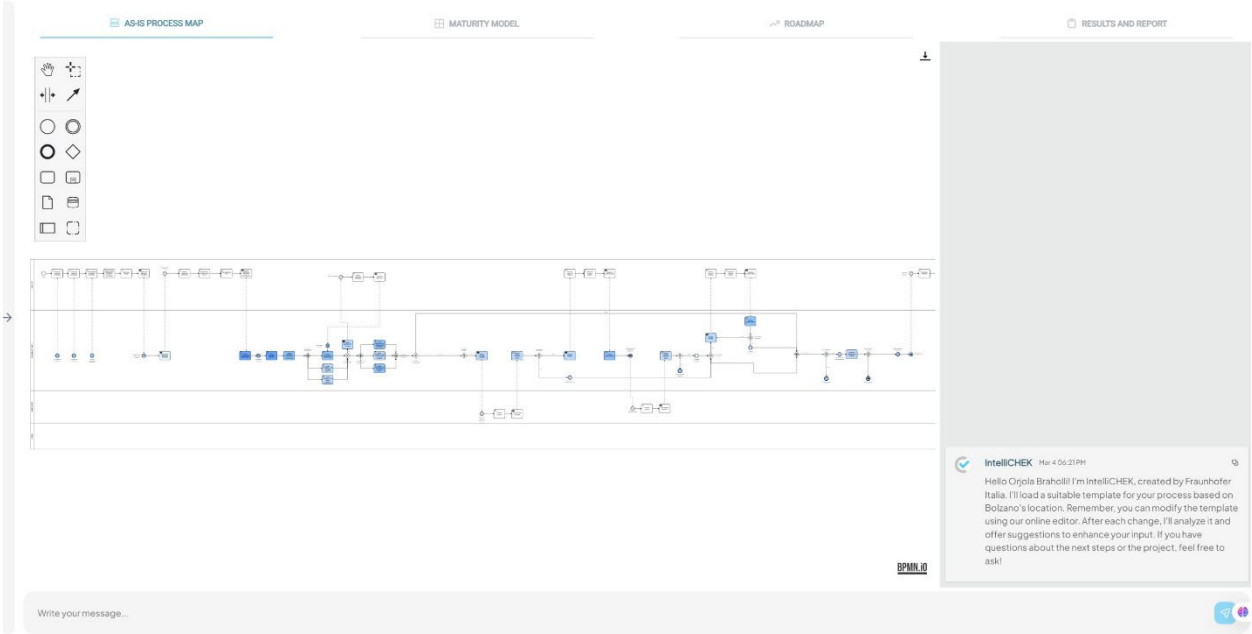


Figure 3 VA Process Map of Ascoli Piceno

The FHI facilitator consulted with the municipality technician to obtain the necessary details, entering the responses directly into the chat. The VA then reviewed these inputs to determine whether they were sufficient for assessing the action's maturity, or if further details were required. This interactive mapping approach continued until the entire process was documented to the satisfaction of the municipality representative.

Organisation Questionnaire Completion

Upon completion of the process map, the municipality representative was prompted to complete a multiple-choice questionnaire. This questionnaire collected supplementary information not directly obtainable from the process map, focusing on aspects such as organisational structure, regulatory compliance, and legislation relevant to the building permit process. This information was intended for use in the subsequent maturity assessment and served as an important input for evaluating the municipality's current digital capabilities. The full questionnaire is available in APPENDIX 01 – Organisation Questionnaire from CHEK Virtual Assistant of this document.

Maturity Assessment

After the questionnaire completion, the VA tool automatically proceeded with the maturity assessment phase. Using data from the process map, chat responses, and questionnaire answers, the VA evaluated the maturity of the building permit process. The tool generated a report summarising the process's maturity level, accompanied by visual graphs depicting key results.

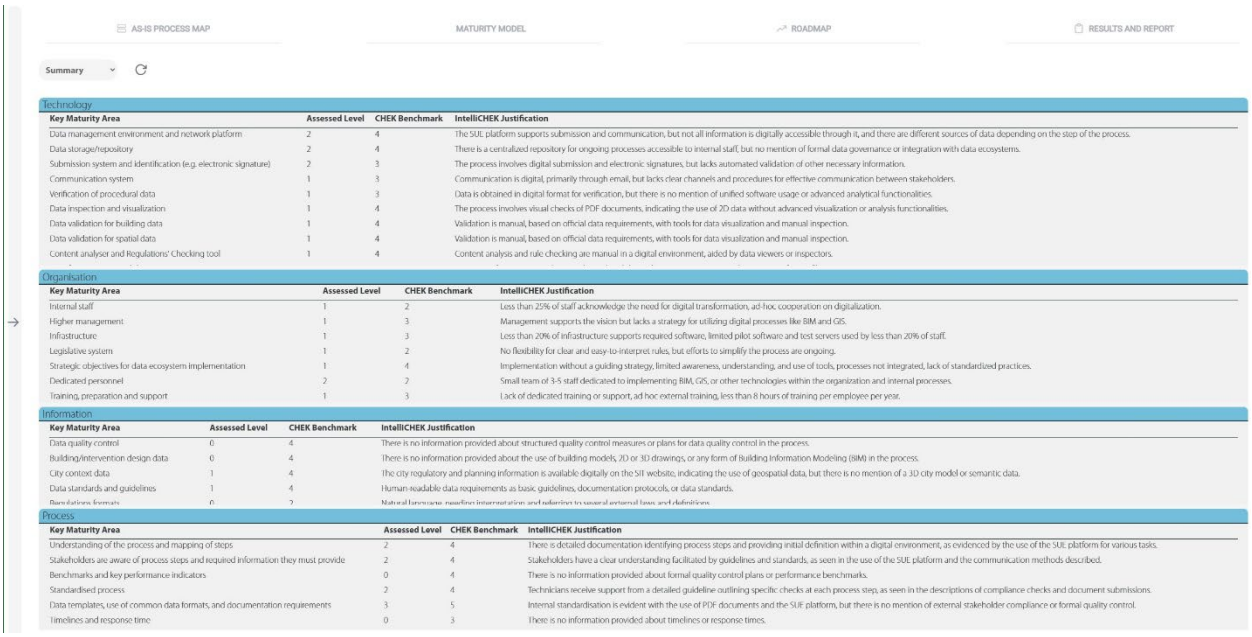


Figure 4 Summary of the maturity assessment

Roadmap Generation

Following the maturity assessment, the VA tool generated an improvement roadmap based on the CHEK Benchmark, which is embedded in the VA's database. This roadmap was automatically designed to guide the municipality from its current process state to a target state, as defined by CHEK objectives.

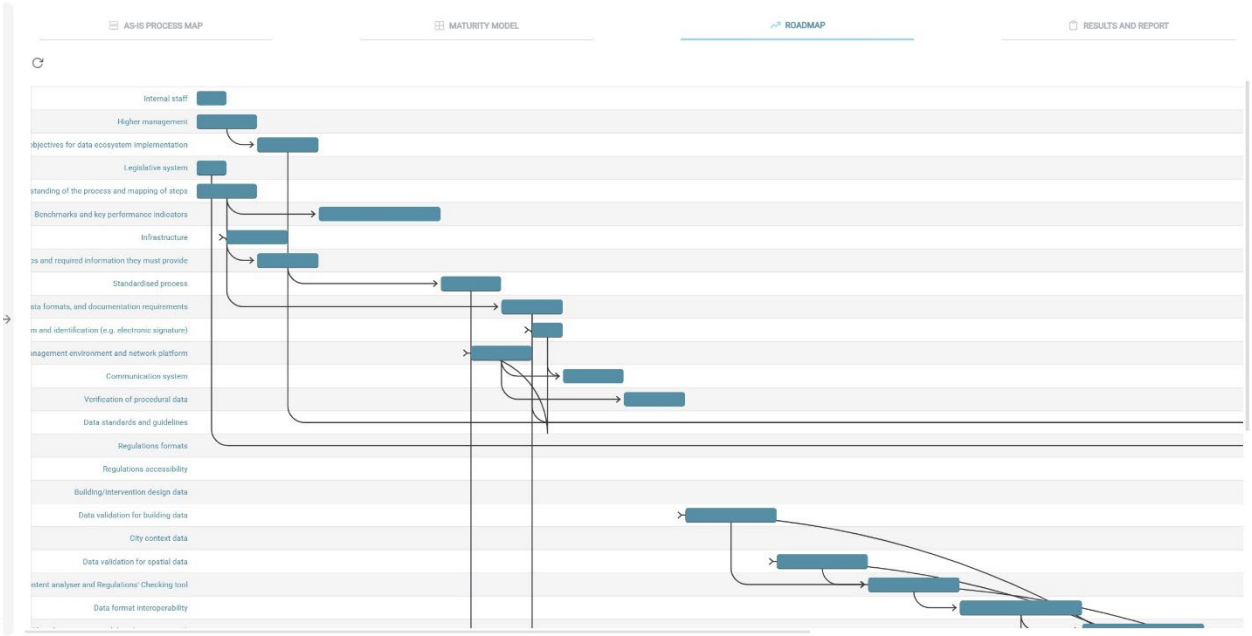
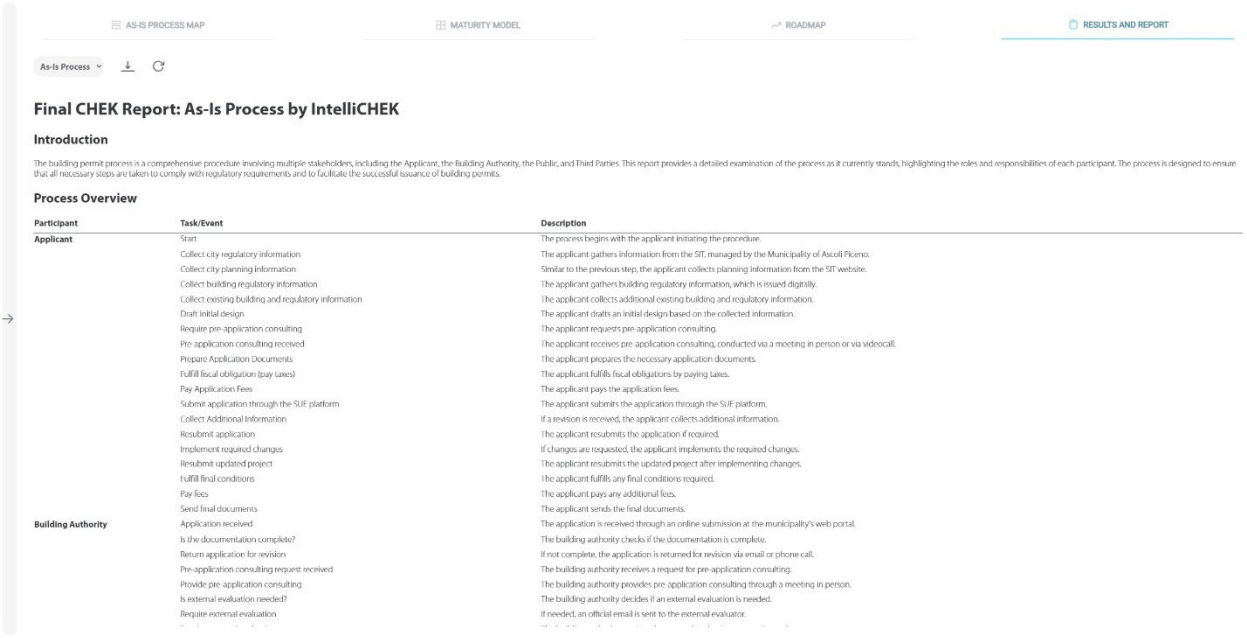


Figure 5 VA. Roadmap of Ascoli Piceno

Final Report Generation

The VA tool concluded with the automatic generation of a final report, which consolidated the maturity assessment results, the improvement roadmap, and visual analyses. This report provides a comprehensive overview of the municipality's current digital building permit process and outlines the steps recommended for further development.


AS-IS PROCESS MAP | MATURITY MODEL | ROADMAP | RESULTS AND REPORT

As-Is Process

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a comprehensive procedure involving multiple stakeholders, including the Applicant, the Building Authority, the Public, and Third Parties. This report provides a detailed examination of the process as it currently stands, highlighting the roles and responsibilities of each participant. The process is designed to ensure that all necessary steps are taken to comply with regulatory requirements and to facilitate the successful issuance of building permits.

Process Overview

Participant	Task/Event	Description
Applicant	Start	The process begins with the applicant initiating the procedure.
	Collect city regulatory information	The applicant gathers information from the SIT, managed by the Municipality of Ascoli Piceno.
	Collect city planning information	Similar to the previous step, the applicant collects planning information from the SIT website.
	Collect building regulatory information	The applicant gathers building regulatory information, which is issued digitally.
	Collect existing building and regulatory information	The applicant collects additional existing building and regulatory information.
	Draft initial design	The applicant drafts an initial design based on the collected information.
	Require pre-application consulting	The applicant requests pre-application consulting.
	Pre-application consulting received	The applicant receives pre-application consulting, conducted via a meeting in person or via videocall.
	Prepare Application Documents	The applicant prepares the necessary application documents.
	Fulfill fiscal obligation (pay taxes)	The applicant fulfills fiscal obligations by paying taxes.
	Pay Application Fees	The applicant pays the application fees.
	Submit application through the SUE platform	The applicant submits the application through the SUE platform.
	Collect Additional Information	If a revision is received, the applicant collects additional information.
	Resubmit application	The applicant resubmits the application if required.
	Implement required changes	If changes are requested, the applicant implements the required changes.
	Resubmit updated project	The applicant resubmits the updated project after implementing changes.
	Fulfill final conditions	The applicant fulfills any final conditions required.
	Pay fees	The applicant pays any additional fees.
	Send final documents	The applicant sends the final documents.
Building Authority	Application received	The application is received through an online submission at the municipality's web portal.
	Is the documentation complete?	The building authority checks if the documentation is complete.
	Return application for revision	If not complete, the application is returned for revision via email or phone call.
	Pre-application consulting request received	The building authority receives a request for pre-application consulting.
	Provide pre-application consulting	The building authority provides pre-application consulting through a meeting in person.
	Is external evaluation needed?	The building authority decides if an external evaluation is needed.
	Require external evaluation	If needed, an official email is sent to the external evaluator.

Figure 6 VA final report of Ascoli Piceno

4.1.2 Process map[10]

Detailed Process Description of the Building Permit Process in the municipality of Ascoli Piceno.

Applicant

The applicant initiates the building permit process by gathering essential regulatory, planning, and building information from the SIT, a public site managed by the Municipality of Ascoli Piceno. Using this information, the applicant drafts an initial design and requests a pre-application consultation, which can be conducted in person or via videocall. Following the consultation, the applicant prepares the necessary documents, fulfils fiscal obligations by paying taxes and fees, and submits the application through the SUE platform. If revisions are requested, the applicant collects additional information, implements required changes, and resubmits the application. The applicant then ensures all final conditions are met, pays any additional fees, and submits the final documents to complete their role in the process.

Building Authority

Upon receiving the application through the SUE platform, the building authority verifies the completeness of the documentation; if incomplete, the application is returned for revision. The authority manages pre-application

[10] The description is based on the one automatically generated by the VA.

consultation requests and determines if external evaluation is needed, sending requests to third-party evaluators by official email. Once external evaluation reports are received, the authority assesses whether changes are required, communicates these to the applicant, and reviews the updated project for compliance. When all checks are approved, the authority drafts the final building permit proposal, sends it to the SUE platform manager for review, and, upon approval, notifies the applicant. The authority then prepares and digitally issues the permit, updates the building permit database, and notifies the public through the municipality's website.

Public Engagement

The public is notified of the building permit issuance on the municipality's public site and is provided with an option to give feedback, which is reviewed and may influence the process if provided.

Third-Party Actions

When an external evaluation is necessary, third-party evaluators receive requests for application assessments, conduct evaluations, and submit their reports to the building authority. They are informed of any updates or changes to the project throughout the process.

Conclusion

This structured process, involving the applicant, building authority, public, and third-party evaluators, ensures comprehensive regulatory compliance, transparency, and efficient issuance of building permits. Each stakeholder's role contributes to a streamlined application workflow, upholding process integrity and regulatory standards.

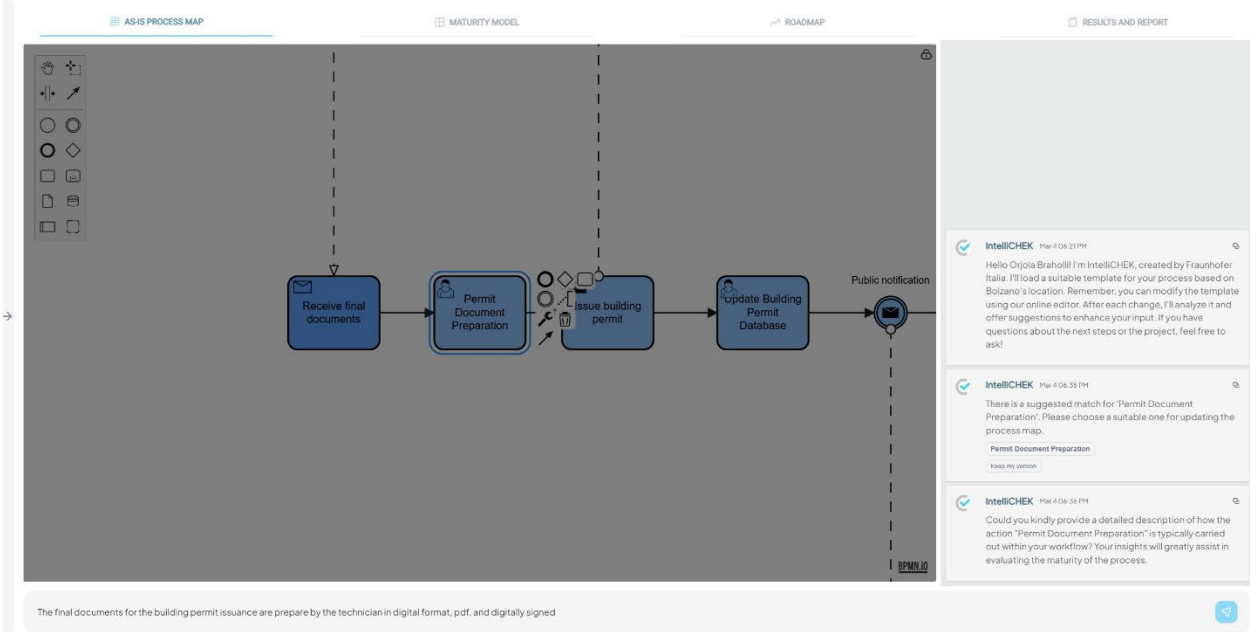


Figure 7 Process map of Ascoli Piceno

4.1.3 Maturity assessment[11]

Process (Average Maturity Level: 1.4)

The Process category has the most developed maturity level, indicating that the municipality has made progress in formalising and standardising its building permit process. Process documentation and stakeholder guidelines are relatively robust, facilitated by the SUE platform. The availability of step-by-step guidelines for technicians ensures a standardised approach to each phase of the process. Additionally, internal data templates and documentation practices support a level of consistency, although external compliance standards are not fully addressed.

Despite these strengths, several critical components remain underdeveloped. There are no key performance indicators (KPIs) or formal benchmarks, making it difficult to assess process efficiency and identify improvement opportunities. Timelines and response times are not documented, limiting predictability and accountability. Real-time tracking and automated workflows enhance transparency and accessibility, yet the process lacks formal mechanisms to measure and improve performance over time.

Conclusion: The Process domain has a solid foundation, particularly in internal standardisation and transparency. However, areas such as performance measurement, response times, and external compliance need further attention to enhance process efficiency and accountability.

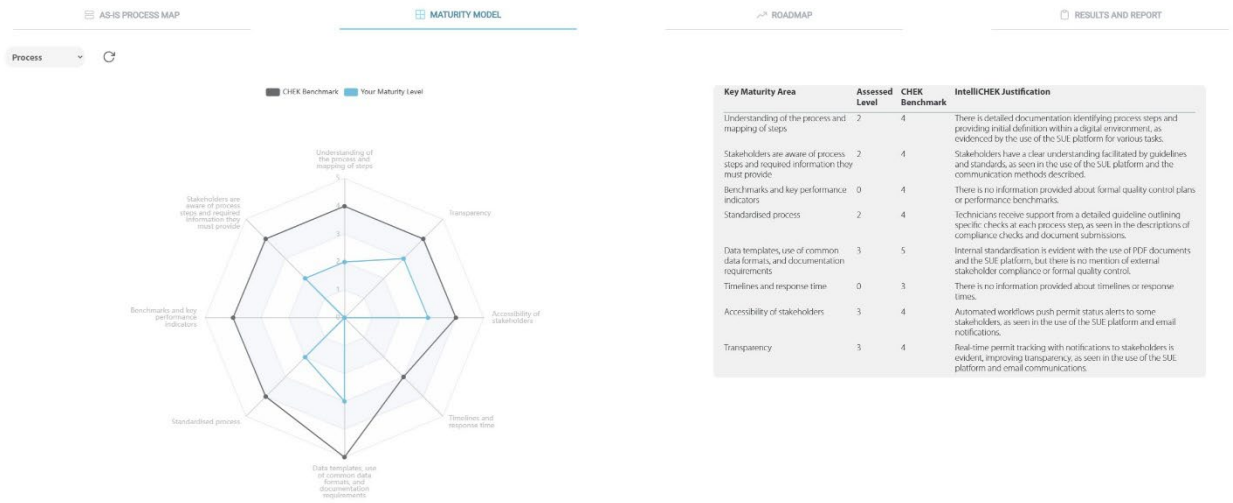


Figure 8. Process maturity for Ascoli Piceno

Organisation (Average Maturity Level: 1.1)

In the organisation category, the assessment highlights initial efforts toward digital transformation but reveals a lack of strategic planning from top bottom initiative, insufficient infrastructure, and limited digital skills. Digital transformation

[11] The description is based on the one automatically generated by the VA.

awareness is low among staff, and management, while supportive of a digital vision, has yet to implement a structured approach to incorporating tools like BIM and GIS.

Infrastructure to support necessary software is underdeveloped, with digital initiatives limited to pilot programs used by a minority of staff. Legislative systems are recognized as complex, and although there are attempts to simplify procedures, rules remain rigid, creating obstacles to digitalisation. Strategic objectives for a data ecosystem are not clearly defined, with minimal tool integration and limited efforts to standardise digital workflows.

Training is insufficient, with less than eight hours per employee per year, contributing to low digital literacy among technicians and stakeholders. Basic digital skills are present, but knowledge is limited to fewer than 25% of technicians, and stakeholders use digital data sparingly without reusing or building upon it in subsequent processes.

Conclusion: The organisation domain requires significant development in digital skills training, strategic planning, and infrastructure enhancement. Establishing structured training programs, clearer strategic goals, and investing in infrastructure will be essential for advancing digitalisation and supporting an effective data ecosystem.

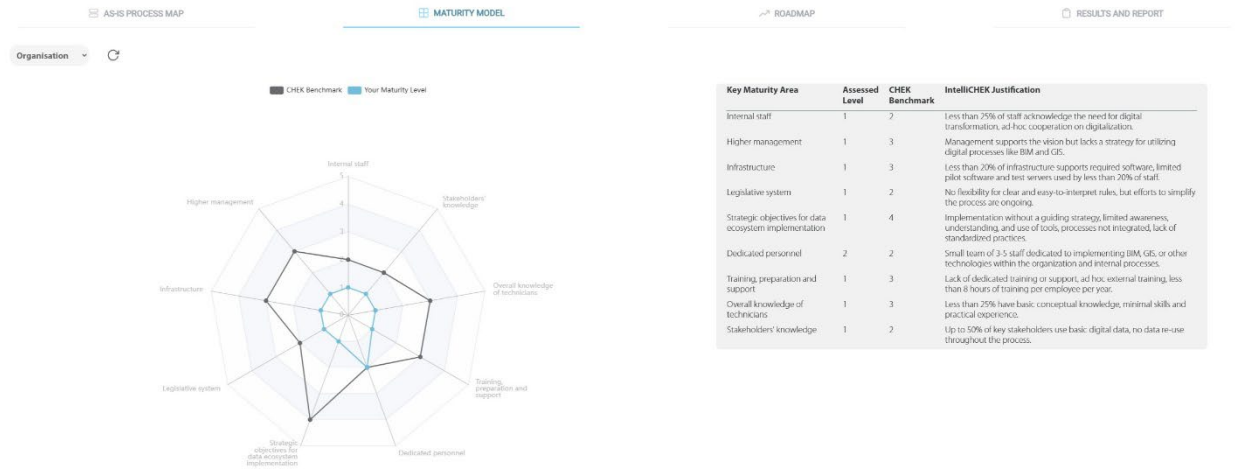


Figure 9 Organisation maturity for Ascoli Piceno

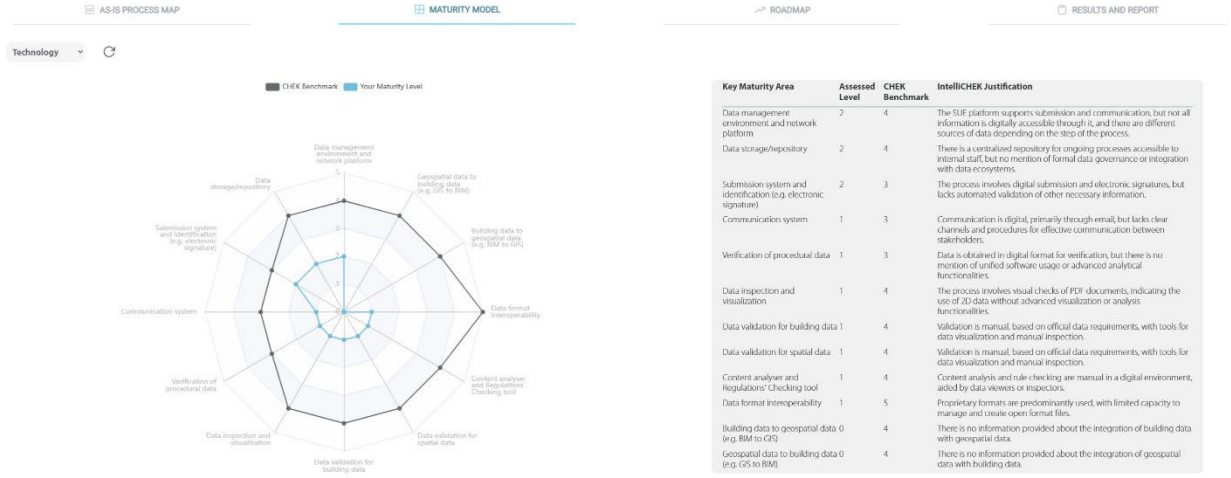
Technology (Average Maturity Level: 1.1)

The technology category shows that the municipality has implemented some foundational digital tools but lacks depth in both integration and automation. The SUE platform enables digital submissions and electronic signatures, facilitating an online workflow. However, the system does not fully support end-to-end digital processes, as submissions require manual validation, and data accessibility is inconsistent. Without a unified communication system, stakeholders rely on email, which does not support efficient, structured communication or tracking.

Moreover, data verification and visualisation capabilities are minimal, limited to basic 2D documents without advanced analytic tools. The reliance on manual data validation for building and spatial data introduces potential inefficiencies and human error, while the lack of interoperability across formats further hampers seamless data exchange and

integration. The absence of integration between building and geospatial data underscores a critical gap in achieving comprehensive data analysis.

Conclusion: Technology infrastructure is at an initial stage, with some digital functionalities but limited by manual processes, lack of data integration, and insufficient interoperability. Priority areas for improvement include the automation of submission validations, enhancing communication systems, and adopting advanced data visualisation and analysis tools.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data management environment and network platform	2	4	The SUE platform supports submission and communication, but not all information is digitally accessible through it, and there are different sources of data depending on the step of the process.
Data storage/repository	2	4	There is a centralized repository for ongoing processes accessible to internal staff, but no mention of formal data governance or integration with data ecosystems.
Submission system and identification (e.g. electronic signature)	2	3	The process involves digital submission and electronic signatures, but lacks automated validation of other necessary information.
Communication system	1	3	Communication is digital, primarily through email, but lacks clear channels and procedures for effective communication between stakeholders.
Verification of procedural data	1	3	Data is obtained in digital format for verification, but there is no mention of unified software usage or advanced analytical functionalities.
Data inspection and visualization	1	4	The process involves visual checks of PDF documents, indicating the use of 2D data without advanced visualization or analysis functionalities.
Data validation for building data	1	4	Validation is manual, based on official data requirements, with tools for data visualization and manual inspection.
Data validation for spatial data	1	4	Validation is manual, based on official data requirements, with tools for data visualization and manual inspection.
Content analyser and Regulations' Checking tool	1	4	Content analysis and rule checking are manual in a digital environment, aided by data viewers or inspectors.
Data format interoperability	1	5	Proprietary formats are predominantly used, with limited capacity to manage and create open format files.
Building data to geospatial data (e.g. BIM to GIS)	0	4	There is no information provided about the integration of building data with geospatial data.
Geospatial data to building data (e.g. GIS to BIM)	0	4	There is no information provided about the integration of geospatial data with building data.

Figure 10 Technology maturity for Ascoli Piceno

Information (Average Maturity Level: 0.5)

In the Information category, the assessment reveals a nascent stage of digitalisation, with limited data structuring and minimal utilization of advanced data standards. The absence of data quality control measures and the lack of a structured approach to building or intervention design data, such as BIM, indicate that critical information is not effectively managed or structured within a digital framework.

While there is digital access to city regulatory and planning information, it lacks the sophistication of 3D modelling or semantic enhancements, limiting its utility for complex analyses. Documentation standards and data guidelines are basic, providing only human-readable formats with minimal automation. Regulations are presented in natural language, requiring interpretation, and although they are accessible online, they are not integrated with digital processes that could enhance usability.

Conclusion: Information management is at a very early stage, primarily limited to basic documentation with minimal structuring or standardisation. Key areas for development include implementing data quality controls, adopting advanced data formats such as BIM, and developing automated standards for documentation and regulatory data.

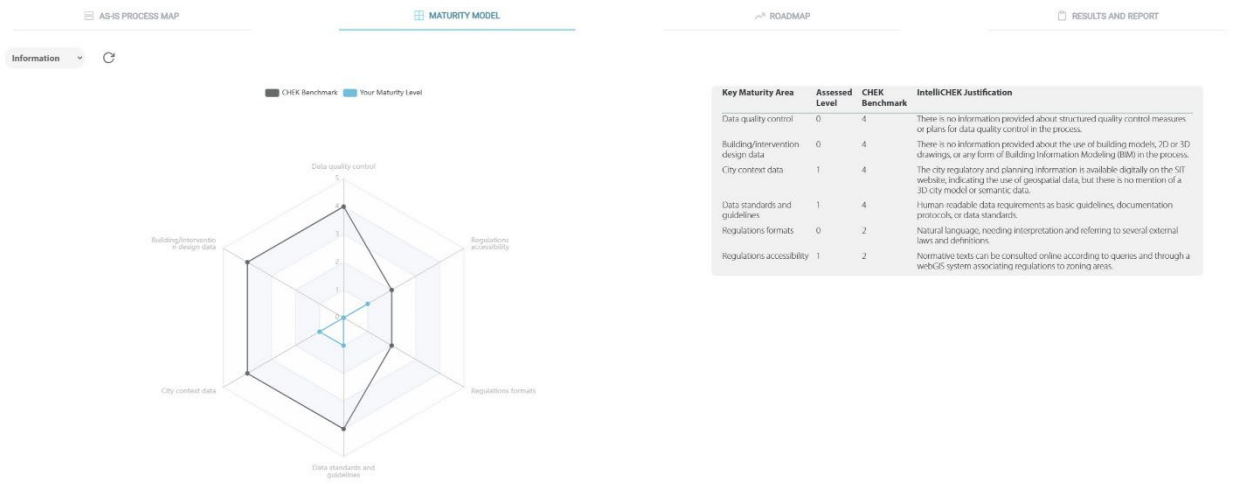


Figure 11 Information maturity for Ascoli Piceno

Overall conclusion

The maturity assessment of the building permit process indicates an early stage of digital transformation, with significant room for improvement across all dimensions. The current system is predominantly analogue with some digital integration, particularly in the Process dimension. To advance the maturity levels, there is a need for enhanced digital integration, standardisation, and strategic planning. Focus should be placed on developing a comprehensive digital strategy, improving data governance, and increasing stakeholder engagement and training to support a more robust digital transformation.

The maturity assessment reveals that the process has foundational elements in place, particularly within the Process domain. However, other areas—especially Information and Organisation—require substantial improvements to achieve a cohesive, efficient digital workflow. The Technology domain shows early adoption of digital tools, though limited by manual processes and insufficient integration. Strategic interventions, such as implementing data standards, enhancing interoperability, increasing automation, and formalising training and infrastructure investments, will be essential for advancing the municipality's digital maturity and improving the building permit process overall.

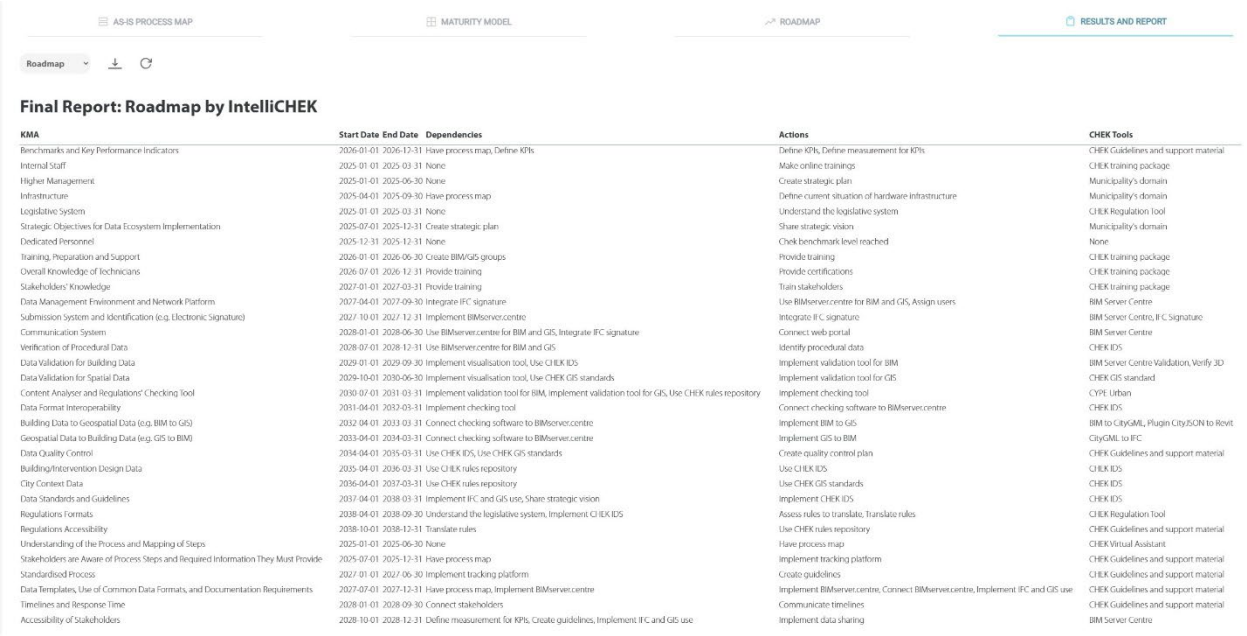
4.1.4 Automated roadmap and report

The maturity roadmap for Ascoli Piceno provides a structured digital transformation plan to elevate the municipality's building permit process to CHEK benchmark levels. The current system remains largely analogue, with limited digital integration in key areas such as process standardisation, data governance, and stakeholder engagement. The roadmap focuses on enhancing digital infrastructure, improving interoperability, and implementing standardised frameworks to streamline permit processing and decision-making.

The transformation begins with internal training programs for municipal staff and leadership, ensuring alignment with the new digital framework. Infrastructure development follows, with the implementation of BIM and GIS technologies to facilitate data integration, electronic submission, and validation. Standardisation of processes and regulations is critical, requiring the adoption of CHEK GIS and BIM standards to improve automation, compliance, and efficiency.

The roadmap emphasises stakeholder engagement, introducing process mapping and tracking platforms to enhance transparency and communication. Performance monitoring is achieved through the definition of key performance indicators (KPIs) and the continuous evaluation of benchmark levels. The final stage involves automation and optimisation through AI-driven validation systems and the implementation of a centralised BIMServer Centre for data management and sharing.

By executing this roadmap, Ascoli Piceno will transition to a fully digital, standardised, and interoperable building permit system. The result will be a faster, more accurate approval process, improved compliance with regulations, and enhanced collaboration between municipal departments and external stakeholders. This approach will ensure a more efficient, transparent, and future-ready permit management system that meets international digital governance standards.



AS-IS PROCESS MAP | MATURITY MODEL | ROADMAP | RESULTS AND REPORT

Roadmap

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Benchmarks and Key Performance Indicators	2026-01-01	2026-12-31	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Internal Staff	2025-01-01	2025-03-31	None	Make online trainings	CHEK training package
Higher Management	2025-01-01	2025-06-30	None	Create strategic plan	Municipality's domain
Infrastructure	2025-04-01	2025-09-30	Have process map	Define current situation of hardware-infrastructure	Municipality's domain
Legislative System	2025-01-01	2025-03-31	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2025-12-31	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2025-12-31	2025-12-31	None	Chek benchmark level reached	None
Training, Preparation and Support	2026-01-01	2026-06-30	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2026-07-01	2026-12-31	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2027-01-01	2027-03-31	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2027-04-01	2027-09-30	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2027-10-01	2027-12-31	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2028-01-01	2028-06-30	Use BIMserver.centre for BIM and GIS, Integrate IFC signature	Connect web portal	BIM Server Centre
Verification of Procedural Data	2028-07-01	2028-12-31	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2029-01-01	2029-09-30	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2029-10-01	2030-06-30	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and Regulations' Checking Tool	2030-07-01	2031-03-31	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2031-04-01	2032-03-31	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g. BIM to GIS)	2032-04-01	2033-03-31	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g. GIS to BIM)	2033-04-01	2034-03-31	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2034-04-01	2035-03-31	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2035-04-01	2036-03-31	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2036-04-01	2037-03-31	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2037-04-01	2038-03-31	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2038-04-01	2038-09-30	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2038-10-01	2038-12-31	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-06-30	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-07-01	2025-12-31	Have process map	Implement tracking platform	CHEK Guidelines and support material
Standardised Process	2027-01-01	2027-06-30	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2027-07-01	2027-12-31	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response Time	2028-01-01	2028-09-30	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material
Accessibility of Stakeholders	2028-10-01	2028-12-31	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre

Figure 12 CHEK Roadmap for Ascoli Piceno

The full report is available on Annex II of this deliverable.

4.2 Lisbon

4.2.1 Workshop report

In this phase of testing, FHI utilized the CHEK Virtual Assistant (VA) tool to map the current (as-is) building permit process for the municipality of Lisbon. The process mapping involved a virtual workshop, with two representatives from

the municipality providing direct insights into their existing workflow. This report details the steps undertaken during the workshop, the process map construction, and the subsequent stages of evaluation using the VA tool.

Workshop Setup and Execution

The workshop was conducted via videoconference, with FHI sharing the VA tool screen to facilitate real-time collaboration. The session was designed to last two hours, during which the as-is process map was constructed incrementally. Throughout the workshop, the FHI facilitator guided the municipality representative through each process step, asking clarifying questions from IntelliCHEK, and, at the conclusion, assisting with a final questionnaire. This session exceeded with 20 min the planned duration. However, all intended objectives were fully addressed.

Initial Process Setup in VA

At the beginning of the workshop, FHI logged into the VA and set up a new project for mapping the building permit process. The municipality's technicians then provided a brief description of the process, covering four essential elements:

- *Dematerialisation: The building permit process is entirely digitised from start to finish, with no paper documents involved.*
- *Documentation Format: All documents are in digital format only (only dematerialised, without metadata).*
- *Communication Channel: All interactions between the municipality and applicants are managed through the municipality's digital platform, with in-person meetings available only in exceptional cases.*
- *Data Storage: All data and documents are stored on the municipality's platform*

This information was entered into the VA tool to ensure an accurate foundation for further mapping and analysis.

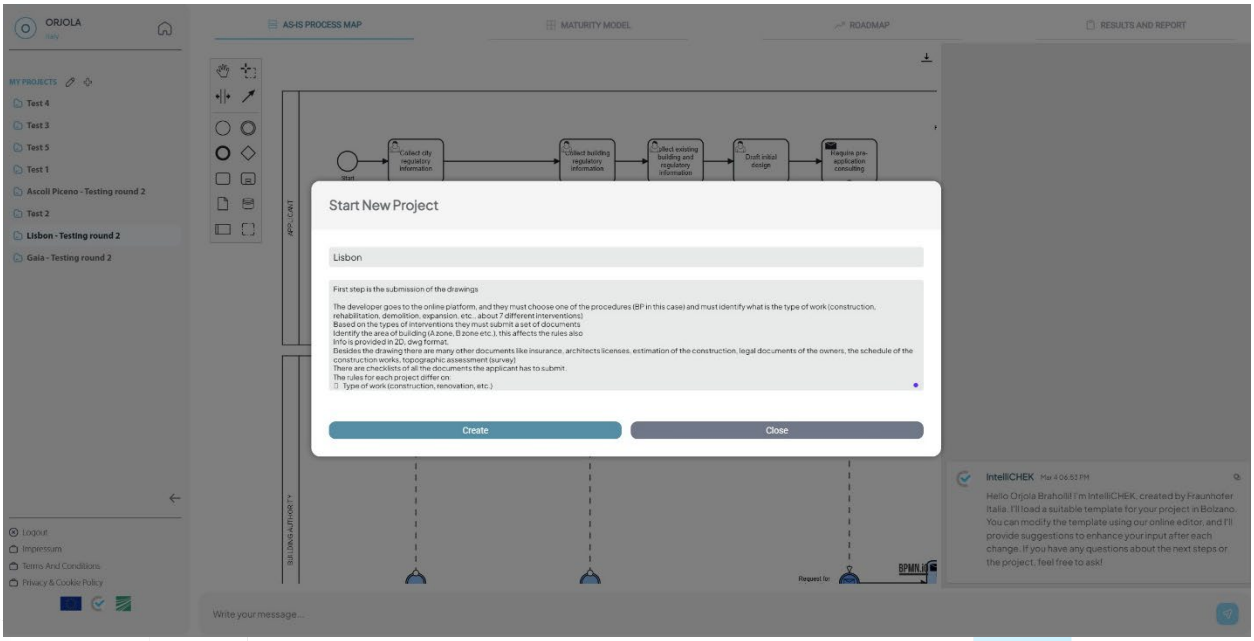


Figure 13 Starting the project with the municipality of Lisbon

Process Mapping with the VA Tool

Following the initial setup, FHI and the municipality representatives worked together to construct the building permit process map using the VA tool's default BP process template, which could be modified within the bpmn.io visual editor. The FHI user adjusted the process map based on the municipality's input, ensuring that each step accurately represented the current procedures.

For each action added or modified in the map, IntelliCHEK's chatbot was activated, providing immediate analysis and feedback. The chatbot offered suggestions for naming conventions and requested additional details as needed to clarify each action. Key details requested by the chatbot included action types, executors, information exchange methods, and communication protocols. An example prompt from the chatbot was:

"You have mentioned the action: Accept application. Could you kindly provide a detailed description of how this action is typically carried out within the workflow? This information will greatly assist in evaluating the process according to the maturity model."

The FHI facilitator consulted with the municipality technician to obtain the necessary details, entering the responses directly into the chat. The VA then reviewed these inputs to determine whether they were sufficient for assessing the action's maturity, or if further details were required. This interactive mapping approach continued until the entire process was documented to the satisfaction of the municipality representative.

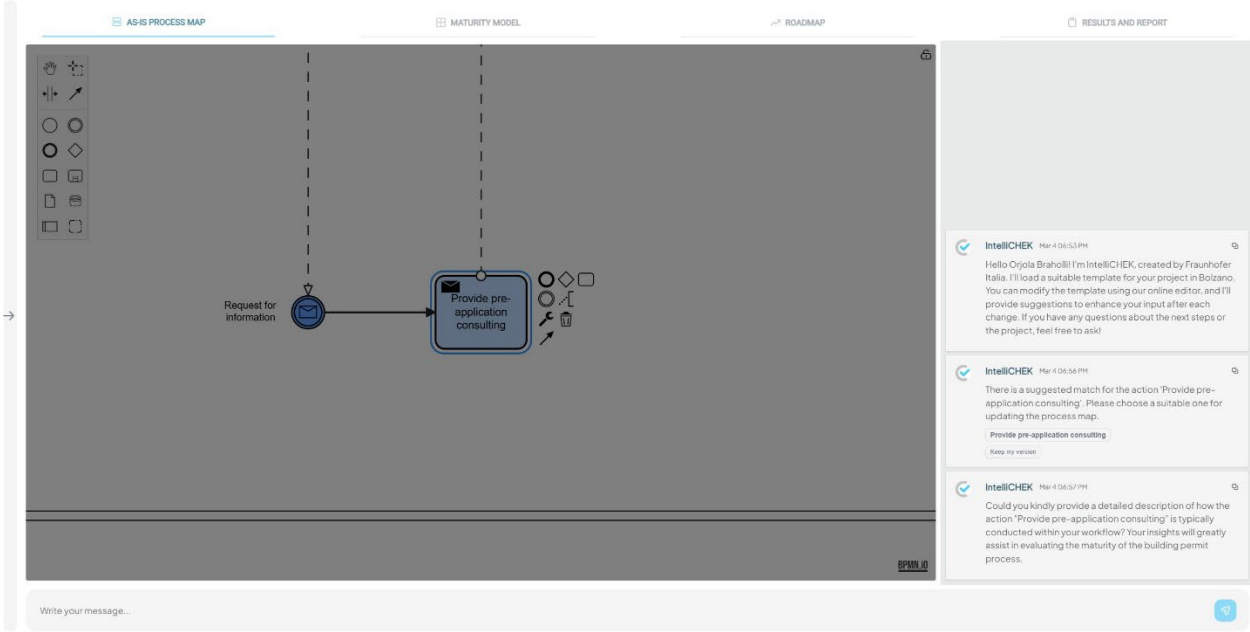


Figure 14 VA Process map of Lisbon

Organisation Questionnaire Completion

Upon completion of the process map, the municipality representative was prompted to complete a multiple-choice questionnaire. This questionnaire collected supplementary information not directly obtainable from the process map, focusing on aspects such as organisational structure, regulatory compliance, and legislation relevant to the building permit process. This information was intended for use in the subsequent maturity assessment and served as an important input for evaluating the municipality's current digital capabilities. The full questionnaire is available in APPENDIX 01 – Organisation Questionnaire from CHEK Virtual Assistant of this document.

Maturity Assessment

After the questionnaire completion, the VA tool automatically proceeded with the maturity assessment phase. Using data from the process map, chat responses, and questionnaire answers, the VA evaluated the maturity of the building permit process. The tool generated a report summarising the process's maturity level, accompanied by visual graphs depicting key results.

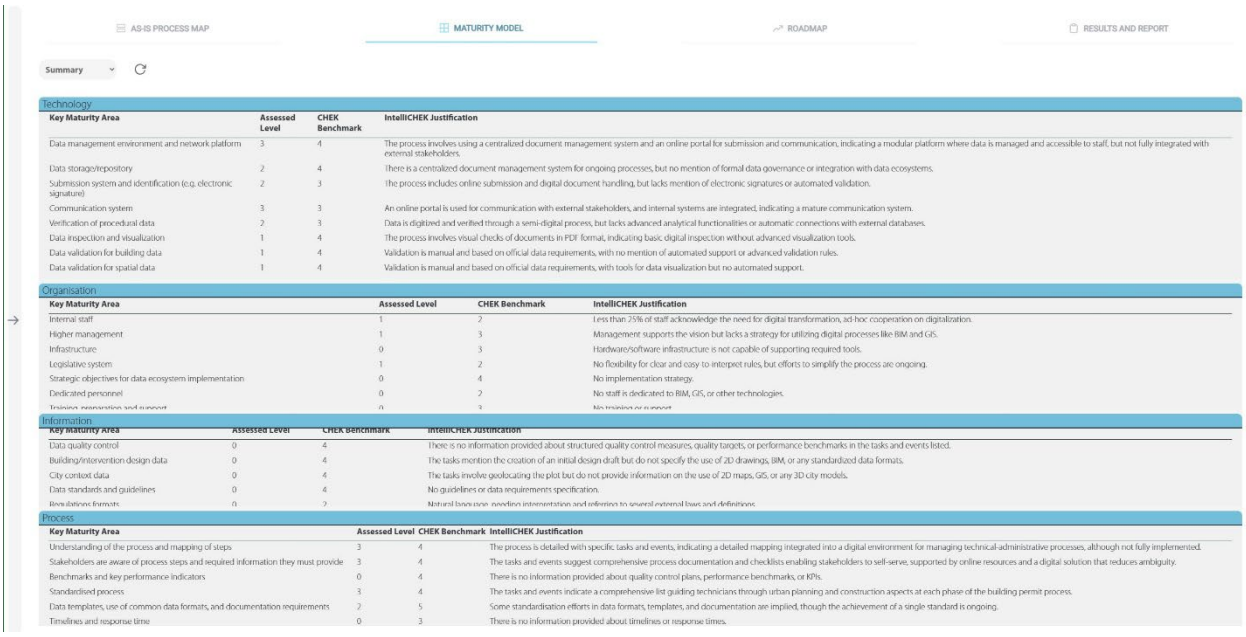


Figure 15 VA Summary of the maturity assessment

Roadmap Generation

Following the maturity assessment, the VA tool generated an improvement roadmap based on the CHEK Benchmark, which is embedded in the VA's database. This roadmap was automatically designed to guide the municipality from its current process state to a target state, as defined by CHEK objectives.

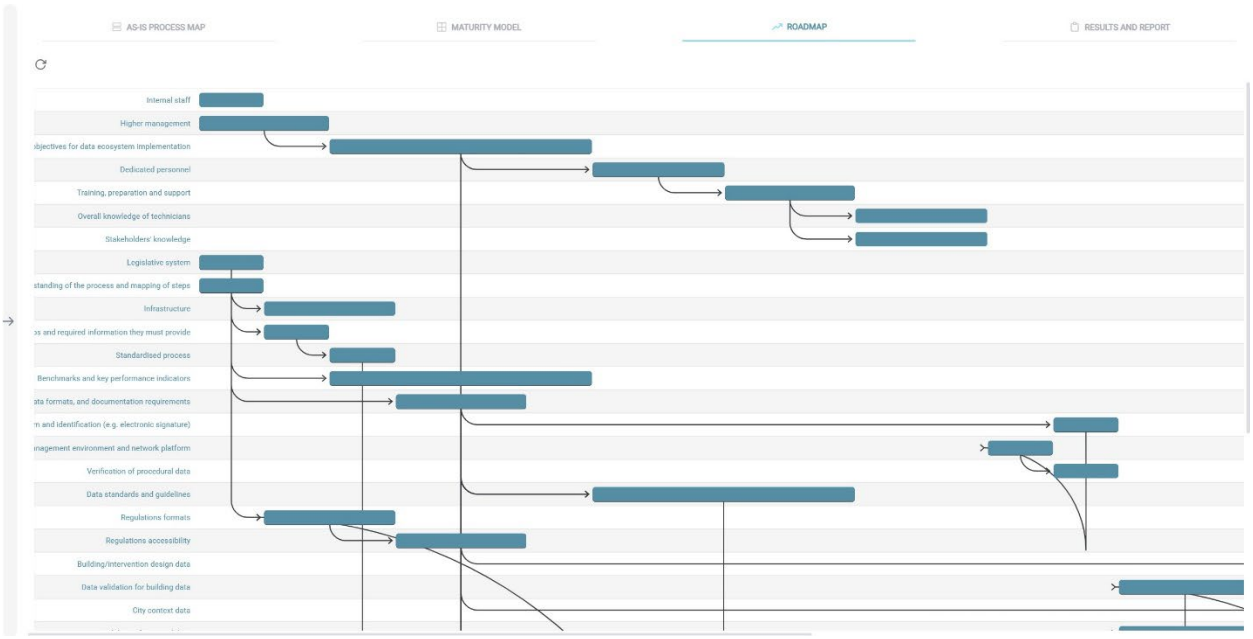


Figure 16 VA Roadmap of Lisbon's building permit process digitalisation

Final Report Generation

The VA tool concluded with the automatic generation of a final report, which consolidated the maturity assessment results, the improvement roadmap, and visual analyses. This report provides a comprehensive overview of the municipality's current digital building permit process and outlines the steps recommended for further development.

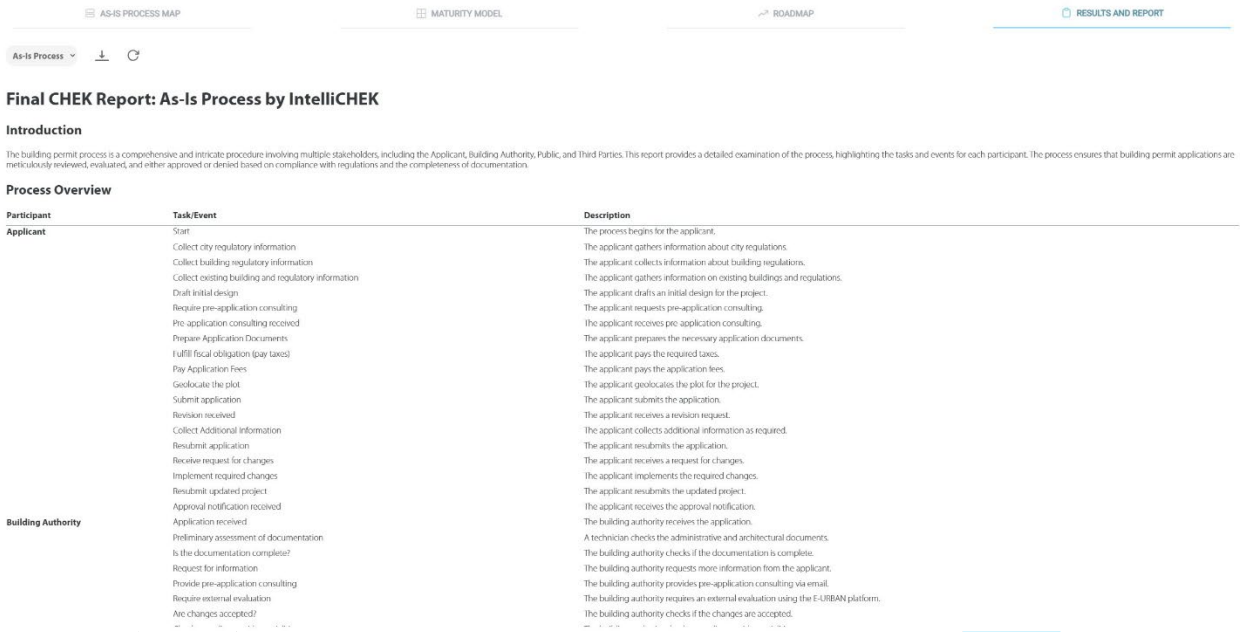


Figure 17 VA final report of Lisbon

4.2.2 Process map[12]

Detailed Process Description of the Building Permit Process in the municipality of Lisbon.

Applicant

The applicant initiates the building permit process by gathering essential regulatory information, including city and building regulations, as well as data on existing structures. This foundational knowledge is crucial for drafting an initial design that aligns with local requirements. Recognizing the complexity of the process, the applicant seeks pre-application consulting to ensure compliance and address potential issues early on.

Upon receiving guidance, the applicant prepares the application documents, fulfilling fiscal obligations such as paying taxes and application fees. The geolocation of the project plot is a critical step, ensuring accurate representation in the application. Once the application is submitted, the applicant remains engaged, responding promptly to revision requests and implementing necessary changes. This iterative process of resubmission and revision underscores the applicant's commitment to meeting regulatory standards. Ultimately, the applicant receives the coveted approval notification, signifying the successful navigation of the permit process.

Building Authority

The building authority plays an important role in the permit process, commencing with the receipt and preliminary assessment of the application. A thorough review of administrative and architectural documents ensures completeness and compliance. Should any deficiencies be identified, the authority promptly requests additional information or documents from the applicant.

Pre-application consulting is provided to guide applicants through the regulatory landscape, while external evaluations via the E-URBAN platform offer an objective assessment of the project. The authority meticulously checks compliance with specialised requirements, ensuring that all aspects of the project adhere to established standards.

Upon receiving updated submissions, the authority conducts a final review, culminating in the acceptance of the project. The approval process is comprehensive, involving multiple checks and balances to safeguard public interest and regulatory compliance. Once all criteria are met, the authority prepares and issues the building permit, formally authorizing the commencement of construction.

Third-Party Actions

Third parties are integral to the evaluation process, providing an external perspective on the project's feasibility and compliance. Upon receiving a request for evaluation, these entities conduct a thorough assessment, leveraging their expertise to identify potential issues or areas for improvement. The external evaluation report is a critical component of the decision-making process, informing the building authority's final determination.

Conclusion

The building permit process is a multifaceted procedure that demands collaboration and diligence from all participants. The applicant's proactive engagement, coupled with the building authority's rigorous oversight and the third parties' expert evaluations, ensures that projects meet the highest standards of safety and compliance. This comprehensive

[12] The description is based on the one automatically generated by the VA.

approach not only facilitates the approval of building permits but also upholds the integrity of the built environment, fostering sustainable and responsible development.

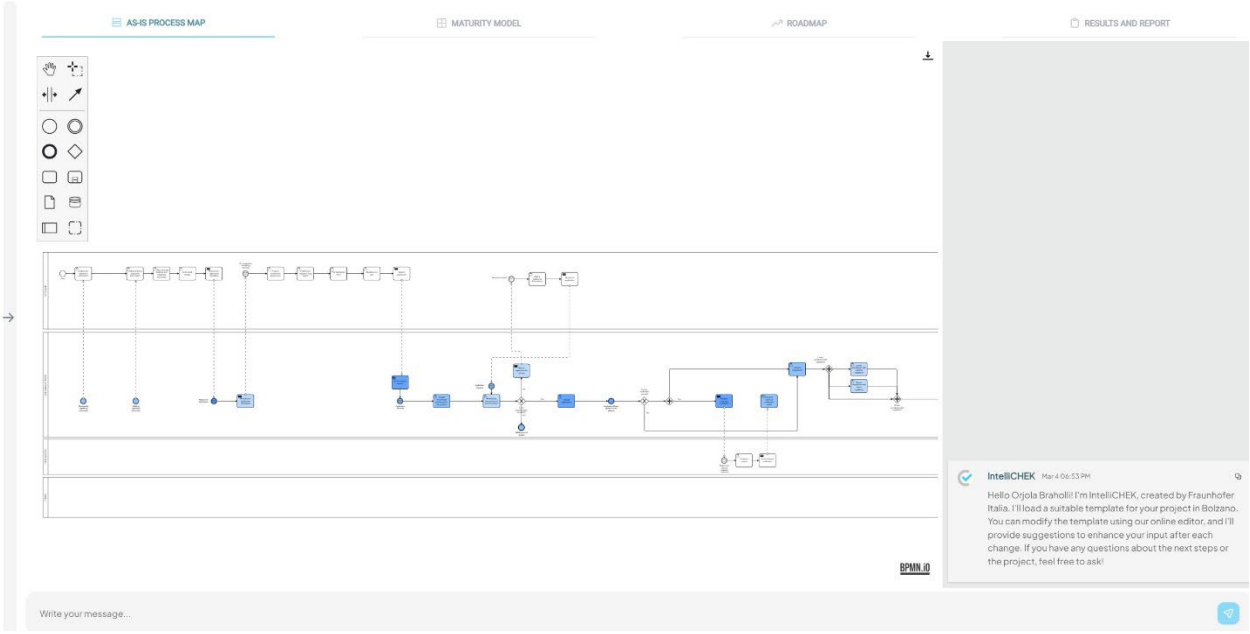


Figure 18 Process map of Lisbon's building permit process

4.2.3 Maturity assessment[13]

Process (Average Maturity Level: 2.0)

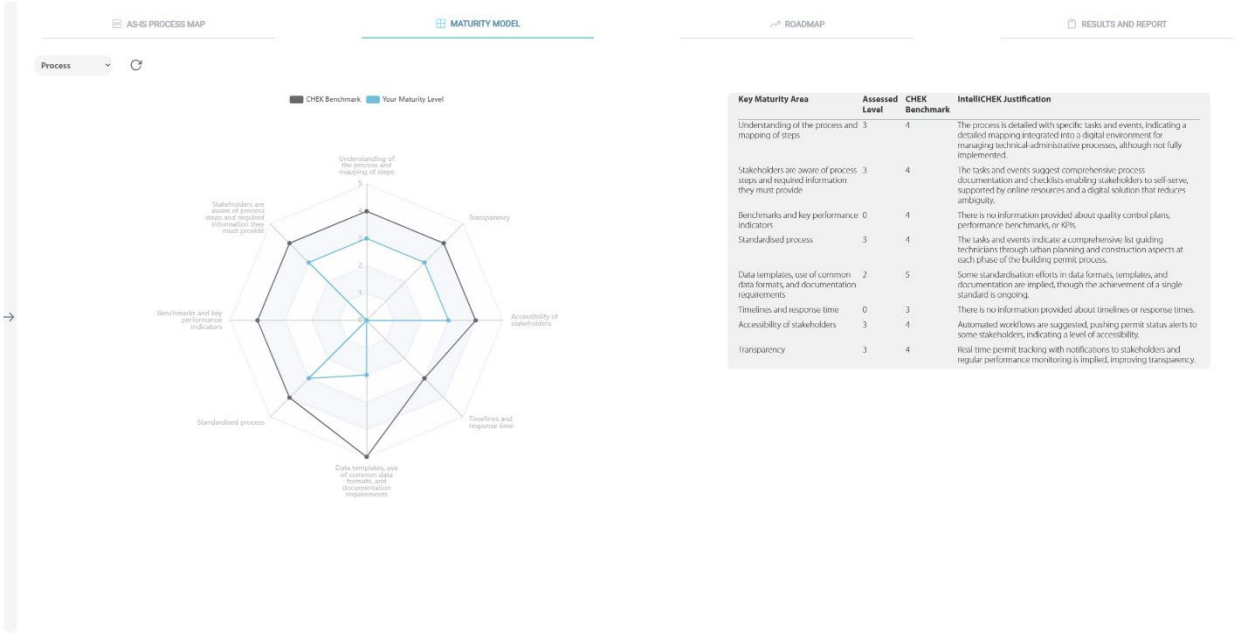
In the Process category, the municipality has achieved moderate maturity, with significant progress in documenting and standardising workflows, though gaps remain in performance measurement and time management.

There is detailed mapping of tasks and events within a digital environment, allowing a clear understanding of process steps, though these are not fully implemented across all stakeholders. Stakeholder awareness is well-supported by comprehensive documentation and checklists, enabling a certain level of self-service. The process is highly standardised with specific guidance throughout the urban planning and construction phases, contributing to a more consistent workflow. Data templates and documentation show some standardisation, although they are not unified under a single standard, which can create inconsistencies across different stages or teams. Automated workflows and real-time tracking enhance both accessibility and transparency, allowing stakeholders to view process progress and updates as they occur.

However, there are no established benchmarks or KPIs, making it difficult to measure process efficiency, set improvement targets, or evaluate success over time. Timelines and response times are also lacking, affecting predictability and accountability within the process.

[13] The description is based on the one automatically generated by the VA.

Conclusion: Process maturity is moderately developed, with strong documentation, standardisation, and transparency but lacking in performance metrics and time management. Next steps should focus on defining KPIs, setting benchmarks, and establishing response time guidelines to improve accountability and process efficiency.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Understanding of the process and mapping of steps	3	4	The process is detailed with specific tasks and events, indicating a detailed mapping integrated into a digital environment for managing technical-administrative processes, although not fully implemented.
Stakeholders are aware of process steps and required information they must provide	3	4	The tasks and events suggest comprehensive process documentation and checklists enabling stakeholders to self-serve, supported by online resources and a digital solution that reduces ambiguity.
Benchmarks and key performance indicators	0	4	There is no information provided about quality control plans, performance benchmarks, or KPIs.
Standardised process	3	4	The tasks and events indicate a comprehensive list guiding technicians through urban planning and construction aspects at each phase of the building permit process.
Data templates, use of common data formats, and documentation requirements	2	5	Some standardisation efforts in data formats, templates, and documentation are implied, though the achievement of a single standard is ongoing.
Timelines and response time	0	3	There is no information provided about timelines or response times.
Accessibility of stakeholders	3	4	Automated workflows are suggested, pushing permit status alerts to some stakeholders, indicating a level of accessibility.
Transparency	3	4	Real time permit tracking with notifications to stakeholders and regular performance monitoring is implied, improving transparency.

Figure 19 Process maturity for Lisbon

Organisation (Average Maturity Level: 0.4)

In the organisation category, the maturity level is low, with limited strategic planning, insufficient infrastructure, and minimal training or digital awareness among staff.

The digital transformation needs of the organisation are not widely acknowledged, and higher management, while supportive of digital processes, has not taken steps to implement a structured digital strategy. Infrastructure is a significant bottleneck, as it lacks the necessary hardware and software to support the building permit process digitally. Efforts are in place to simplify procedures, yet legislative systems remain inflexible, making it difficult to adapt to digital innovations. There are no strategic objectives or dedicated personnel focused on developing a cohesive data ecosystem, further hindering progress toward a more digital environment. Training and support for digital technology are absent, leaving technicians and stakeholders with limited understanding and skills in data and technology. This lack of knowledge impedes the organisation's capacity to fully leverage digital tools and participate in a comprehensive digital transformation.

Conclusion: Organisational maturity is very low, with critical weaknesses in digital infrastructure, strategic planning, and workforce capability. To improve, the organisation should prioritize creating a strategic digital plan, investing in digital infrastructure, implementing regular training programs, and designating staff to oversee digital initiatives.

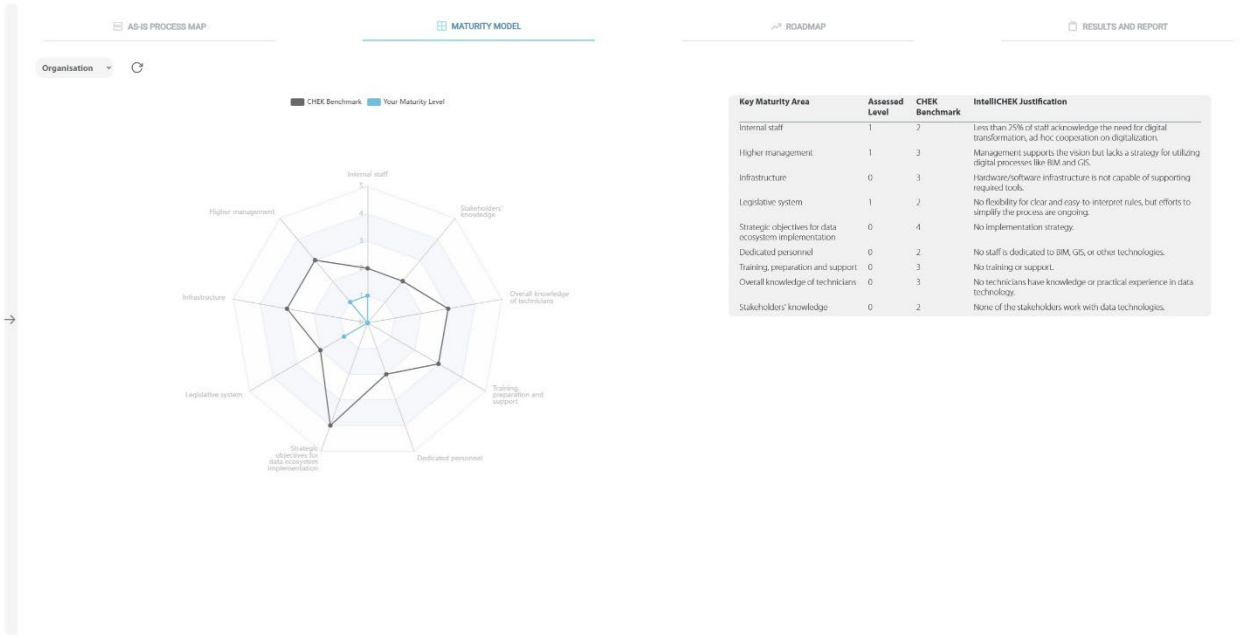


Figure 20 Organisational maturity for Lisbon

Technology (Average Maturity Level: 1.36)

The Technology category shows moderate progress toward digitalisation, with some essential digital tools in place, though there are gaps in automation, data integration, and interoperability.

A centralised document management system supports data accessibility for internal staff, indicating a modular platform, though the system is not fully integrated with external stakeholders, limiting broader data-sharing capabilities. Data storage relies on a centralised repository but lacks formal data governance and integration into larger data ecosystems, affecting efficiency and data quality management. While the submission system includes online submission and digital document handling, it does not yet incorporate electronic signatures or automated validation, limiting full digital authentication.

The communication system is a notable strength, with a mature online portal enabling both internal and external communications. Verification of procedural data is semi-digital, allowing for some manual verification, but does not support advanced analytics or automatic database connections, limiting efficiency. Data inspection relies on basic PDF document checks, with limited data visualisation tools, and data validation remains largely manual, based on official requirements without automated support. Content analysis and regulatory checks are handled manually, using a digital environment but without automation. Interoperability is limited to PDFs, restricting data versatility, and there is no integration between building and geospatial data, marking a significant gap in spatial data analysis.

Conclusion: Technology is at a moderate level of digitalisation, with strengths in data management and communication but limited by manual processes, lack of automation, and poor interoperability. Key improvements could include implementing advanced data analytics, automating validation processes, and enhancing data integration and interoperability.

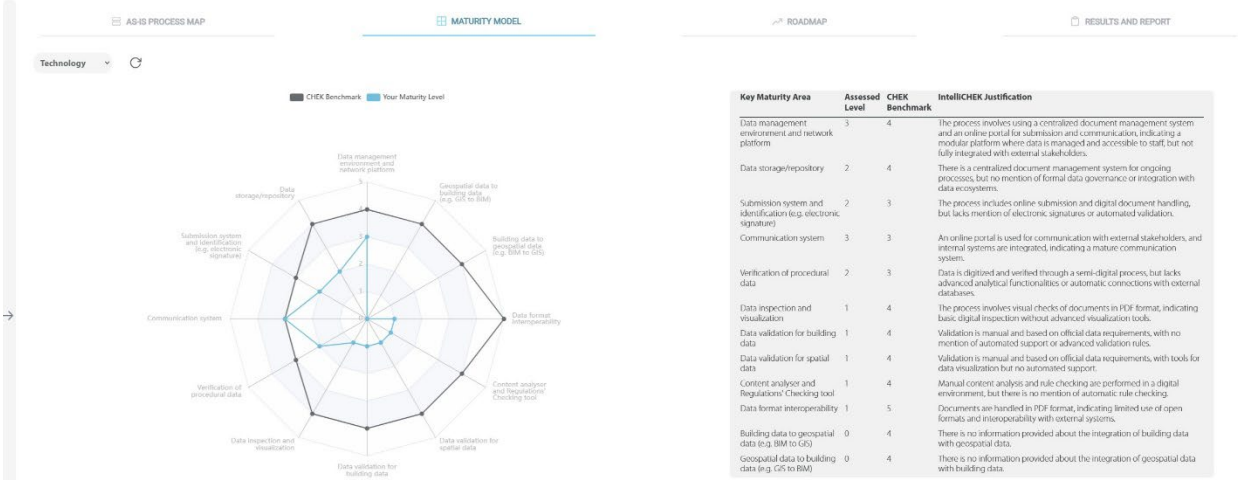


Figure 21 Technological maturity of Lisbon's building permit process

Information (Average Maturity Level: 0.0)

The Information category reveals significant deficiencies in data management, with no standardised quality control measures, structured data standards, or advanced information tools.

The absence of data quality control measures indicates that data consistency and accuracy are not currently managed in a structured way, increasing the risk of errors in the process. Building and intervention design data lacks standardisation, with no use of formats like 2D drawings or BIM models, limiting the ability to share, visualise, or analyse building data effectively. Geolocation of plots is mentioned, but there is no use of GIS or 3D city models, which could enhance the spatial understanding of construction projects within city contexts. The absence of data standards, guidelines, and documented data requirements means that there is no unified approach to how data should be collected, stored, or used, creating inconsistencies and inefficiencies. Regulations are available only in natural language and in static formats like paper or PDF, which requires interpretation and hinders usability for digital processes.

Conclusion: Information management is at a foundational level, with no quality control, data standardisation, or advanced design data capabilities. Critical improvements include establishing data standards, implementing quality control measures, introducing BIM or 3D models, and creating structured data formats for regulatory documents.

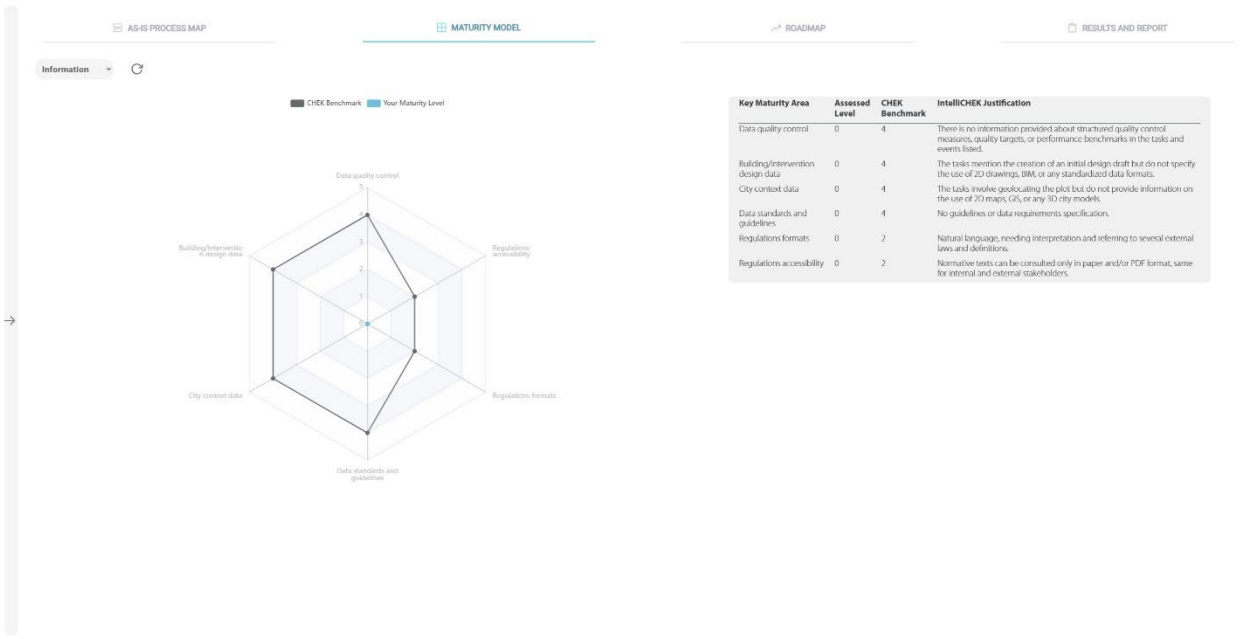


Figure 22 Information maturity of Lisbon's building permit process

Overall conclusion

The maturity assessment of the building permit process reveals a moderate level of digitisation in the technology and process dimensions, with significant gaps in information management and organisational readiness. The findings suggest that while there are some advancements in digital platforms and process standardisation, there is a critical need for strategic planning, infrastructure enhancement, and capacity building. To advance the digitisation of building permit processes, it is essential to address the deficiencies in information management and organisational support, ensuring a comprehensive approach to digital transformation.

While advancements in technology platforms and process standardisation exist, the process is held back by a lack of strategic direction, minimal infrastructure investment, and an unstructured approach to data management. To advance the digital maturity of the building permit process, the municipality should focus on establishing data standards, implementing automation, defining performance metrics, enhancing infrastructure, and building digital competencies within the organisation. This comprehensive approach would support a more integrated, efficient, and accessible building permit process, enabling the municipality to meet modern standards for digital governance and public service efficiency.

4.2.4 Automated roadmap and report

The maturity roadmap for Lisbon outlines a structured digital transformation strategy to reach the CHEK benchmark levels and overcome inefficiencies in the building permit process. The municipality currently faces challenges in process standardisation, data management, interoperability, and organisational readiness. To address these, the roadmap prioritizes the progressive integration of technology, staff training, infrastructure upgrades, and regulatory compliance improvements.

The transformation begins with capacity building through staff training and stakeholder engagement, ensuring that municipal personnel and higher management are equipped to manage the shift toward digitisation. Infrastructure development follows, with a focus on upgrading IT systems and integrating BIM and GIS technologies for better data validation, submission, and management. Standardisation and interoperability play a crucial role, requiring the municipality to implement CHEK GIS and BIM standards to streamline permit processing and ensure seamless collaboration across departments.

Regulatory compliance is another critical aspect, involving the digitisation and automation of building regulations to enable faster, more accurate approval processes. Tools such as CYPE Urban and the CHEK Regulation Tool will support this transition. Stakeholder engagement is reinforced through the development of tracking platforms that improve transparency and communication, while performance monitoring is ensured by defining key performance indicators and benchmark metrics. The final phase involves automation and continuous improvement, leveraging AI-driven validation tools and digital data-sharing platforms to maintain efficiency and compliance with modern governance standards.

By following this roadmap, municipality of Lisbon can transition to a fully digital, standardised, and interoperable building permit system. This transformation will lead to faster approvals, improved regulatory compliance, increased transparency, and enhanced collaboration between municipal departments and external stakeholders. The result is a smarter, more efficient, and future-proof permit management system that aligns with international best practices.

AS-IS PROCESS MAP | MATURITY MODEL | ROADMAP | RESULTS AND REPORT

Roadmap

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-03-31	None	Make online trainings	CHEK training package
Higher Management	2025-01-01	2025-06-30	None	Create strategic plan	Municipality's domain
Infrastructure	2025-04-01	2025-09-30	Have process map	Define current situation of hardware infrastructure	Municipality's domain
Legislative System	2025-01-01	2025-03-31	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2026-06-30	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2026-07-01	2026-12-31	Share strategic vision	Create BIM/GIS groups	Municipality's domain
Training, Preparation and Support	2027-01-01	2027-06-30	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2027-07-01	2027-12-31	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2027-07-01	2027-12-31	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2028-01-01	2028-03-31	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2028-04-01	2028-06-30	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2028-07-01	2028-07-01	None	Chek benchmark level reached	Chek benchmark level reached
Verification of Procedural Data	2028-04-01	2028-06-30	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2028-07-01	2028-12-31	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2028-07-01	2028-12-31	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and Regulations' Checking Tool	2029-01-01	2029-06-30	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2029-07-01	2030-06-30	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g. BIM to GIS)	2030-07-01	2031-06-30	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g. GIS to BIM)	2030-07-01	2031-06-30	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2028-07-01	2029-06-30	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2029-07-01	2030-06-30	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2029-07-01	2030-06-30	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2026-07-01	2027-06-30	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2025-04-01	2025-09-30	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2025-10-01	2026-03-31	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-03-31	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-04-01	2025-06-30	Have process map	Implement tracking platform	CHEK Guidelines and support material
Benchmarks and Key Performance Indicators	2025-07-01	2026-06-30	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Standardised Process	2025-07-01	2025-09-30	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2025-10-01	2026-03-31	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response Time	2026-04-01	2026-09-30	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material
Accessibility of Stakeholders	2026-10-01	2026-12-31	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre

Figure 23 CHEK Roadmap for municipality of Lisbon

4.3 Vila Nova de Gaia

4.3.1 Workshop report

In this phase of testing, FHI utilized the CHEK Virtual Assistant (VA) tool to map the current building permit process for the municipality of Vila Nova de Gaia. The process mapping involved a virtual workshop, with three representatives

from the municipality providing direct insights into their existing workflow. This report details the steps undertaken during the workshop, the process map construction, and the subsequent stages of evaluation using the VA tool.

Workshop Setup and Execution

The workshop was conducted via videoconference, with FHI sharing the VA tool screen to facilitate real-time collaboration. The session was designed to last two hours, during which the as-is process map was constructed incrementally. Throughout the workshop, the FHI facilitator guided the municipality representative through each process step, asking clarifying questions from IntelliCHEK, and, at the conclusion, assisting with a final questionnaire. This session exceeded with 20 min the planned duration. However, all intended objectives were fully addressed.

Initial Process Setup in VA

At the beginning of the workshop, FHI logged into the VA and set up a new project for mapping the building permit process. The municipality's technicians then provided a brief description of the process, covering four essential elements:

- *Dematerialisation: The building permit process is entirely digitised, with no paper documents involved.*
- *Documentation Format: All documents are in digital format only, PDF and CAD. IFC models are accepted but is not a formal format.*
- *Communication Channel: Communication between the municipalities and other parties are by email or through an online platform. There might be online, in-person or hybrid meetings with other parties.*
- *Data Storage: All data and documents are stored digitally on the municipality's internal servers.*

This information was entered into the VA tool to ensure an accurate foundation for further mapping and analysis.

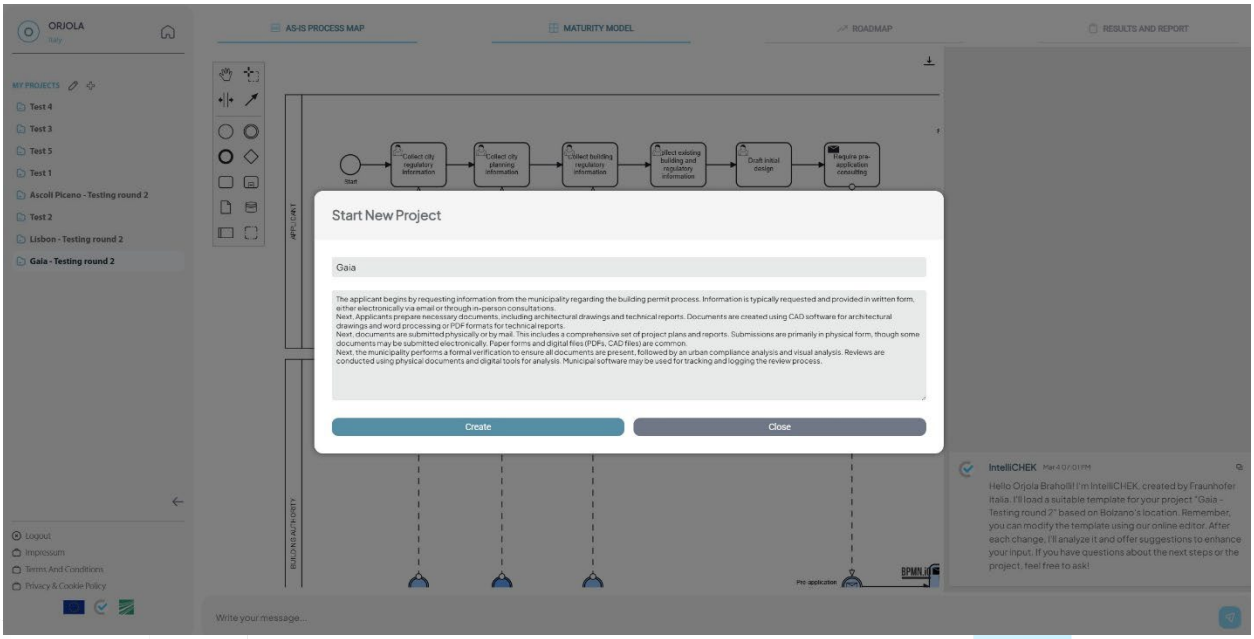


Figure 24 Starting the project with Vila Nova de Gaia

Process Mapping with the VA Tool

Following the initial setup, FHI and the municipality representatives worked together to construct the building permit process map using the VA tool's default BP process template, which could be modified within the bpmn.io visual editor. The FHI user adjusted the process map based on the municipality's input, ensuring that each step accurately represented the current procedures.

For each action added or modified in the map, IntelliCHEK's chatbot was activated, providing immediate analysis and feedback. The chatbot offered suggestions for naming conventions and requested additional details as needed to clarify each action. Key details requested by the chatbot included action types, executors, information exchange methods, and communication protocols. An example prompt from the chatbot was:

"You have mentioned the action: Accept application. Could you kindly provide a detailed description of how this action is typically carried out within the workflow? This information will greatly assist in evaluating the process according to the maturity model."

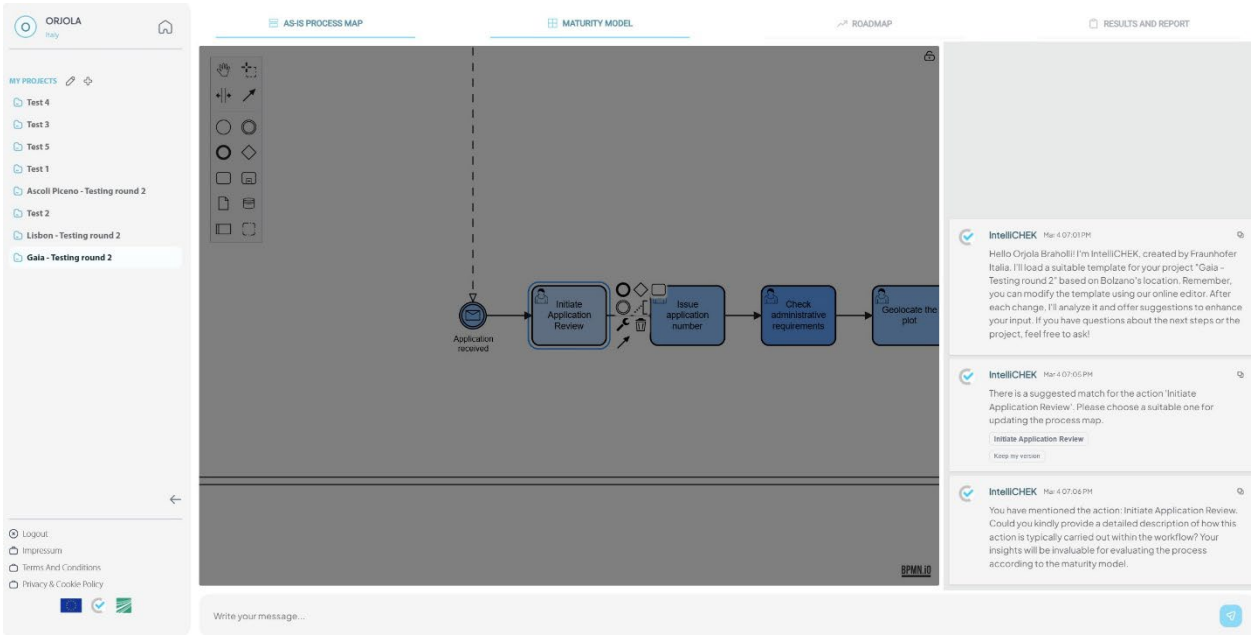


Figure 25 Mapping the building permit process of Vila Nova de Gaia

The FHI facilitator consulted with the municipality technician to obtain the necessary details, entering the responses directly into the chat. The VA then reviewed these inputs to determine whether they were sufficient for assessing the action's maturity, or if further details were required. This interactive mapping approach continued until the entire process was documented to the satisfaction of the municipality representative.

Organisation Questionnaire Completion

Upon completion of the process map, the municipality representative was prompted to complete a multiple-choice questionnaire. This questionnaire collected supplementary information not directly obtainable from the process map, focusing on aspects such as organisational structure, regulatory compliance, and legislation relevant to the building permit process. This information was intended for use in the subsequent maturity assessment and served as an important input for evaluating the municipality's current digital capabilities. The full questionnaire is available in APPENDIX 01 – Organisation Questionnaire from CHEK Virtual Assistant of this document.

Maturity Assessment

After the questionnaire completion, the VA tool automatically proceeded with the maturity assessment phase. Using data from the process map, chat responses, and questionnaire answers, the VA evaluated the maturity of the building permit process. The tool generated a report summarizing the process's maturity level, accompanied by visual graphs depicting key results.

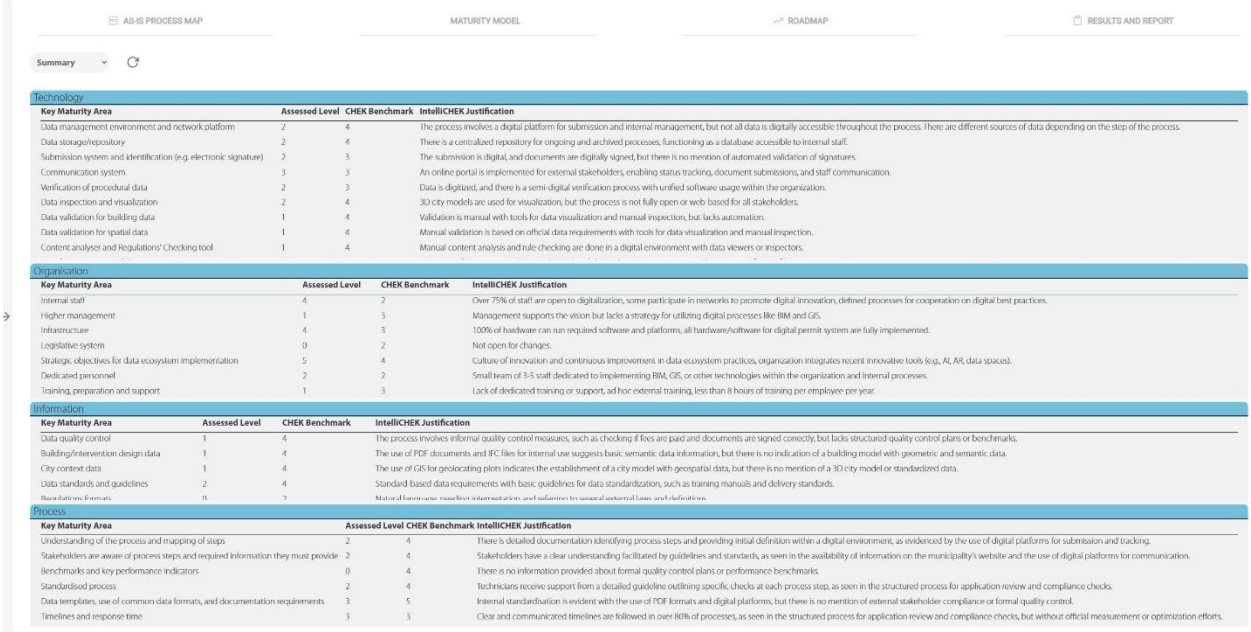


Figure 26 Summary of the maturity assessment for the building permit process of Vila Nova de Gaia

Roadmap Generation

Following the maturity assessment, the VA tool generated an improvement roadmap based on the CHEK Benchmark, which is embedded in the VA's database. This roadmap was automatically designed to guide the municipality from its current process state to a target state, as defined by CHEK objectives.

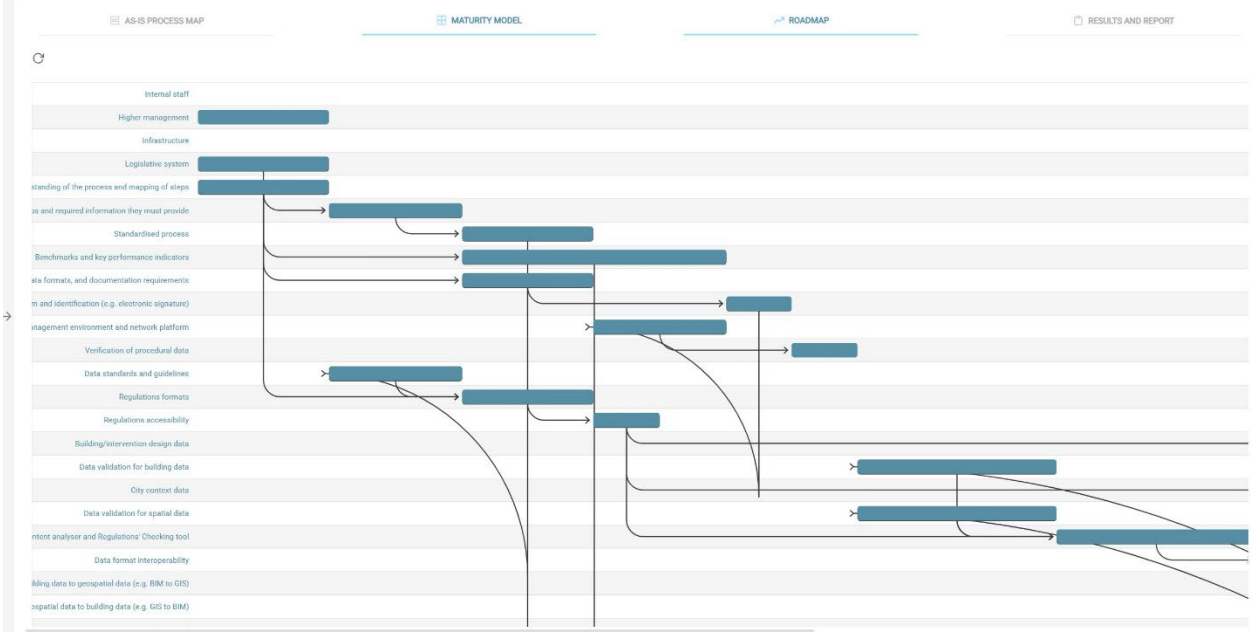


Figure 27 Roadmap of Vila Nova de Gaia's building permit process digitalisation

Final Report Generation

The VA tool concluded with the automatic generation of a final report, which consolidated the maturity assessment results, the improvement roadmap, and visual analyses. This report provides a comprehensive overview of the municipality's current digital building permit process and outlines the steps recommended for further development.

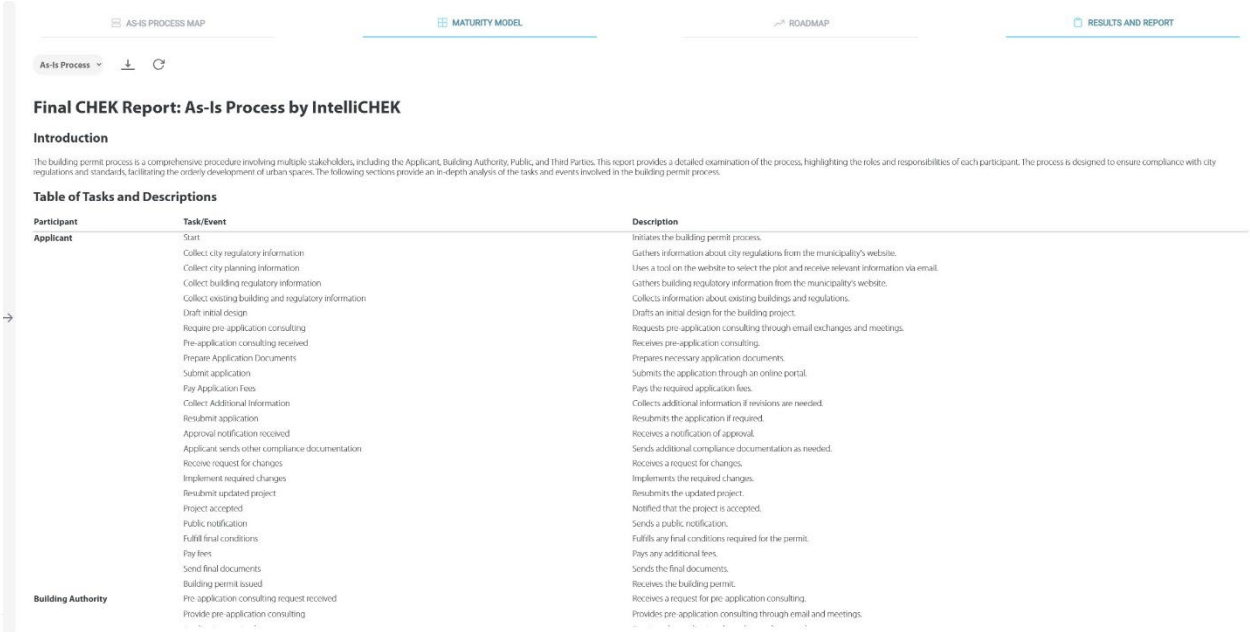


Figure 28 VA Final report of the maturity assessment and roadmap for Vila Nova de Gaia

4.3.2 Process map[14]

Detailed Process Description of the Building Permit Process in the municipality of Vila Nova de Gaia.

Applicant

The applicant initiates the building permit process by gathering essential regulatory and technical information from the municipality's digital platforms. Using this data, the applicant prepares an initial design and, if necessary, requests a pre-application consultation. This consultation can take place in person or through digital communication tools. After refining the design based on preliminary feedback, the applicant compiles the required documents, including architectural plans and environmental assessments, and submits the application through the municipality's digital permit system. The system performs an initial check for missing or incorrect information, allowing the applicant to make necessary corrections before formal submission. Throughout the process, the applicant tracks the application status through the online portal and responds to any revision requests from the building authority. Once all conditions are met, final documents are submitted, and upon approval, the applicant receives the digital building permit, officially completing their role in the process.

Building authority

Upon receiving the application, the building authority reviews the documentation for completeness and compliance with urban planning regulations, zoning laws, and construction standards. If any information is missing or requires clarification, the application is sent back to the applicant for revisions. The building authority manages interdepartmental coordination, ensuring that different municipal departments review the project as needed. External evaluations may also be requested, with reports submitted through the municipality's integrated system. Compliance checks are conducted using digital tools such as CHEK Regulation Tool and CYPE Urban, though manual intervention remains necessary for complex assessments. Once all approvals are secured, the building authority prepares the final permit and submits it for administrative validation. The permit is then digitally issued to the applicant, recorded in the municipality's database, and published online to notify the public.

Public

The public is informed of permit applications and approvals through the municipality's digital platforms. For projects with a potential public impact, citizens have the opportunity to submit feedback during designated consultation periods. Public engagement is facilitated through online portals where residents can review project details, submit objections or comments, and access municipal planning information. While feedback is reviewed and considered, the level of integration between public input and final decision-making remains limited, requiring further automation and transparency improvements.

Third parties

When specific assessments are required, third-party entities such as environmental agencies, historical preservation authorities, and utility providers are consulted. These external evaluators receive requests through the municipality's system, conduct their analysis, and submit their reports digitally. Their findings may result in modifications to the project, which are communicated to the applicant via the digital portal. Although some processes are automated, coordination between third-party organisations and the building authority still relies on manual communication, leading to potential delays in the approval process.

[14] The description is based on the one automatically generated by the VA.

Conclusion

The building permit process in Vila Nova de Gaia integrates digital tools to improve workflows, but complex automation and interoperability have yet to be achieved. The applicant, building authority, public, and third-party entities each play a vital role in ensuring regulatory compliance and efficient permit issuance. While digital submission platforms, compliance-checking tools, and public engagement mechanisms have been implemented, challenges remain in fully automating regulatory checks and improving coordination across agencies. Advancing compliance validation, enhancing third-party integration, and increasing transparency in public feedback mechanisms will further optimise the efficiency and reliability of the system.

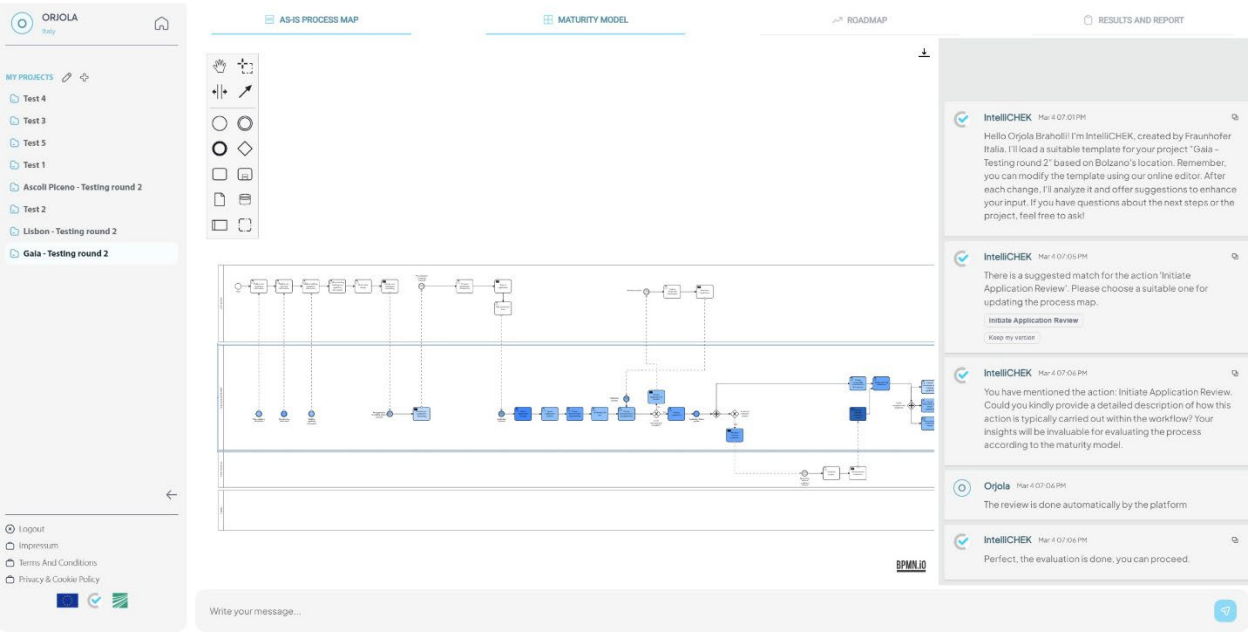


Figure 29 Process map of the building permit process in Vila Nova de Gaia

4.3.3 Maturity assessment[15]

Process (Average Maturity Level: 2.25)

In the Process category, the municipality has achieved moderate maturity, demonstrating significant progress in documenting and standardising workflows, though gaps remain in performance measurement and quality control. The process steps are clearly identified and documented, providing a comprehensive understanding of the digital workflow. Stakeholders have a clear grasp of their roles, supported by detailed guidelines and standards.

There is detailed mapping of tasks within a digital environment, allowing clear understanding of process steps. Automated workflows and real-time tracking enhance accessibility and transparency, enabling stakeholders to view process progress and updates. Standardised data formats and templates exist internally, though they are not consistently followed by external stakeholders.

[15] The description is based on the one automatically generated by the VA.

However, critical weaknesses persist. There are no established benchmarks or key performance indicators reported. Quality control plans are informal or non-existent, limiting the ability to systematically improve the process.

Conclusion: Process maturity is moderately developed, with strong documentation and transparency but lacking in performance metrics and quality control mechanisms.

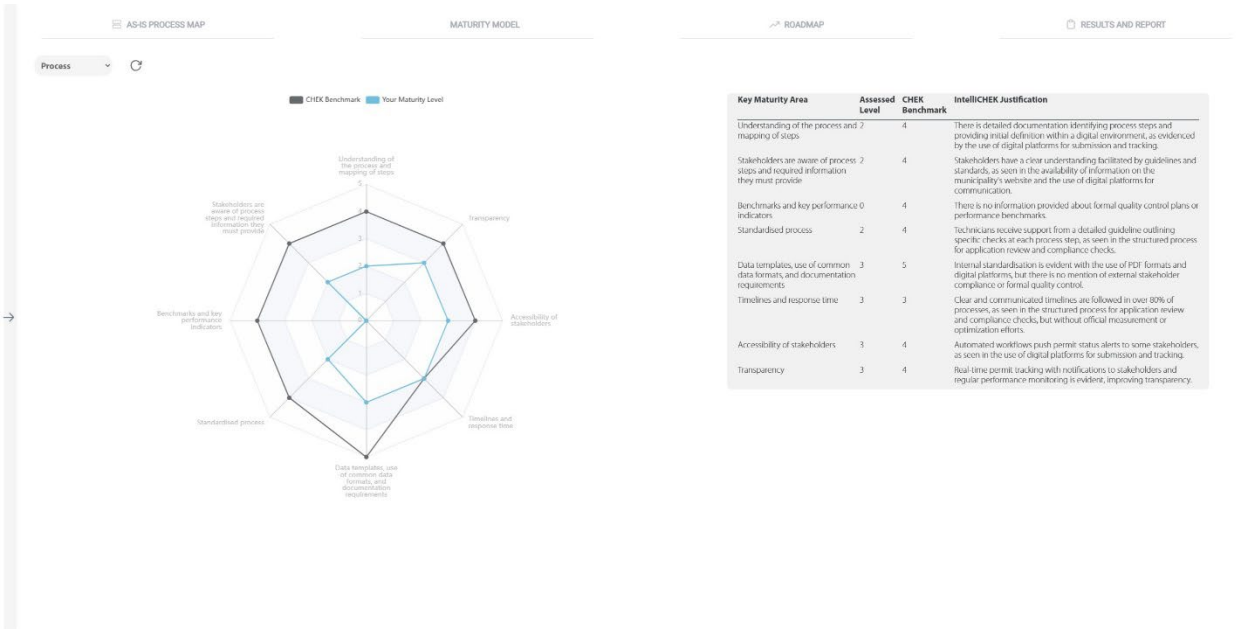


Figure 30 Process maturity of the building permit process of Vila Nova de Gaia

Organisation (Average Maturity Level: 2.22)

In the organisation category, the maturity level reveals significant challenges in digital transformation readiness. While over 75% of staff are open to digitalisation and participate in innovation networks, the organisation struggles with strategic implementation and digital capabilities.

Higher management supports the digital vision but lacks a structured strategy for implementing technologies like BIM and GIS. Infrastructure shows promise, with 100% of hardware capable of running required software and platforms. A culture of innovation exists, with the organisation seeking to integrate innovative tools such as AI and AR into their processes.

However, critical limitations exist in human capital. Less than 25% of technicians have basic conceptual digital knowledge, and training is minimal, with less than 8 hours per employee annually. A small team of 3-5 staff is dedicated to implementing new technologies, but this is insufficient for comprehensive digital transformation. Stakeholders' digital data usage remains primarily isolated, with minimal interoperability and collaboration.

Conclusion: Organisational maturity is constrained by insufficient digital skills, limited training, and an unstructured approach to digital strategy.

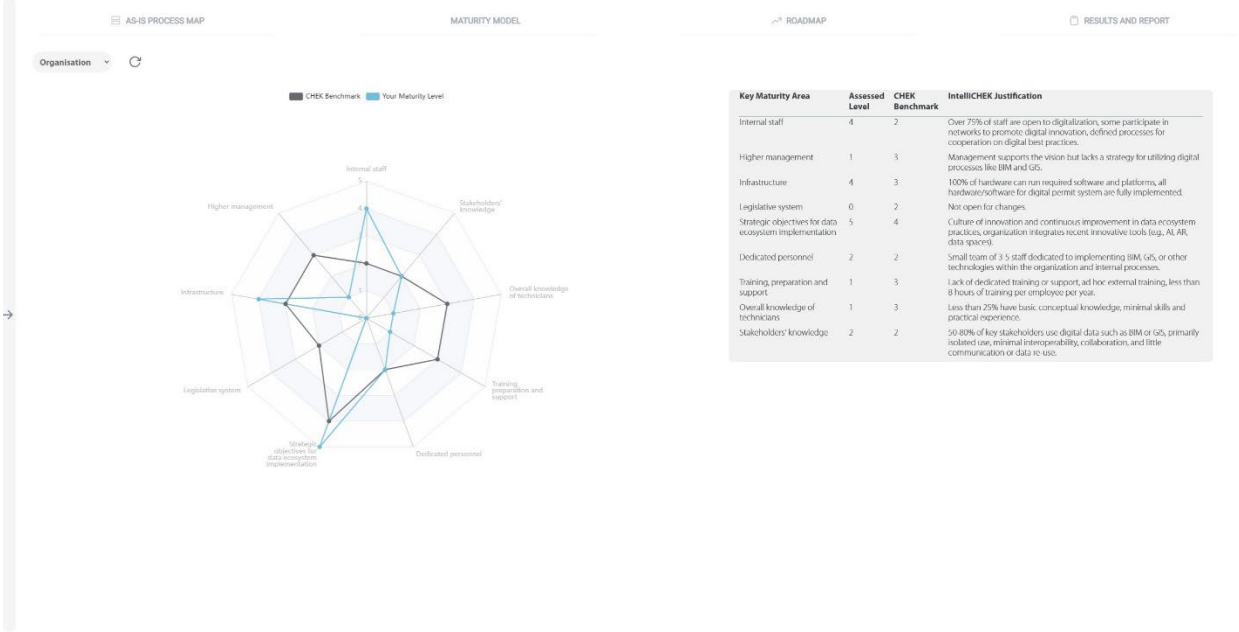


Figure 31 Organisational maturity of the building permit process of Vila Nova de Gaia

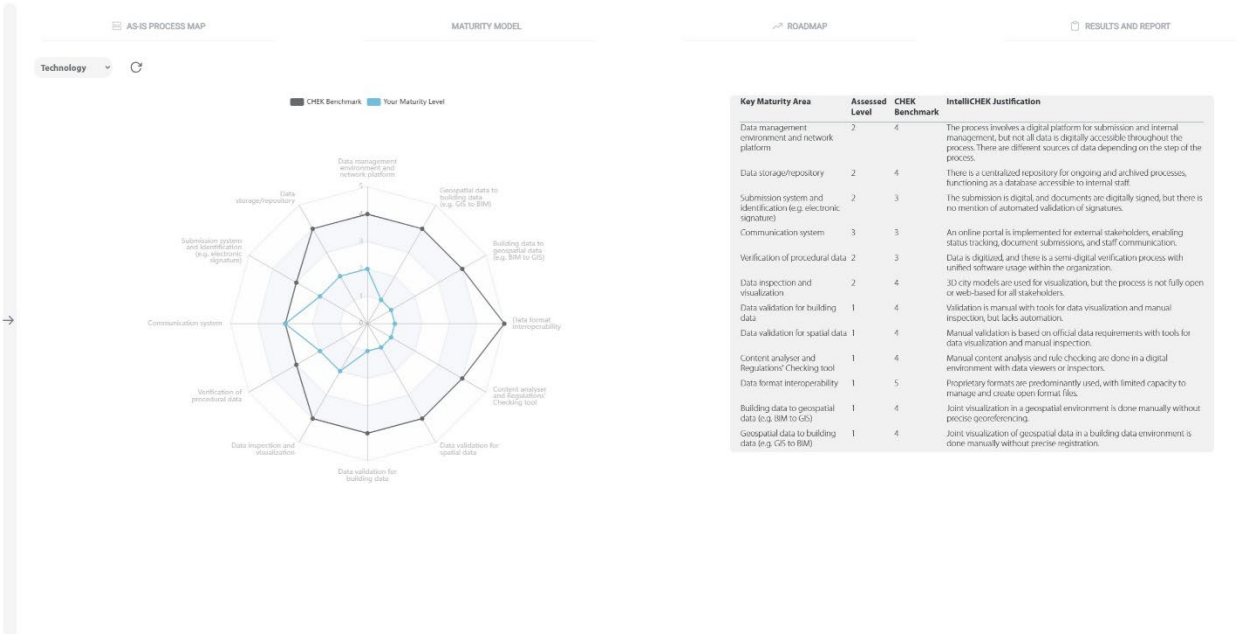
Technology (Average Maturity Level: 1.58)

The Technology category reveals a moderate approach to digitalisation, characterised by partial digital tools and significant manual processes. A centralised document management system supports data accessibility for internal staff, indicating a modular platform. The communication system is a notable strength, with an online portal enabling internal and external communications.

Data storage relies on a centralised repository, but lacks formal data governance and integration into larger data ecosystems. The submission system allows digital submissions with electronic signatures, though not all information is automatically verified. Data verification remains semi-digital, with manual checks supported by visualisation tools.

Significant limitations exist in data interoperability, with mainly proprietary formats and reduced capacity to exchange data with external systems. Integration between building and geospatial data is minimal, requiring manual location and visualisation.

Conclusion: Technology is at an intermediate stage of digitalisation, constrained by manual processes, limited automation, and poor data interoperability.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data management environment and network platform	2	4	The process involves a digital platform for submission and internal management, but not all data is digitally accessible throughout the process. There are different sources of data depending on the step of the process.
Data storage/repository	2	4	There is a centralized repository for ongoing and archived processes, functioning as a database accessible to internal staff.
Submission system and identification (e.g. electronic signature)	2	3	The submission is digital, and documents are digitally signed, but there is no mention of automated validation of signatures.
Communication system	3	3	An online portal is implemented for external stakeholders, enabling status tracking, document submissions, and staff communication.
Verification of procedural data	2	3	Data is digitized, and there is a semi-digital verification process with unified software usage within the organization.
Data inspection and visualization	2	4	3D city models are used for visualization, but the process is not fully open or web-based for all stakeholders.
Data validation for building data	1	4	Validation is manual with tools for data visualization and manual inspection, but lacks automation.
Data validation for spatial data	1	4	Manual validation is based on official data requirements with tools for data visualization and manual inspection.
Content analyser and Regulations' Checking tool	1	4	Manual content analysis and rule checking are done in a digital environment with data viewers or inspectors.
Data format interoperability	1	5	Proprietary formats are predominantly used, with limited capacity to manage and create open format files.
Building data to geospatial data (e.g. BIM to GIS)	1	4	Joint visualization in a geospatial environment is done manually without precise georeferencing.
Geospatial data to building data (e.g. GIS to BIM)	1	4	Joint visualization of geospatial data in a building data environment is done manually without precise registration.

Figure 32 Technological maturity or the building permit process of Vila Nova de Gaia

Information (Average Maturity Level: 1.0)

The Information category reveals significant deficiencies in data management, with no standardised quality control measures or structured data standards. Basic guidelines for data standardisation exist, but quality control remains informal. Building design data is limited to 2D drawings with minimal semantic information.

City models are partially developed but not fully populated with semantic data. Regulations remain in natural language format, requiring manual interpretation and referencing multiple external laws. While normative texts can be consulted online through a webGIS system, they lack comprehensive digital integration.

Conclusion: Information management is at a foundational level, with critical needs for data standardisation, quality control, and advanced information tools.

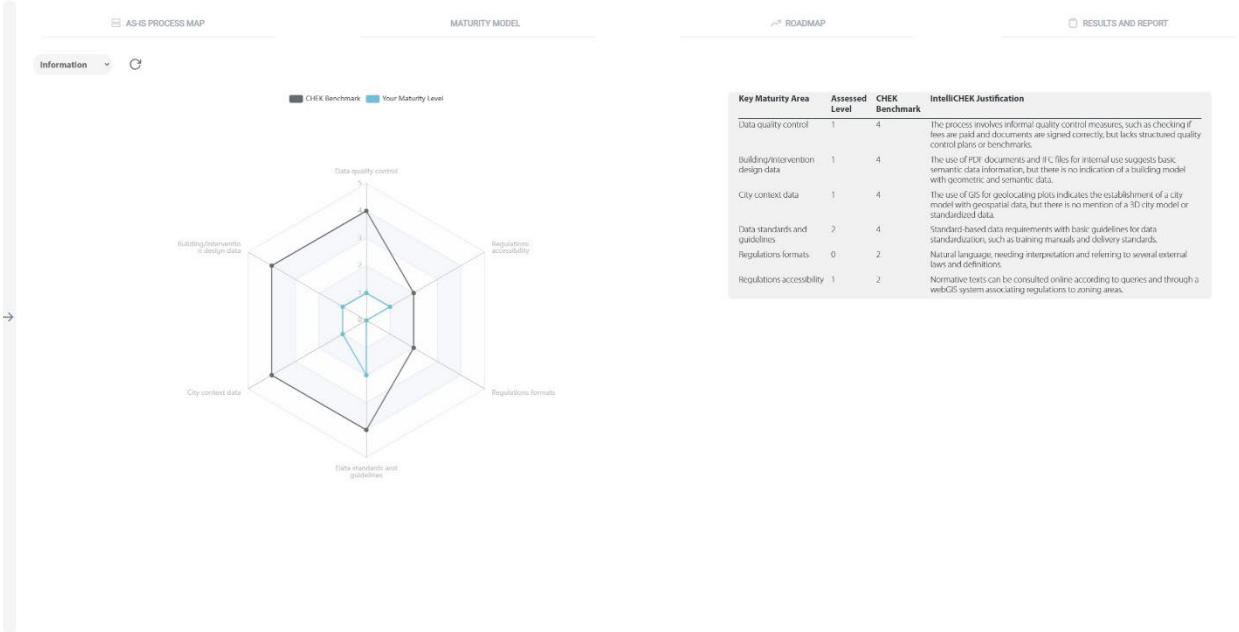


Figure 33 Information maturity of the building permit process for Vila Nova de Gaia

Overall conclusion

The maturity assessment reveals a moderate level of digitisation with significant room for improvement. While some advancements exist in process documentation and technological infrastructure, the municipality faces substantial challenges in digital transformation. Strategic interventions should focus on enhancing digital skills, implementing comprehensive performance metrics, improving data interoperability, and developing advanced information management strategies.

The current digital approach is in early stages, presenting significant opportunities for targeted improvements in technological capabilities, organisational readiness, and information management.

4.3.4 Automated roadmap and report

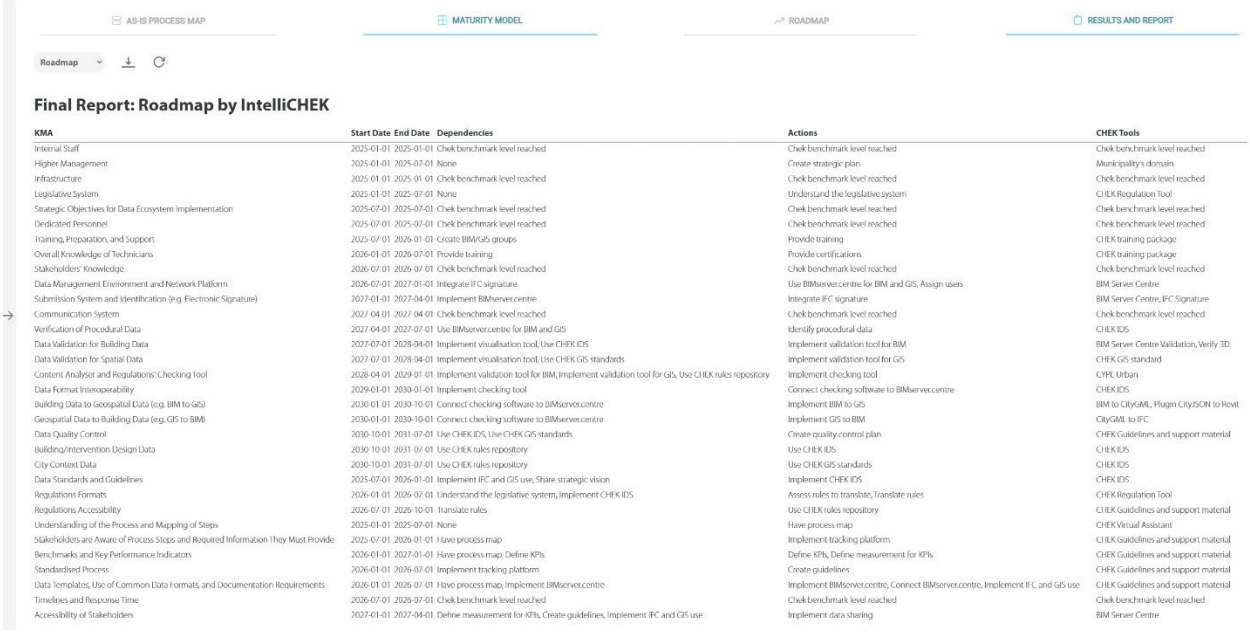
The maturity roadmap for Vila Nova de Gaia outlines a structured digital transformation plan aimed at enhancing the municipality's building permit process and achieving the CHEK benchmark levels. The current system shows early-stage digitisation, with gaps in process standardisation, data management, and regulatory compliance. To address these challenges, the roadmap emphasizes digital integration, stakeholder engagement, and automation to streamline operations.

The transformation process starts with staff training and leadership alignment to ensure readiness for digitisation. Infrastructure upgrades follow, incorporating BIM and GIS technologies to facilitate data sharing, validation, and submission of building permits. Standardisation plays a key role in ensuring interoperability, requiring the adoption of CHEK GIS and BIM standards to automate compliance checks and improve data integration across departments.

Regulatory compliance is strengthened through the digitisation of legal frameworks and the implementation of automated validation tools such as CYPE Urban and the CHEK Regulation Tool. The roadmap also prioritizes stakeholder engagement by introducing tracking platforms, process mapping, and transparency measures.

Performance monitoring is ensured through well-defined key performance indicators (KPIs) to track progress and optimise workflows. The final phase involves full automation, leveraging AI-driven validation systems and centralised data management through BIMServer Centre.

By following this roadmap, Vila Nova de Gaia will transition to a fully digital, efficient, and standardised building permit system. This transformation will lead to improved approval times, enhanced regulatory compliance, and better collaboration between municipal departments and external stakeholders. The result will be a more transparent, automated, and future-ready building permit process, aligning with modern digital governance standards.



AS-IS PROCESS MAP | MATURITY MODEL | ROADMAP | RESULTS AND REPORT

Roadmap

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Higher Management	2025-01-01	2025-07-01	None	Create strategic plan	Municipality's domain
Infrastructure	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Legislative System	2025-01-01	2025-07-01	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2025-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Dedicated Personnel	2025-07-01	2025-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Training, Preparation, and Support	2025-07-01	2026-01-01	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2026-01-01	2026-07-01	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2026-07-01	2026-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Data Management Environment and Network Platform	2026-07-01	2027-01-01	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2027-01-01	2027-04-01	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2027-04-01	2027-04-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Verification of Procedural Data	2027-04-01	2027-07-01	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2027-07-01	2028-04-01	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2027-07-01	2028-04-01	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and Regulations' Checking Tool	2028-04-01	2029-01-01	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2029-01-01	2030-01-01	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g. BIM to GIS)	2030-01-01	2030-10-01	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g. GIS to BIM)	2030-01-01	2030-10-01	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2030-10-01	2031-07-01	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2030-10-01	2031-07-01	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2030-10-01	2031-07-01	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2025-07-01	2026-01-01	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2026-01-01	2026-07-01	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2026-07-01	2026-10-01	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-07-01	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-07-01	2026-01-01	Have process map	Implement tracking platform	CHEK Guidelines and support material
Benchmarks and Key Performance Indicators	2026-01-01	2027-01-01	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Standardised Process	2026-01-01	2026-07-01	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2026-01-01	2026-07-01	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response Time	2026-07-01	2026-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Accessibility of Stakeholders	2027-01-01	2027-04-01	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre

Figure 34 CHEK roadmap of Vila Nova de Gaia's building permit process digitalisation

The full report is available on Annex II of this deliverable.

4.4 Prague

4.4.1 Workshop report

In this phase of testing, FHI utilized the CHEK Virtual Assistant (VA) tool to map the current (as-is) building permit process for the municipality of Prague. The process mapping involved a virtual workshop, with one representative from the municipality providing direct insights into their existing workflow. This report details the steps undertaken during the workshop, the process map construction, and the subsequent stages of evaluation using the VA tool.

Workshop Setup and Execution

The workshop was conducted via videoconference, with FHI sharing the VA tool screen to facilitate real-time collaboration. The session was designed to last two hours, during which the as-is process map was constructed incrementally. Throughout the workshop, the FHI facilitator guided the municipality representative through each process step, asking clarifying questions from IntelliCHEK, and, at the conclusion, assisting with a final questionnaire. During the two-hour session all intended objectives were fully addressed.

Initial Process Setup in VA

At the beginning of the workshop, FHI logged into the VA and set up a new project for mapping the building permit process. The municipality's technicians then provided a brief description of the process, covering four essential elements:

- *Dematerialisation: All documents around the permitting process are in paper (physical files).*
- *Documentation Format: Documents submitted are typically printed on the project and forms (physical paper).*
- *Communication Channel: The are calls among applicant and municipalities, but usually the applicant should be in person in the municipality. The invitation to the meeting can be by phone from the municipality. The application can be started online (email), but the documents should be still delivered in the municipality. The most common method of communication is emails and phone calls.*
- *Data Storage: The data is stored in physical folders (box of papers).*

This information was entered into the VA tool to ensure an accurate foundation for further mapping and analysis.

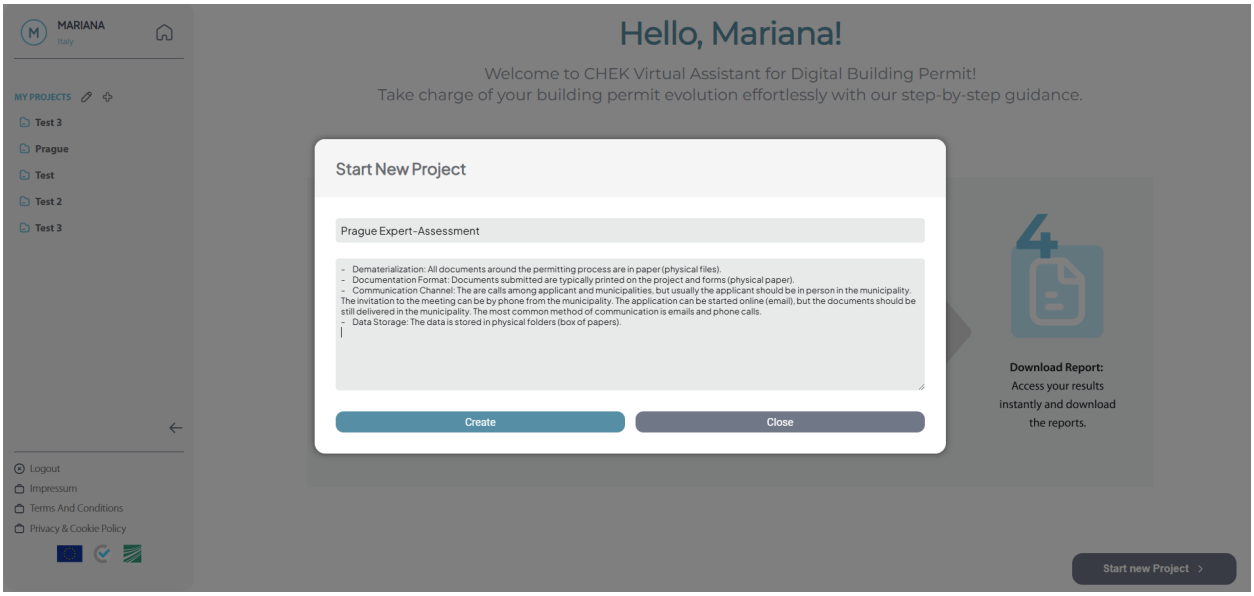


Figure 35 Starting the project with Prague

Process Mapping with the VA Tool

Following the initial setup, FHI and the municipality representatives worked together to construct the building permit process map using the VA tool's default BP process template, which could be modified within the bpmn.io visual editor. The FHI user adjusted the process map based on the municipality's input, ensuring that each step accurately represented the current procedures.

For each action added or modified in the map, IntelliCHEK's chatbot was activated, providing immediate analysis and feedback. The chatbot offered suggestions for naming conventions and requested additional details as needed to clarify each action. Key details requested by the chatbot included action types, executors, information exchange methods, and communication protocols.

Figure 36 VA Process Map of Prague

The FHI facilitator consulted with the municipality technician to obtain the necessary details, entering the responses directly into the chat. The VA then reviewed these inputs to determine whether they were sufficient for assessing the action's maturity, or if further details were required. This interactive mapping approach continued until the entire process was documented to the satisfaction of the municipality representative.

Organisation Questionnaire Completion

Upon completion of the process map, the municipality representative was prompted to complete a multiple-choice questionnaire. This questionnaire collected supplementary information not directly obtainable from the process map, focusing on aspects such as organisational structure, regulatory compliance, and legislation relevant to the building permit process. This information was intended for use in the subsequent maturity assessment and served as an important input for evaluating the municipality's current digital capabilities. The full questionnaire is available in APPENDIX 01 of this document.

Maturity Assessment

After the questionnaire completion, the VA tool automatically proceeded with the maturity assessment phase. Using data from the process map, chat responses, and questionnaire answers, the VA evaluated the maturity of the building permit process. The tool generated a report summarizing the process's maturity level, accompanied by visual graphs depicting key results.

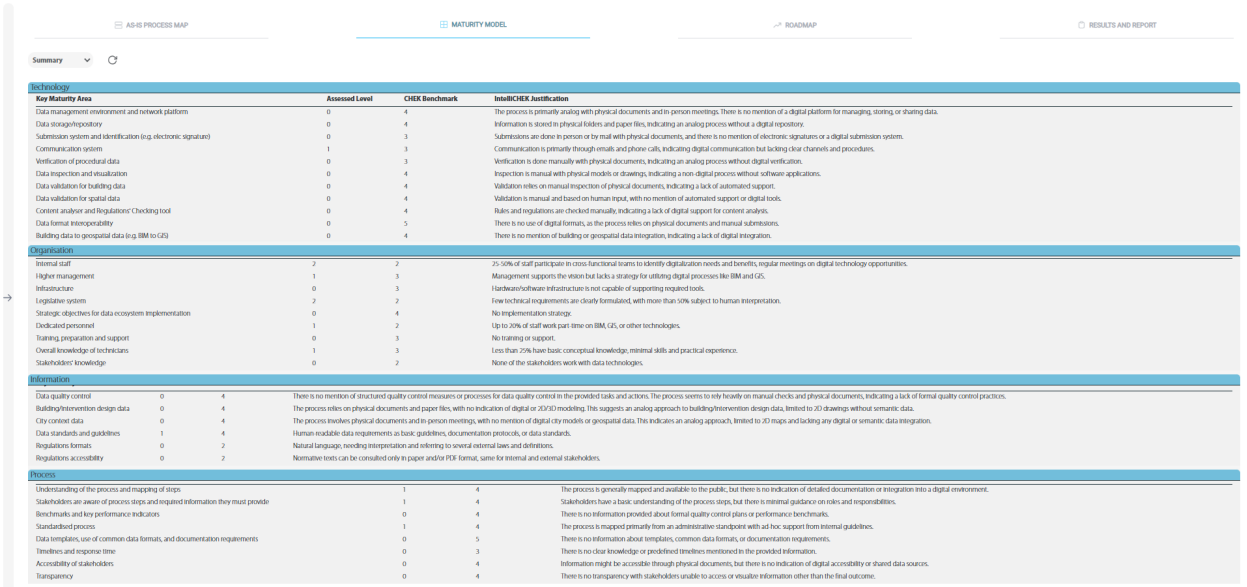


Figure 37 Summary of the maturity assessment for the building permit process of Prague

Roadmap Generation

Following the maturity assessment, the VA tool generated an improvement roadmap based on the CHEK Benchmark, which is embedded in the VA's database. This roadmap was automatically designed to guide the municipality from its current process state to a target state, as defined by CHEK objectives.

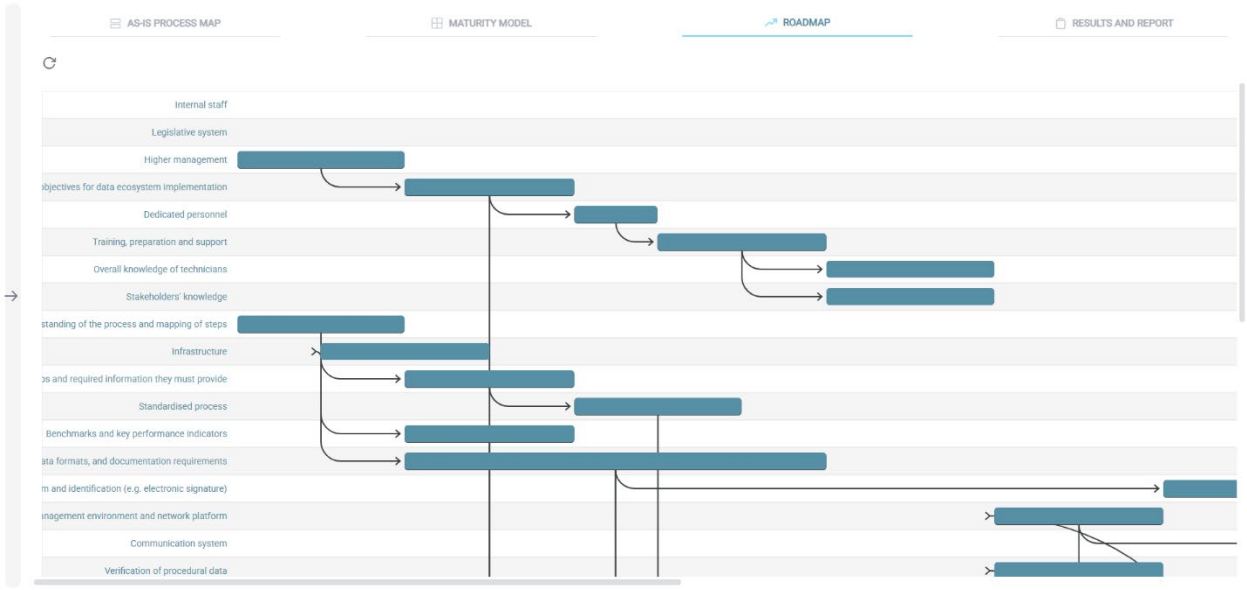


Figure 38 VA Roadmap of Prague

Final Report Generation

The VA tool concluded with the automatic generation of a final report, which consolidated the maturity assessment results, the improvement roadmap, and visual analyses. This report provides a comprehensive overview of the municipality's current digital building permit process and outlines the steps recommended for further development.

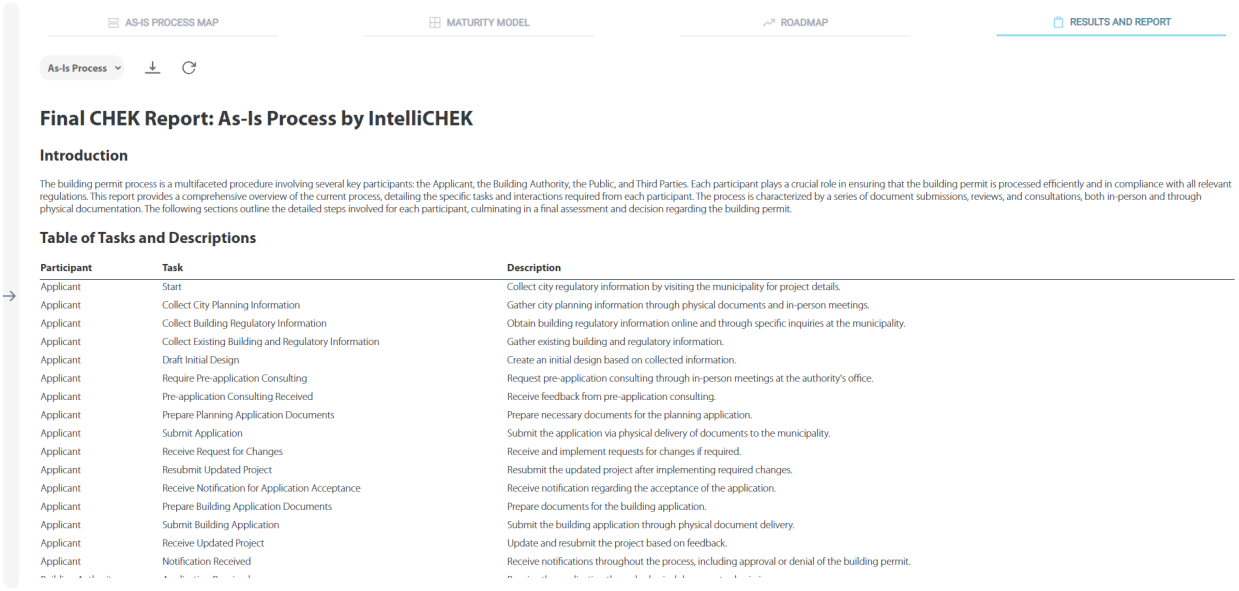


Figure 39 VA Final report of Prague

4.4.2 Process map[16]

Detailed Process Description of the Building Permit Process in the municipality of Prague.

Applicant

The applicant initiates the building permit process by gathering essential regulatory and planning information from the municipality. This involves both online research and in-person visits to collect city planning and building regulatory information. The applicant then drafts an initial design, which serves as the foundation for further consultations and applications. Pre-application consulting is a critical step, requiring the applicant to engage with the building authority to receive feedback and guidance. Following this, the applicant prepares and submits the planning application documents, often necessitating physical delivery to the municipality. Throughout the process, the applicant must be responsive to requests for changes, resubmitting updated projects as needed. Notifications from the building authority guide the applicant through the acceptance of applications and the preparation of building application documents. The applicant remains engaged, updating and resubmitting projects based on feedback until the final notification of approval or denial is received.

Building Authority

[16] The description is based on the one automatically generated by the VA.

The building authority plays a pivotal role in reviewing and processing the building permit application. Upon receiving the application, the authority initiates a thorough review process, directing documents to the appropriate departments and assigning an application number. The authority is responsible for verifying third-party approvals and analysing the planning permit against established rules. A meticulous check of documentation completeness is conducted, with incomplete applications returned for revision. Once accepted, the application is assigned to a responsible technician who ensures compliance with all relevant regulations, including building, structural, and fire safety standards. The authority requires changes if compliance checks are not met, and upon approval, public notification is issued. Public feedback is evaluated against legal standards, influencing the final assessment conducted by the technician. The building authority's decision on the building permit is communicated to the applicant, with a permit issued if approved or a denial notification sent if not.

Public

The public is an integral part of the building permit process, with the right to be notified and provide feedback on applications. Public notification is a formal process, ensuring that neighbours and other stakeholders are informed of potential developments. The public's feedback is collected and sent to the relevant parties for consideration. If changes are accepted based on public input, the public is informed accordingly. Approval notifications are also communicated to the public, ensuring transparency and community involvement in the decision-making process.

Third Parties

Third parties, often external evaluators or consultants are engaged to provide independent assessments of the building permit application. Upon receiving requests for external evaluation, third parties conduct their analysis and send their findings back to the applicant or building authority. Their evaluations are crucial in ensuring that all aspects of the application meet the necessary standards. Positive statements from third parties can significantly influence the building authority's decision, providing an additional layer of assurance and compliance.

Conclusion

The building permit process, as outlined in this report, is a complex and collaborative effort involving multiple stakeholders. Each participant, from the applicant to the building authority, public, and third parties, plays a vital role in ensuring that the process is thorough, compliant, and transparent. The reliance on physical document submissions and in-person consultations underscores the importance of clear communication and meticulous documentation. As the process progresses from initial application to final decisions, each step is carefully managed to uphold regulatory standards and address community concerns. This comprehensive approach ensures that building permits are granted in a manner that balances development needs with public interest and safety.

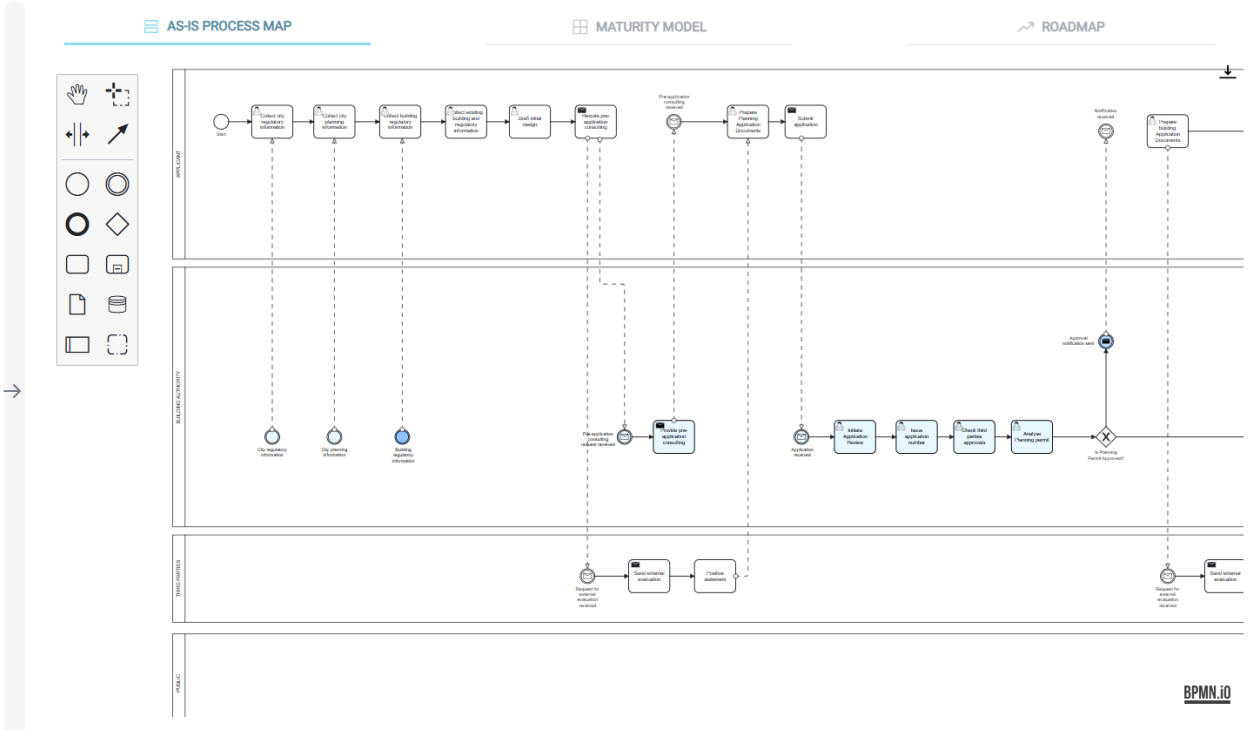


Figure 40 Process Map of Prague

4.4.3 Maturity assessment[17]

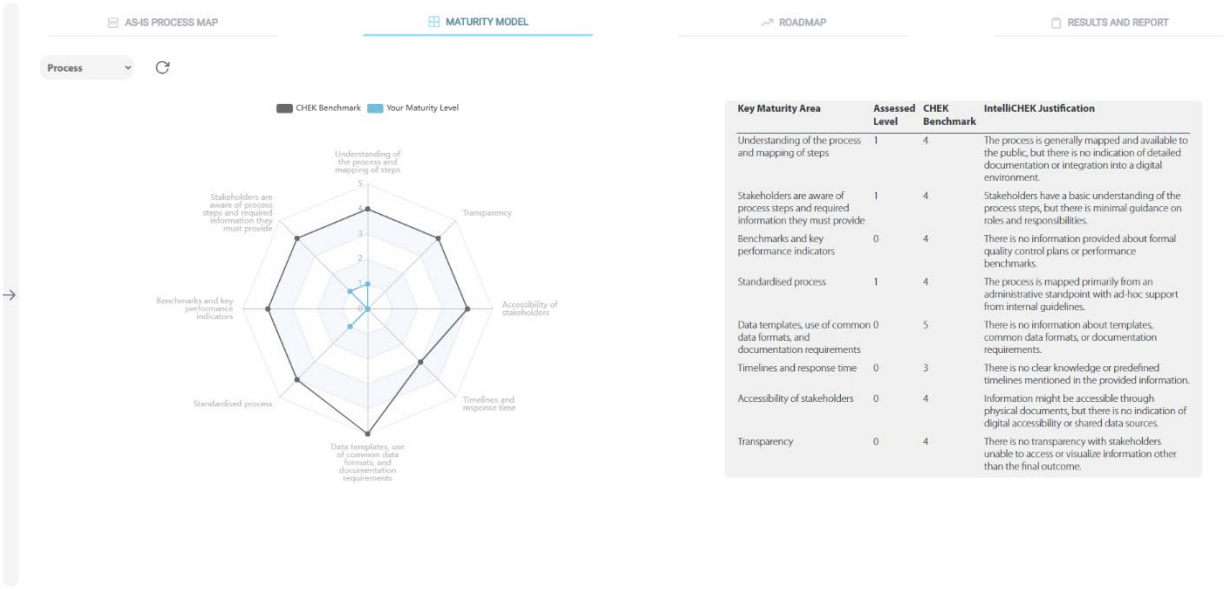
Process (Average Maturity Level: 0.38)

In the Process category, the municipality exhibits a low level of maturity, with minimal progress in defining and standardising workflows.

Process understanding is at an initial stage, with basic mapping of steps providing a rudimentary foundation for further development. Stakeholder awareness is also basic, with limited efforts to support active participation or self-service capabilities. Documentation and digital integration are absent, resulting in inconsistencies and inefficiencies. Quality control measures, benchmarks, and performance tracking mechanisms are not established, reducing the ability to evaluate or enhance process efficiency.

Conclusion: Process maturity is at an early stage, with foundational efforts in mapping and awareness but lacking formal documentation, digital integration, and performance metrics. Next steps should focus on establishing formal workflows, introducing benchmarks, and integrating digital tools to improve accountability and efficiency.

[17] The description is based on the one automatically generated by the VA.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Understanding of the process and mapping of steps	1	4	The process is generally mapped and available to the public, but there is no indication of detailed documentation or integration into a digital environment.
Stakeholders are aware of process steps and required information they must provide	1	4	Stakeholders have a basic understanding of the process steps, but there is minimal guidance on roles and responsibilities.
Benchmarks and key performance indicators	0	4	There is no information provided about formal quality control plans or performance benchmarks.
Standardised process	1	4	The process is mapped primarily from an administrative standpoint with ad-hoc support from internal guidelines.
Data templates, use of common data formats, and documentation requirements	0	5	There is no information about templates, common data formats, or documentation requirements.
Timelines and response time	0	3	There is no clear knowledge or predefined timelines mentioned in the provided information.
Accessibility of stakeholders	0	4	Information might be accessible through physical documents, but there is no indication of digital accessibility or shared data sources.
Transparency	0	4	There is no transparency with stakeholders unable to access or visualize information other than the final outcome.

Figure 41 Process Maturity for Prague

Organisation (Average Maturity Level: 0.78)

In the organisation category, moderate progress is evident in staff participation and management support, but critical gaps remain in infrastructure and training.

Cross-functional teams engage in discussions about digital technologies, reflecting a degree of internal awareness. Management demonstrates some support for digital transformation, though this has not translated into a clear strategic vision. Infrastructure is severely underdeveloped, with no hardware or software to support digital workflows. Training and stakeholder knowledge are minimal, with no dedicated personnel or structured programs to build digital competencies among staff and stakeholders.

Conclusion: Organisational maturity is limited by the absence of strategic planning, infrastructure, and training. The organisation should prioritize developing a strategic digital plan, investing in infrastructure, and implementing regular training programs to strengthen digital readiness.

Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Internal staff	2	2	25-50% of staff participate in cross-functional teams to identify digitalization needs and benefits, regular meetings on digital technology opportunities.
Higher management	1	3	Management supports the vision but lacks a strategy for utilizing digital processes like BIM and GIS.
Infrastructure	0	3	Hardware/software infrastructure is not capable of supporting required tools.
Legislative system	2	2	Few technical requirements are clearly formulated, with more than 50% subject to human interpretation.
Strategic objectives for data ecosystem implementation	0	4	No implementation strategy.
Dedicated personnel	1	2	Up to 20% of staff work part-time on BIM, GIS, or other technologies.
Training, preparation and support	0	3	No training or support.
Overall knowledge of technicians	1	3	Less than 25% have basic conceptual knowledge, minimal skills and practical experience.
Stakeholders' knowledge	0	2	None of the stakeholders work with data technologies.

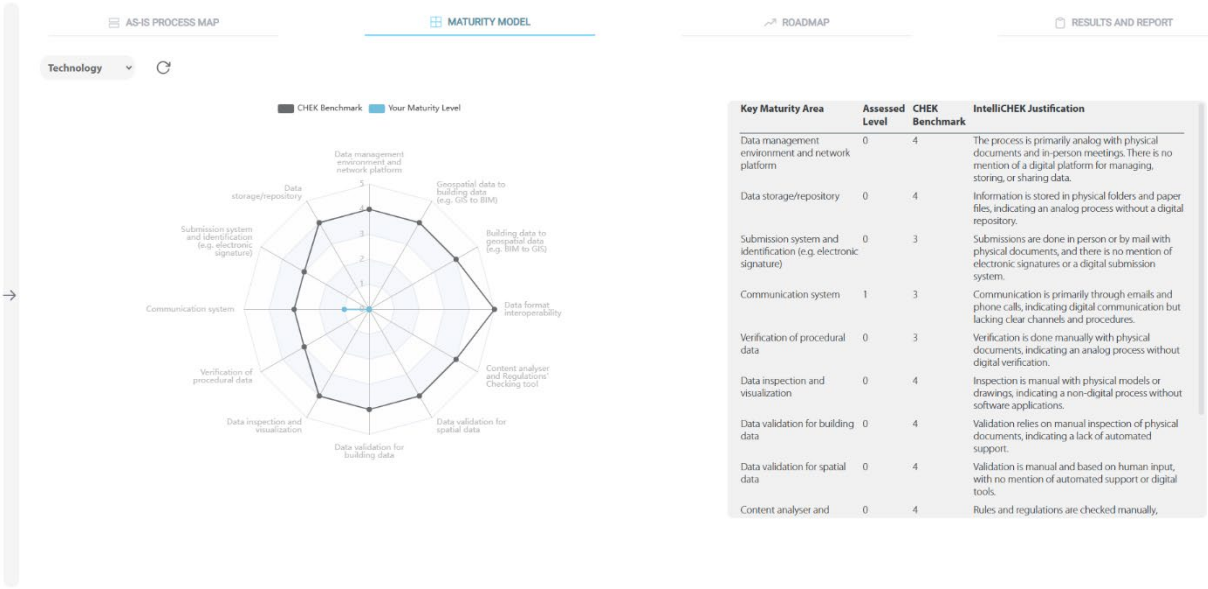
Figure 42 Organisation Maturity for Prague

Technology (Average Maturity Level: 0.08)

The Technology category demonstrates the lowest level of maturity, characterised by reliance on manual processes and physical documentation.

There is no digital platform for data management or networked operations, resulting in inefficiencies and a lack of scalability. Data storage and submission systems are entirely analogue, with no digital repository to centralise or standardise data. Communication relies on unstructured channels such as emails and phone calls, which hinder efficiency and transparency. Verification, inspection, and validation processes are entirely manual, with no integration of digital tools to enhance accuracy or reduce processing time.

Conclusion: Technology maturity is at a foundational level, with critical deficiencies in digital infrastructure and automation. Key improvements should include adopting a centralised digital platform, implementing automated workflows, and developing structured communication systems to enhance operational efficiency and transparency.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data management environment and network platform	0	4	The process is primarily analog with physical documents and in-person meetings. There is no mention of a digital platform for managing, storing, or sharing data.
Data storage/repository	0	4	Information is stored in physical folders and paper files, indicating an analog process without a digital repository.
Submission system and identification (e.g. electronic signature)	0	3	Submissions are done in person or by mail with physical documents, and there is no mention of electronic signatures or a digital submission system.
Communication system	1	3	Communication is primarily through emails and phone calls, indicating digital communication but lacking clear channels and procedures.
Verification of procedural data	0	3	Verification is done manually with physical documents, indicating an analog process without digital verification.
Data inspection and visualization	0	4	Inspection is manual with physical models or drawings, indicating a non-digital process without software applications.
Data validation for building data	0	4	Validation relies on manual inspection of physical documents, indicating a lack of automated support.
Data validation for spatial data	0	4	Validation is manual and based on human input, with no mention of automated support or digital tools.
Content analyser and	0	4	Rules and regulations are checked manually,

Figure 43 Technology Maturity for Prague

Information (Average Maturity Level: 0.17)

The Information category highlights a complete reliance on physical documentation, with minimal progress in data structuring or standardisation.

Data quality control measures are absent, increasing the risk of errors and inconsistencies. Building and intervention design data, as well as city context data, are managed through physical documents, preventing the adoption of advanced tools such as GIS or BIM. While basic data standards and guidelines exist, these are limited to human-readable formats, restricting their utility in digital workflows.

Conclusion: Information management is at a foundational level, with no quality control, data standardisation, or advanced capabilities for design or spatial data. To improve, the municipality should focus on establishing data quality control measures, adopting advanced data formats, and developing structured guidelines to enhance consistency and integration.

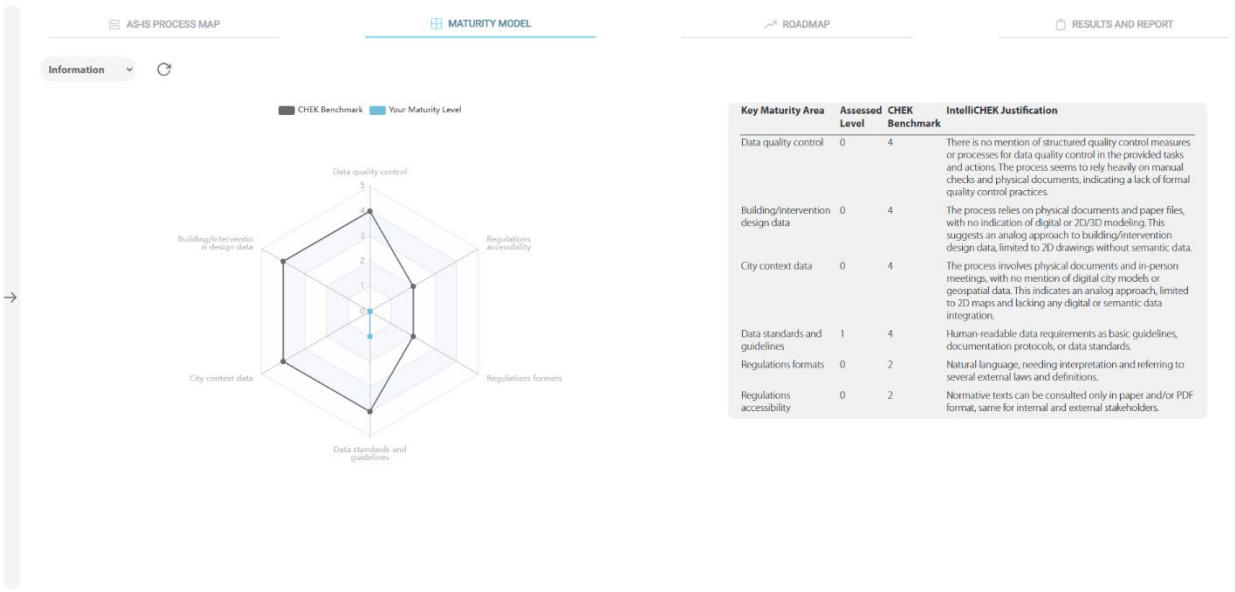


Figure 44 Information Maturity for Prague

Overall conclusion

The maturity assessment of the building permit process reveals a predominantly analogue system, with low maturity levels across all evaluated dimensions. The Technology, Information, and Process categories are largely at foundational levels, indicating a significant reliance on manual methods and physical documentation. The organisation category demonstrates some progress, with moderate levels of staff engagement and management support, but lacks the infrastructure and strategic planning necessary for meaningful digital transformation.

While the current state reflects foundational efforts in mapping processes and fostering basic awareness among stakeholders, the overall maturity remains low, with critical deficiencies in digital infrastructure, data management, and structured workflows. The findings suggest that the municipality is in the early stages of its digital transformation journey, requiring significant development across all dimensions to achieve a cohesive, efficient, and accessible building permit process.

4.4.4 Automated roadmap and report

The maturity assessment of the building permit process indicates a significant need for digital transformation across all dimensions. The current state is predominantly analog, with minimal digital integration, particularly in the Technology and Information dimensions. The organisation dimension shows some progress, but a strategic approach is lacking. To enhance efficiency, transparency, and integration, a comprehensive digital transformation strategy is essential. This should include the development of digital platforms, structured communication channels, and training programs to improve stakeholder engagement and process efficiency.

The outlined roadmap provides a comprehensive plan for achieving a benchmark value in the future through a series of strategic actions and dependencies. Each step is designed to build upon the previous one, ensuring a cohesive and integrated approach to data management, infrastructure development, and stakeholder engagement. By following this road map, the organisation can effectively implement the necessary tools and processes to enhance data

interoperability, quality control, and transparency, ultimately leading to improved efficiency and effectiveness in building permit management.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Higher Management	2025-01-01	2025-07-01	None	Create strategic plan	Municipality's domain
Infrastructure	2025-04-01	2025-10-01	Have process map	Define current situation of hardware infrastructure	Municipality's domain
Legislative System	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2026-01-01	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2026-01-01	2026-04-01	Share strategic vision	Create BIM/GIS groups	Municipality's domain
Training, Preparation and Support	2026-04-01	2026-10-01	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2026-10-01	2027-04-01	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2026-10-01	2027-04-01	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2027-04-01	2027-10-01	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2027-10-01	2028-04-01	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2028-04-01	2028-10-01	Use BIMserver.centre for BIM and GIS, Integrate IFC signature	Connect web portal	BIM Server Centre
Verification of Procedural Data	2027-04-01	2027-10-01	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2028-10-01	2029-04-01	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2028-10-01	2029-04-01	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and Regulations' Checking Tool	2029-04-01	2029-10-01	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2029-10-01	2030-07-01	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g. BIM to GIS)	2030-07-01	2031-01-01	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g. GIS to BIM)	2030-07-01	2031-01-01	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2029-04-01	2029-10-01	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2029-10-01	2030-04-01	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2029-10-01	2030-04-01	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2026-01-01	2026-07-01	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2025-01-01	2025-07-01	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2025-07-01	2026-01-01	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-07-01	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-07-01	2026-01-01	Have process map	Implement tracking platform	CHEK Guidelines and support material
Benchmarks and Key Performance Indicators	2025-07-01	2026-01-01	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Standardised Process	2026-01-01	2026-07-01	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2025-07-01	2026-10-01	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response Time	2026-07-01	2027-01-01	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material
Accessibility of Stakeholders	2027-01-01	2027-07-01	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre
Transparency	2027-07-01	2028-01-01	Implement data sharing	Connect stakeholders	BIM Server Centre

Figure 45 CHEK Roadmap for Prague

The full report is available on Annex II of this deliverable.

5 Testing results – Phase 3

Chapter Summary

Chapter 5 presents the structure and outcomes of the third testing phase (Phase 3), in which municipalities independently used the CHEK Virtual Assistant without expert facilitation. The chapter is organised by municipality, and each subsection includes the process map generated by the VA, followed by an AI-driven maturity assessment across the four dimensions: Process, Organisation, Technology, and Information. Each assessment section follows a standard format: average maturity score, a narrative explanation of the current status, and a concluding analysis of gaps and potential areas for improvement. The chapter also references annexes where the full reports are available, reinforcing a systematic and uniform presentation of autonomous tool use across all participating municipalities.

In this phase of testing, municipality representatives used the CHEK Virtual Assistant (VA) independently to map the current (as-is) building permit process. Each municipality concluded the task of completing the whole workflow in the CHEK Virtual Assistant. The final outcomes of each municipality are here described, with the descriptions provided by the VA. The final outcome of each municipality comprehends a complete process map of their building permit process, the evaluation from the VA for the maturity model assessment, the roadmap automatically created by the VA and the final report of the assessment. All reports are fully available on Annex III of this deliverable.

5.1 Ascoli Piceno

Process map

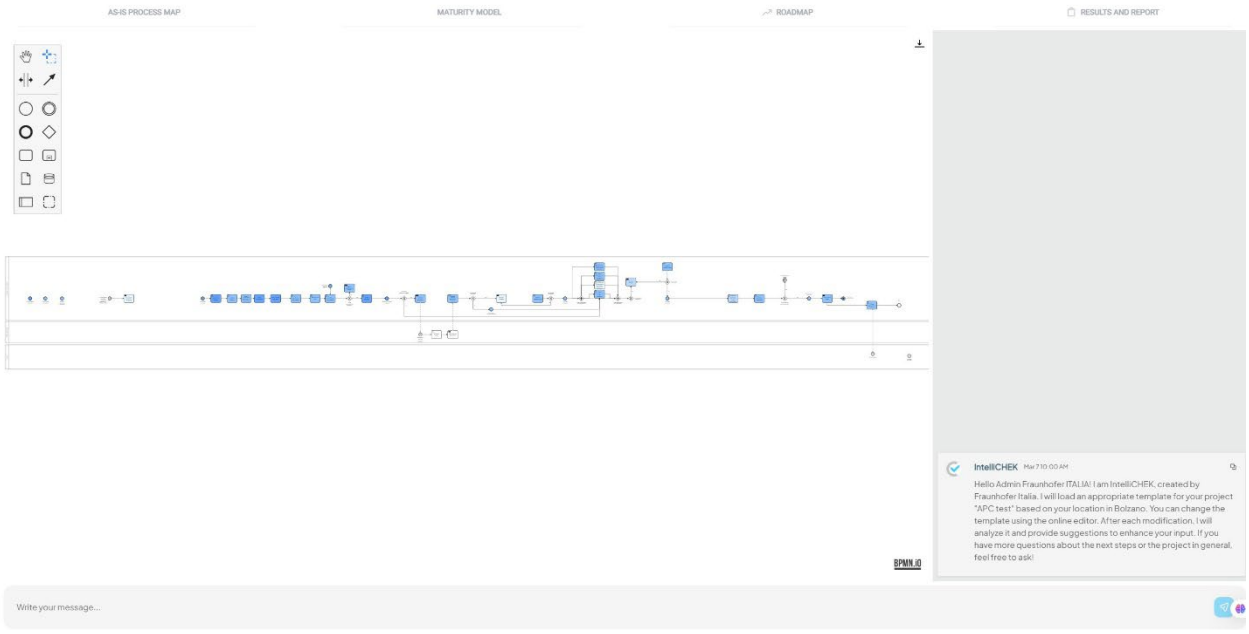


Figure 46 VA Generated Process Map of Ascoli Piceno

Maturity assessment

Process (Average Maturity Level: 2.1)

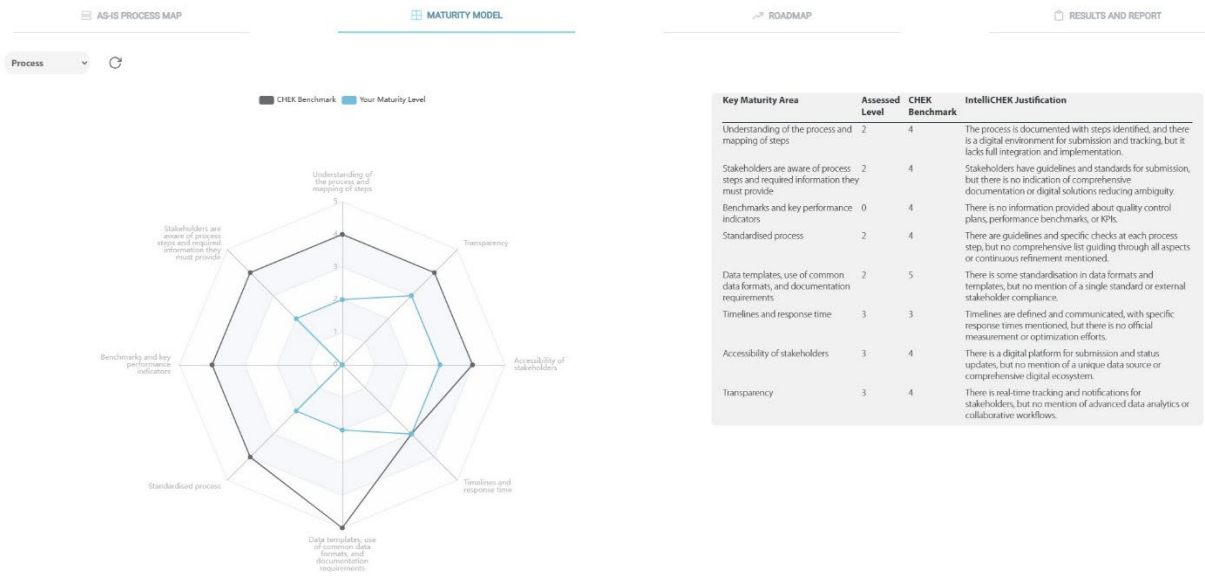
The Process category shows moderate improvement, particularly in defining timelines, accessibility, and standardisation. The municipality has strengthened process documentation and digital tracking, supporting submission and workflow monitoring. However, full integration and automation remain lacking.

Stakeholders have access to guidelines and standards, improving clarity, but documentation is not yet comprehensive. The absence of key performance indicators (KPIs) or formal benchmarks continues to limit the ability to measure and optimise efficiency. While some standardisation in data formats and templates exists, compliance with a single standard or external regulatory frameworks remains unaddressed.

Timelines and response times have seen progress, with defined expectations and specific response times mentioned, though systematic measurement and optimisation are still absent. The accessibility of stakeholders has been enhanced through a digital platform, but the system does not yet support a unified data source or a fully digitalised ecosystem. Transparency benefits from real-time tracking and notifications, yet advanced data analytics and collaborative workflows are still missing.

Conclusion:

The Process domain has advanced in structured documentation, stakeholder accessibility, and defined timelines. However, challenges persist in integrating performance measurement, automation, and compliance frameworks. Prioritising KPIs, external standards, and continuous refinement of workflows will be key to further maturity.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Understanding of the process and mapping of steps	2	4	The process is documented with steps identified, and there is a digital environment for submission and tracking, but it lacks full integration and implementation.
Stakeholders are aware of process steps and required information they must provide	2	4	Stakeholders have guidelines and standards for submission, but there is no indication of comprehensive documentation or digital solutions reducing ambiguity.
Benchmarks and key performance indicators	0	4	There is no information provided about quality control plans, performance benchmarks, or KPIs.
Standardised process	2	4	There are guidelines and specific checks at each process step, but no comprehensive list guiding through all aspects or continuous refinement mentioned.
Data templates, use of common data formats, and documentation requirements	2	5	There is some standardisation in data formats and templates, but no mention of a single standard or external stakeholder compliance.
Timelines and response time	3	3	Timelines are defined and communicated, with specific response times mentioned, but there is no official measurement or optimization efforts.
Accessibility of stakeholders	3	4	There is a digital platform for submission and status updates, but no mention of a unique data source or comprehensive digital ecosystem.
Transparency	3	4	There is real-time tracking and notifications for stakeholders, but no mention of advanced data analytics or collaborative workflows.

Figure 47 Process maturity for Ascoli Piceno

Organisation (Average Maturity Level: 1.3)

The organisation category shows limited progress in digital transformation, with ongoing challenges in strategic planning, infrastructure, and digital skills. While some improvements have been made in defining legislative frameworks and strategic objectives, the overall digital readiness of the municipality remains low.

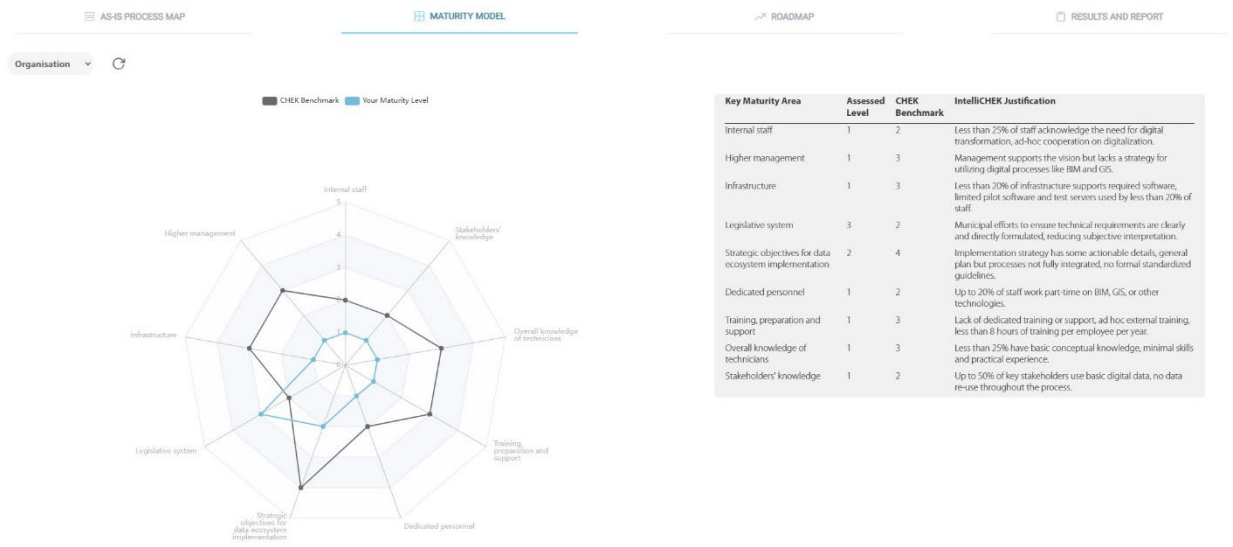
Less than 25% of staff acknowledge the need for digital transformation, and cooperation on digitalisation initiatives remains ad hoc. Management supports the vision but lacks a concrete strategy for implementing digital processes such as BIM and GIS. Infrastructure constraints persist, with fewer than 20% of staff having access to required software or pilot digital tools.

Efforts to ensure that legislative requirements are clearly defined have been somewhat successful, reducing ambiguity in regulatory interpretation. However, strategic objectives for a data ecosystem remain underdeveloped, with no fully integrated processes or standardised guidelines. Dedicated personnel for digital initiatives are scarce, with only up to 20% of staff working part-time on BIM, GIS, or related technologies.

Training remains a critical gap, with less than eight hours of external training per employee per year, and no structured internal training programs. As a result, fewer than 25% of technicians possess basic digital knowledge, and stakeholder engagement with digital data is minimal, with no data reuse throughout the process.

Conclusion:

The organisation domain continues to face major hurdles in digital skills development, infrastructure investment, and strategic integration. While legislative clarity has improved, there is a pressing need for structured training programs, dedicated personnel, and a well-defined roadmap for digital transformation. Without these interventions, the municipality will struggle to build a sustainable digital ecosystem.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Internal staff	1	2	Less than 25% of staff acknowledge the need for digital transformation, ad-hoc cooperation on digitalization.
Higher management	1	3	Management supports the vision but lacks a strategy for utilizing digital processes like BIM and GIS.
Infrastructure	1	3	Less than 20% of infrastructure supports required software, limited pilot software and test servers used by less than 20% of staff.
Legislative system	3	2	Municipal efforts to ensure technical requirements are clearly and directly formulated, reducing subjective interpretation.
Strategic objectives for data ecosystem implementation	2	4	Implementation strategy has some actionable details, general plan but processes not fully integrated, no formal standardized guidelines.
Dedicated personnel	1	2	Up to 20% of staff work part-time on BIM, GIS, or other technologies.
Training, preparation and support	1	3	Lack of dedicated training or support, ad hoc external training, less than 8 hours of training per employee per year.
Overall knowledge of technicians	1	3	Less than 25% have basic conceptual knowledge, minimal skills and practical experience.
Stakeholders' knowledge	1	2	Up to 50% of key stakeholders use basic digital data, no data re-use throughout the process.

Figure 48 Organisational maturity for Ascoli Piceno

Technology (Average Maturity Level: 1.0)

The Technology category remains at an early stage, with minimal progress in automation, integration, and data validation. While digital tools for submission and communication are in place, they lack sophistication and interoperability, limiting efficiency and effectiveness.

A digital platform exists for submission and communication between applicants and the building authority, but there is no centralised data management system or structured governance. Document submissions are still in basic digital

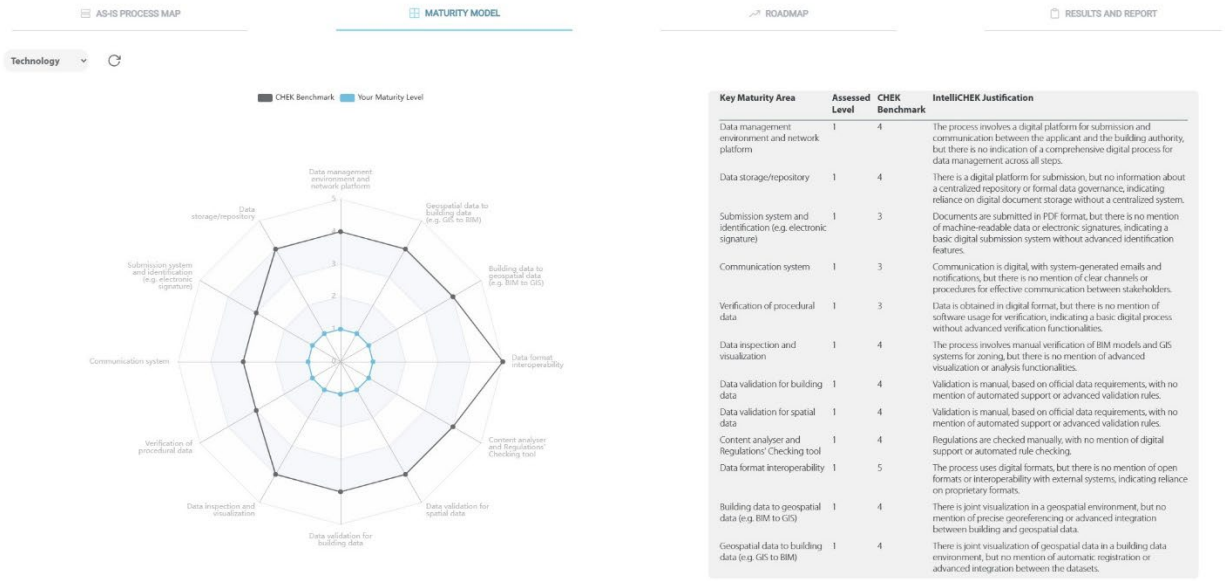
formats, such as PDFs, without machine-readable data or electronic signatures, which restricts automation and verification capabilities.

Communication processes rely on system-generated emails and notifications, but there are no clear structured channels for real-time collaboration or process tracking. Data validation remains manual, with BIM and GIS models requiring human verification for compliance and zoning checks. No advanced visualisation, automated rule-checking, or analytical tools are in place.

Data interoperability is another critical gap, as digital formats are used but are not aligned with open standards or external system integration. Limited visualisation of geospatial and building data exists, but these datasets are not integrated, preventing automated registration and comprehensive spatial analysis.

Conclusion:

The Technology domain is still in its infancy, with basic digital functionalities but no automation, data integration, or advanced validation. Key areas for improvement include implementing centralised data governance, adopting interoperable formats, automating validation processes, and enhancing digital tools to support end-to-end workflow efficiency.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data management environment and network platform	1	4	The process involves a digital platform for submission and communication between the applicant and the building authority, but there is no indication of a comprehensive digital process for data management across all steps.
Data storage/repository	1	4	There is a digital platform for submission, but no information about a centralized repository or formal data governance, indicating reliance on digital document storage without a centralized system.
Submission system and identification (e.g. electronic signature)	1	3	Documents are submitted in PDF format, but there is no mention of machine-readable data or electronic signatures, indicating a basic digital submission system without advanced identification features.
Communication system	1	3	Communication is digital, with system-generated emails and notifications, but there is no mention of clear channels or procedures for effective communication between stakeholders.
Verification of procedural data	1	3	Data is obtained in digital format, but there is no mention of software usage for verification, indicating a basic digital process without advanced verification functionalities.
Data inspection and visualization	1	4	The process involves manual verification of BIM models and GIS systems for zoning, but there is no mention of advanced visualization or analysis functionalities.
Data validation for building data	1	4	Validation is manual, based on official data requirements, with no mention of automated support or advanced validation rules.
Data validation for spatial data	1	4	Validation is manual, based on official data requirements, with no mention of automated support or advanced validation rules.
Content analyser and Regulations' Checking tool	1	4	Regulations are checked manually, with no mention of digital support or automated rule checking.
Data format interoperability	1	5	The process uses digital formats, but there is no mention of open formats or interoperability with external systems, indicating reliance on proprietary formats.
Building data to geospatial data (e.g. BIM to GIS)	1	4	There is joint visualization in a geospatial environment, but no mention of precise georeferencing or advanced integration between building and geospatial data.
Geospatial data to building data (e.g. GIS to BIM)	1	4	There is joint visualization of geospatial data in a building data environment, but no mention of automatic registration or advanced integration between the datasets.

Figure 49 Technology maturity for Ascoli Piceno

Information (Average Maturity Level: 1.2)

The Information category remains at an early stage, with minimal structuring, standardisation, and integration of digital data. While some efforts have been made in using digital models and GIS tools for zoning checks, the overall data ecosystem is fragmented and lacks clear governance.

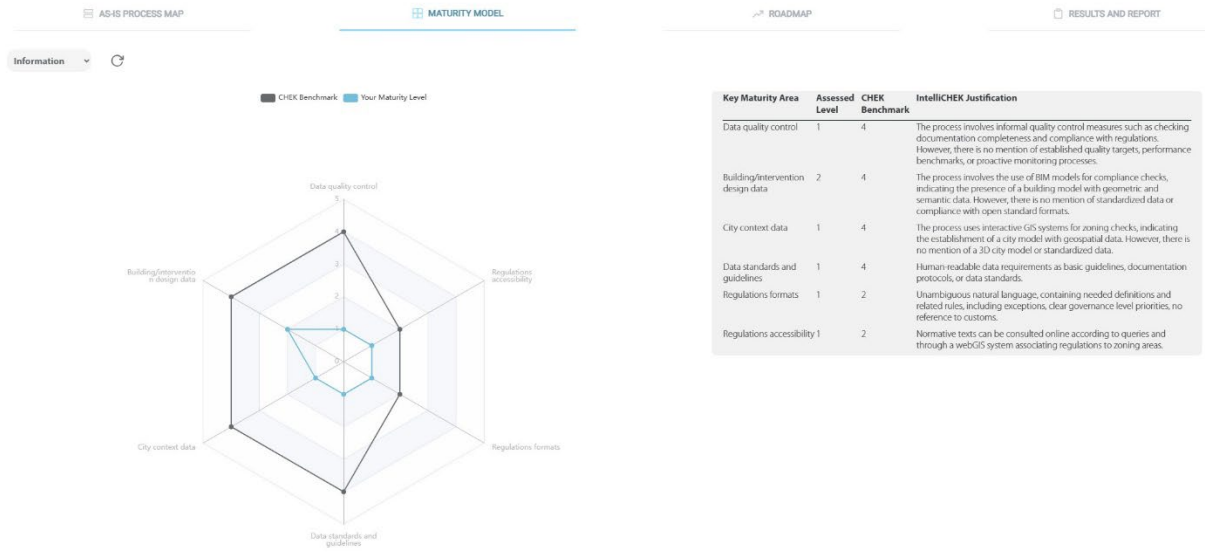
Informal quality control measures exist for checking documentation completeness and compliance with regulations, but there are no established quality benchmarks, performance targets, or systematic monitoring processes. The use of BIM models for compliance checks shows progress, but these models are not standardised or aligned with open formats, limiting interoperability and wider application.

City context data is partially utilized through interactive GIS zoning checks, but the absence of a structured 3D city model or standardised datasets restricts its usefulness for broader spatial analysis and predictive modeling. Data standards remain basic, consisting only of human-readable documentation without formalised protocols for digital workflows.

Regulatory information is available online, with normative texts accessible through web-based GIS systems for zoning queries. However, regulations are presented in natural language without structured data formats or automated rule-checking capabilities, making them difficult to integrate into digital processes.

Conclusion:

The Information domain has made slight advancements in digital modeling and GIS-based zoning checks, but it lacks structured data governance, quality control, and standardisation. To progress, the municipality should focus on implementing clear data standards, enhancing interoperability, and developing structured, machine-readable regulations to support automated compliance checks and predictive urban planning.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data quality control	1	4	The process involves informal quality control measures such as checking documentation completeness and compliance with regulations. However, there is no mention of established quality targets, performance benchmarks, or proactive monitoring processes.
Building/intervention design data	2	4	The process involves the use of BIM models for compliance checks, indicating the presence of a building model with geometric and semantic data. However, there is no mention of standardized data or compliance with open standard formats.
City context data	1	4	The process uses interactive GIS systems for zoning checks, indicating the establishment of a city model with geospatial data. However, there is no mention of a 3D city model or standardized data.
Data standards and guidelines	1	4	Human-readable data requirements as basic guidelines, documentation protocols, or data standards.
Regulations formats	1	2	Unambiguous natural language, containing needed definitions and related rules, including exceptions, clear governance level priorities, no reference to customs.
Regulations accessibility	1	2	Normative texts can be consulted online according to queries and through a webGIS system associating regulations to zoning areas.

Figure 50 Information maturity for Ascoli Piceno

5.2 Lisbon

Process map

Figure 51 VA generated Process map of Lisbon

Maturity assessment

Process (Average Maturity Level: 0.0 - Foundational)

There is no evidence of structured processes, indicating a lack of defined workflows, process mapping, or standardised steps guiding the building permit procedure. Stakeholders are not informed about the steps they need to follow or the required information, which limits their ability to navigate the process independently. The absence of benchmarks, key performance indicators (KPIs), or performance monitoring mechanisms prevents the evaluation of efficiency and the identification of improvement opportunities.

Furthermore, no standardised guidelines or common data formats are in place, leading to inconsistencies in documentation and process execution. Timelines and response time expectations are not established, affecting predictability and accountability. Information accessibility is not ensured, and transparency in workflow execution is entirely absent, making it difficult for stakeholders to track progress or understand decision-making criteria.

Conclusion:

Process maturity remains at a foundational level, with critical gaps in documentation, standardisation, and performance measurement. Immediate priorities should include defining process steps, improving stakeholder awareness, setting performance benchmarks, and ensuring transparency through structured workflows and accessible information.

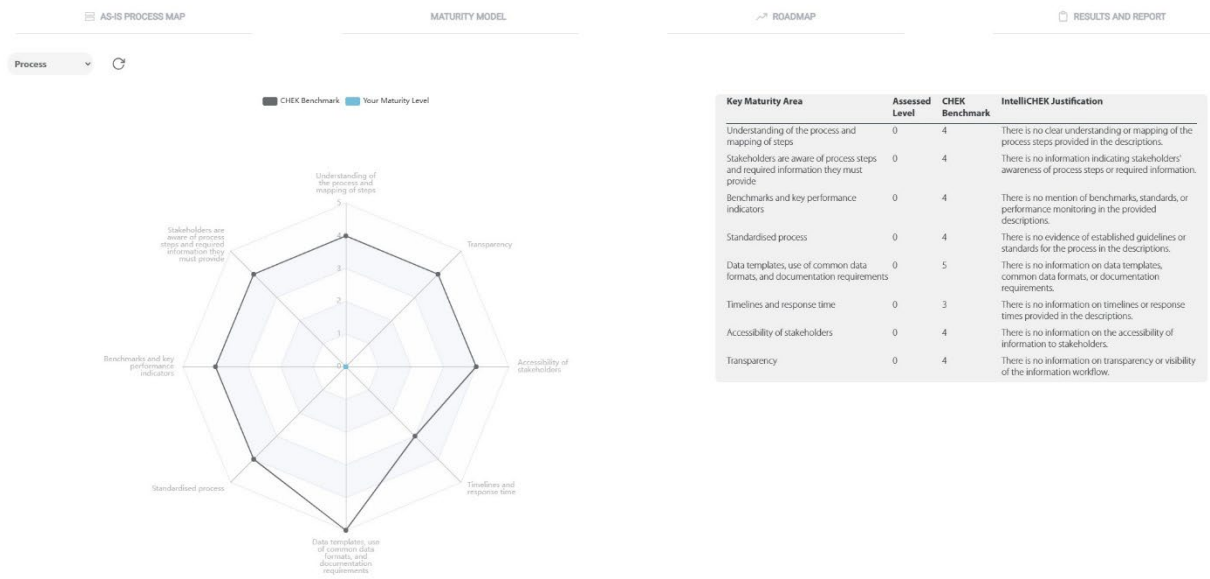


Figure 52 Process maturity for Lisbon

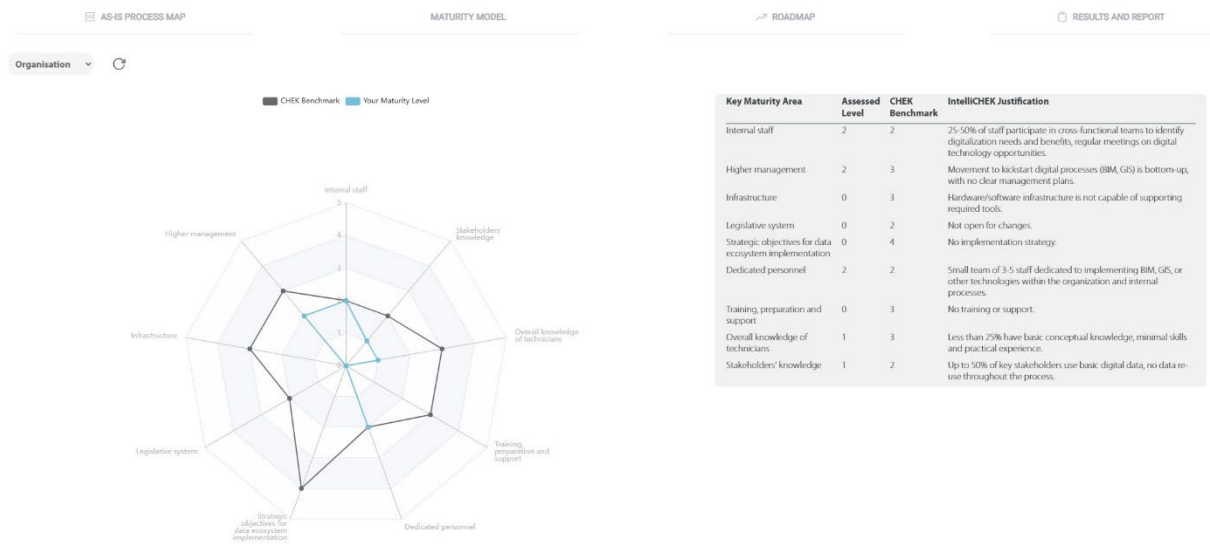
Organisation (Average Maturity Level: 1.0 - Low)

The organisation demonstrates minimal progress in digital transformation, with only isolated efforts toward digitalisation. Internal staff and higher management show some engagement in digital initiatives, but these efforts lack a structured implementation strategy. A small team is dedicated to digital technologies such as BIM and GIS, yet broader organisational adoption remains limited. Infrastructure remains a major bottleneck, as existing hardware and software do not support digital processes effectively.

There is no strategic framework for implementing a data ecosystem, and the legislative system is not open to digital adaptation, further hindering progress. Training opportunities for staff and stakeholders are absent, leaving technicians with limited digital skills and conceptual knowledge. Although up to half of key stakeholders engage with basic digital data, there is no structured data reuse, reducing efficiency across processes.

Conclusion:

Organisational maturity remains low, with fundamental gaps in strategic planning, infrastructure, and workforce capability. To improve, the organisation should establish a formal digital transformation strategy, invest in upgrading infrastructure, provide structured training programs, and promote a culture of digital adoption across all levels.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Internal staff	2	2	25-50% of staff participate in cross-functional teams to identify digitalization needs and benefits, regular meetings on digital technology opportunities.
Higher management	2	3	Movement to kickstart digital processes (BIM, GIS) is bottom-up, with no clear management plans.
Infrastructure	0	3	Hardware/software infrastructure is not capable of supporting required tools.
Legislative system	0	2	Not open for changes.
Strategic objectives for data ecosystem implementation	0	4	No implementation strategy.
Dedicated personnel	2	2	Small team of 3-5 staff dedicated to implementing BIM, GIS, or other technologies within the organization and internal processes.
Training, preparation and support	0	3	No training or support.
Overall knowledge of technicians	1	3	Less than 25% have basic conceptual knowledge, minimal skills and practical experience.
Stakeholders' knowledge	1	2	Up to 50% of key stakeholders use basic digital data, no data re-use throughout the process.

Figure 53 Organisation maturity for Lisbon

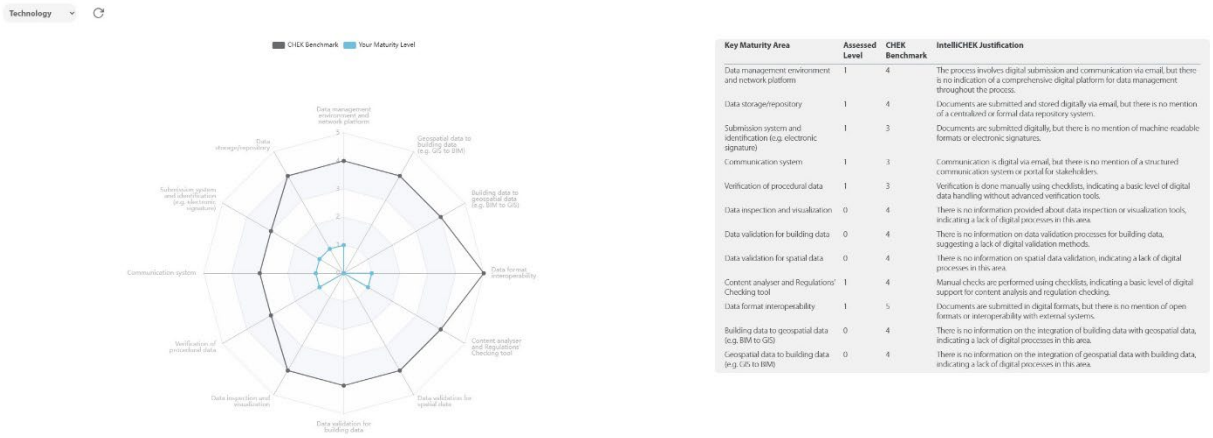
Technology (Average Maturity Level: 0.7 - Low)

Technology adoption within the building permit process remains in its early stages, with limited digital infrastructure and automation. While digital submission of documents is available, there is no centralised data repository or formal data management platform to ensure structured information handling. Communication is primarily conducted through email, lacking an integrated portal for stakeholder interaction. Verification and content analysis processes rely on manual checks, indicating minimal digital support for procedural validation.

There are no automated data validation mechanisms for building or spatial data, limiting the efficiency and accuracy of the permitting process. Data format interoperability is weak, as there are no established open formats or integration with external systems. Additionally, there is no connectivity between geospatial and building data, restricting advanced spatial analysis and regulatory enforcement.

Conclusion:

Technological maturity is low, with basic digital tools in place but no structured integration, automation, or interoperability. To improve, efforts should focus on developing a centralised digital platform, implementing automated validation processes, and enhancing data interoperability between building and geospatial systems.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data management environment and network platform	1	4	The process involves digital submission and communication via email, but there is no indication of a comprehensive digital platform for data management throughout the process.
Data storage/repository	1	4	Documents are submitted and stored digitally via email, but there is no mention of a centralized or formal data repository system.
Submission system and identification (e.g. electronic signature)	1	3	Documents are submitted digitally, but there is no mention of machine-readable formats or electronic signatures.
Communication system	1	3	Communication is digital via email, but there is no mention of a structured communication system or portal for stakeholders.
Verification of procedural data	1	3	Verification is done manually using checklists, indicating a basic level of digital data handling without advanced verification tools.
Data inspection and visualization	0	4	There is no information provided about data inspection or visualization tools, indicating a lack of digital processes in this area.
Data validation for building data	0	4	There is no information on data validation processes for building data, suggesting a lack of digital validation methods.
Data validation for spatial data	0	4	There is no information on spatial data validation, indicating a lack of digital processes in this area.
Content analyser and Regulations' Checking tool	1	4	Manual checks are performed using checklists, indicating a basic level of digital support for content analysis and regulation checking.
Data format interopeability	1	5	Documents are submitted in digital formats, but there is no mention of open formats or interoperability with external systems.
Building data to geospatial data (e.g. BIM to GIS)	0	4	There is no information on the integration of building data with geospatial data, indicating a lack of digital processes in this area.
Geospatial data to building data (e.g. GIS to BIM)	0	4	There is no information on the integration of geospatial data with building data, indicating a lack of digital processes in this area.

Figure 54 Technology maturity for Lisbon

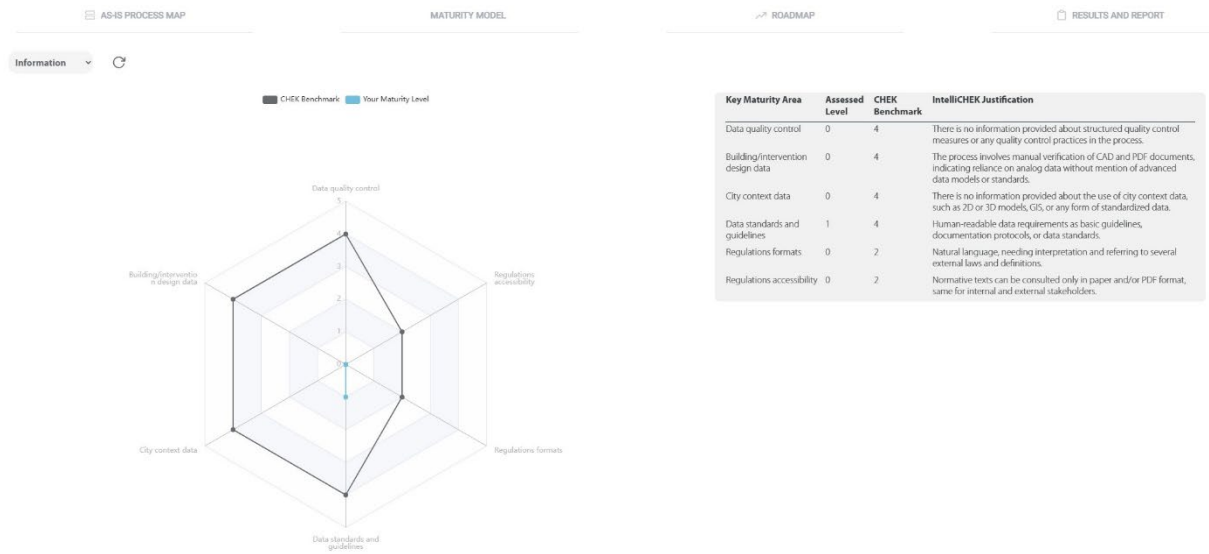
Information (Average Maturity Level: 0.2 - Foundational)

Information management remains at a foundational level, with no structured data quality control measures or standardised information formats. The process relies on manual verification of CAD and PDF documents, without integration into advanced data models such as BIM or GIS. There is no evidence of city context data usage, limiting the ability to analyse building projects in a broader urban framework.

While some basic data standards exist, they are minimal and limited to human-readable guidelines rather than machine-readable formats. Regulations are only available in natural language and static formats such as paper or PDFs, requiring manual interpretation and cross-referencing with multiple external laws. Additionally, regulatory documents are not easily accessible, creating inefficiencies for both internal and external stakeholders.

Conclusion:

Information maturity is critically low, with an absence of quality control, standardised formats, and structured digital data. To improve, the focus should be on implementing data quality management frameworks, adopting standardised digital formats, and integrating GIS and BIM models for enhanced spatial and design data analysis.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data quality control	0	4	There is no information provided about structured quality control measures or any quality control practices in the process.
Building/intervention design data	0	4	The process involves manual verification of CAD and PDF documents, indicating reliance on analog data without mention of advanced data models or standards.
City context data	0	4	There is no information provided about the use of city context data, such as 2D or 3D models, GIS, or any form of standardized data.
Data standards and guidelines	1	4	Human-readable data requirements as basic guidelines, documentation protocols, or data standards.
Regulations formats	0	2	Natural language, needing interpretation and referring to several external laws and definitions.
Regulations accessibility	0	2	Normative texts can be consulted only in paper and/or PDF format, same for internal and external stakeholders.

Figure 55 Information maturity for Lisbon

5.3 Gaia

Process map

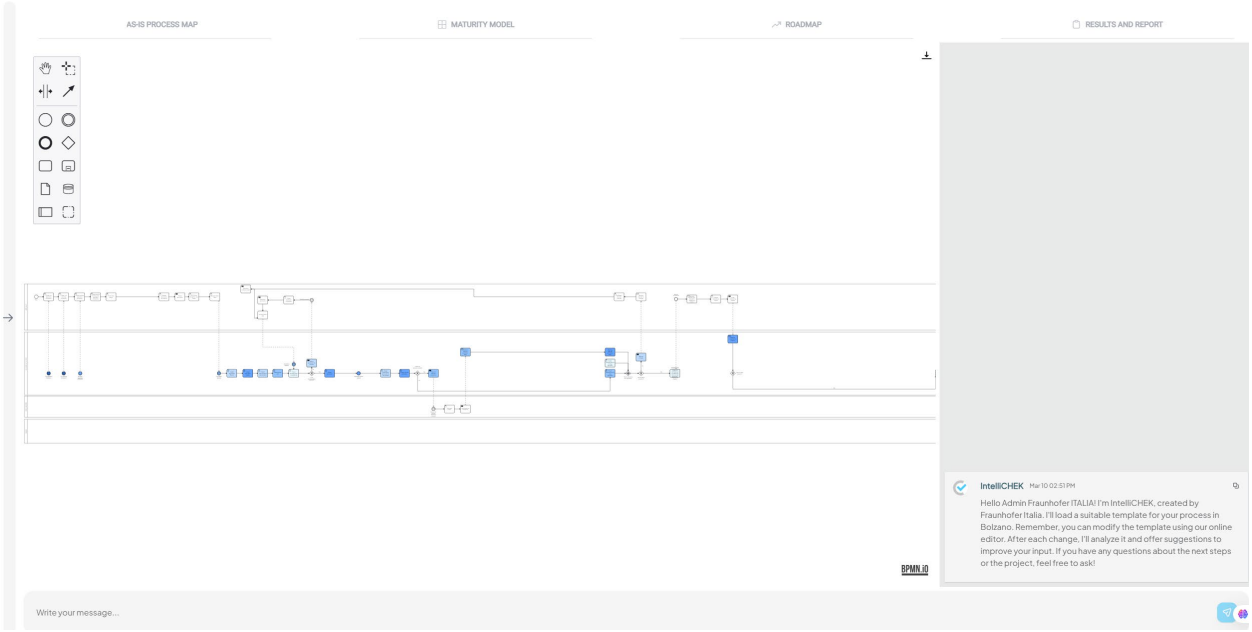


Figure 56 VA Generated Process Map of Vila Nova de Gaia

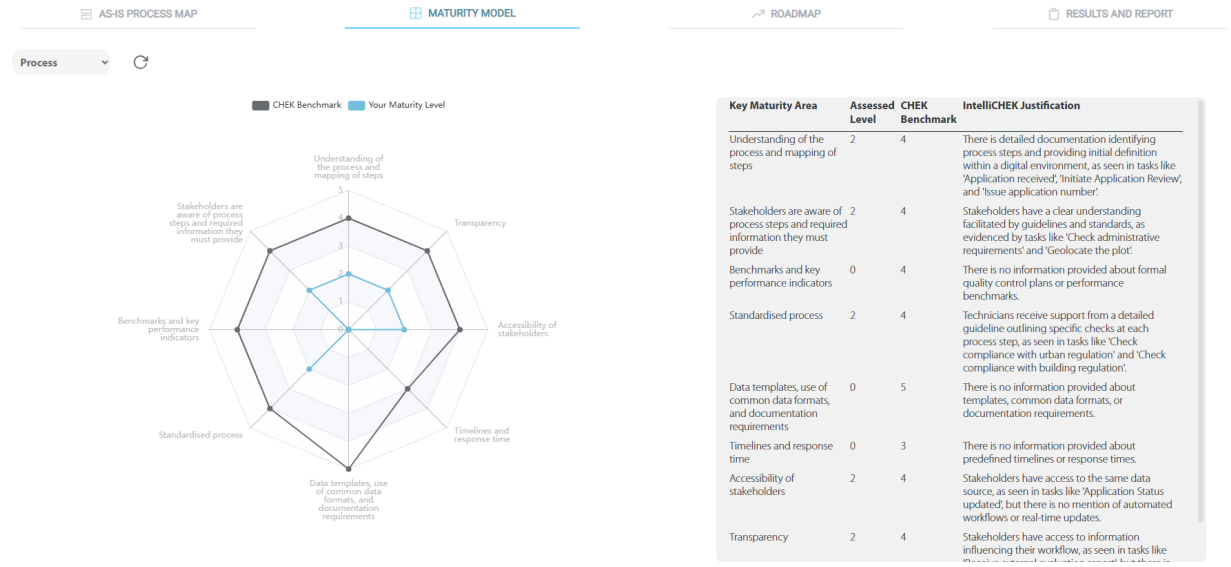
Maturity assessment

Process (Average Maturity Level: 1.4 - Moderate)

Process maturity is moderate, with clear documentation and stakeholder awareness but lacking performance benchmarks, data standardisation, and automation. The process is well-documented, providing an initial digital definition of steps. Stakeholders have a structured understanding of process requirements, guided by clear standards. However, no formal quality control plans, KPIs, or benchmarks are in place. Standardisation exists at a basic level, with defined compliance checks, but there are no common data templates or predefined response times. While stakeholders can access shared data sources, automated workflows and real-time updates are missing.

Conclusion

Although process documentation and stakeholder awareness are strengths, the lack of performance monitoring, standard data formats, and automation limits efficiency. Improvements should focus on introducing KPIs, automating workflows, and ensuring data standardisation.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Understanding of the process and mapping of steps	2	4	There is detailed documentation identifying process steps and providing initial definition within a digital environment, as seen in tasks like 'Application received', 'Initiate Application Review', and 'Issue application number'.
Stakeholders are aware of process steps and required information they must provide	2	4	Stakeholders have a clear understanding facilitated by guidelines and standards, as evidenced by tasks like 'Check administrative requirements' and 'Geolocate the plot'.
Benchmarks and key performance indicators	0	4	There is no information provided about formal quality control plans or performance benchmarks.
Standardised process	2	4	Technicians receive support from a detailed guideline outlining specific checks at each process step, as seen in tasks like 'Check compliance with urban regulation' and 'Check compliance with building regulation'.
Data templates, use of common data formats, and documentation requirements	0	5	There is no information provided about templates, common data formats, or documentation requirements.
Timelines and response time	0	3	There is no information provided about predefined timelines or response times.
Accessibility of stakeholders	2	4	Stakeholders have access to the same data source, as seen in tasks like 'Application Status updated', but there is no mention of automated workflows or real-time updates.
Transparency	2	4	Stakeholders have access to information influencing their workflow, as seen in tasks like

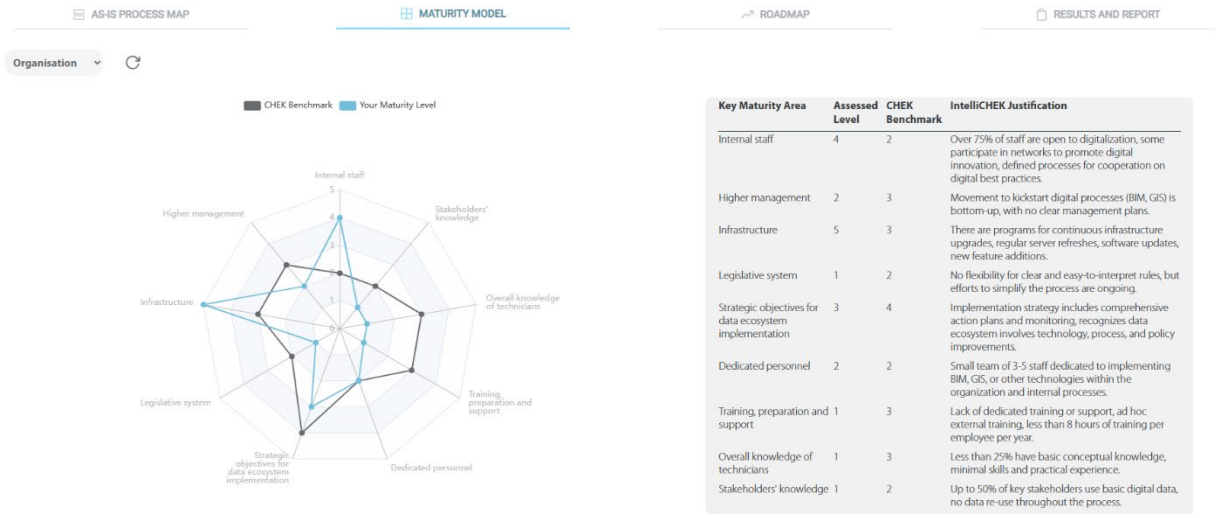
Figure 57 Process maturity for Vila Nova de Gaia

Organisation (Average Maturity Level: 2.2 - Moderate)

Organisational maturity is moderate, with strong infrastructure and engaged staff but gaps in management involvement, training, and strategy. Infrastructure is well-developed, with continuous updates, but digital transformation remains bottom-up, lacking clear management plans. The legislative system is rigid, limiting digital adoption. Strategic objectives exist but are not fully implemented. Training and personnel are key weaknesses—only a small team handles digital initiatives, and employees receive less than 8 hours of training per year. Technician knowledge is low, and stakeholders use basic digital data without reusing it effectively.

Conclusion

While infrastructure and staff engagement are strengths, weak leadership, limited training, and inflexible regulations hinder progress. Priorities should include stronger managerial involvement, structured training, and expanded digital teams to drive transformation.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Internal staff	4	2	Over 75% of staff are open to digitalization, some participate in networks to promote digital innovation, defined processes for cooperation on digital best practices.
Higher management	2	3	Movement to kickstart digital processes (BIM, GIS) is bottom-up, with no clear management plans.
Infrastructure	5	3	There are programs for continuous infrastructure upgrades, regular server refreshes, software updates, new feature additions.
Legislative system	1	2	No flexibility for clear and easy-to-interpret rules, but efforts to simplify the process are ongoing.
Strategic objectives for data ecosystem implementation	3	4	Implementation strategy includes comprehensive action plans and monitoring, recognizes data ecosystem involves technology, process, and policy improvements.
Dedicated personnel	2	2	Small team of 3-5 staff dedicated to implementing BIM, GIS, or other technologies within the organization and internal processes.
Training, preparation and support	1	3	Lack of dedicated training or support, ad hoc external training, less than 8 hours of training per employee per year.
Overall knowledge of technicians	1	3	Less than 25% have basic conceptual knowledge, minimal skills and practical experience.
Stakeholders' knowledge	1	2	Up to 50% of key stakeholders use basic digital data, no data re-use throughout the process.

Figure 58 Organisation maturity for Vila Nova de Gaia

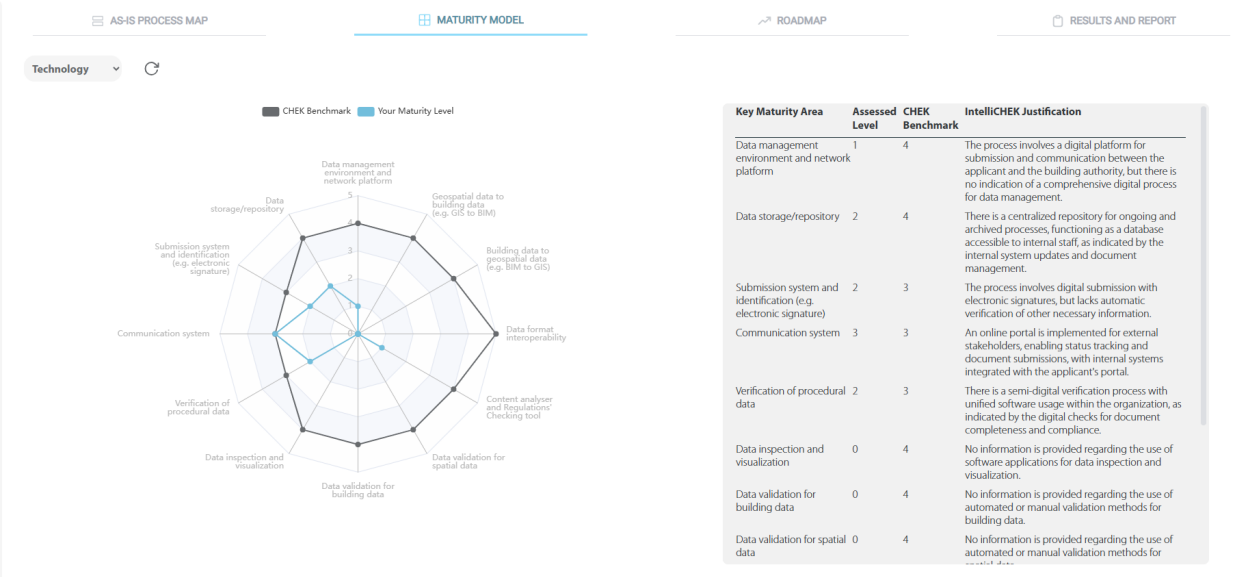
Technology (Average Maturity Level: 1.0 - Low)

Technology maturity is low, with limited data management, weak automation, and poor interoperability. A centralised data repository exists for internal staff, but there is no comprehensive digital process for data management. Digital submissions, including electronic signatures, are enabled but lack automatic verification. An online portal supports external stakeholders, yet verification processes remain semi-digital.

Key gaps include the absence of automated validation for building and spatial data, lack of data inspection tools, and no integration between geospatial and building data. Content analysis is manual, and interoperability between digital formats is non-existent.

Conclusion

While some digital tools exist, technology maturity is hindered by manual processes, lack of automation, and poor data integration. Key improvements should focus on implementing automated validation, enhancing interoperability, and adopting advanced data management systems.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data management environment and network platform	1	4	The process involves a digital platform for submission and communication between the applicant and the building authority, but there is no indication of a comprehensive digital process for data management.
Data storage/repository	2	4	There is a centralized repository for ongoing and archived processes, functioning as a database accessible to internal staff, as indicated by the internal system updates and document management.
Submission system and identification (e.g. electronic signature)	2	3	The process involves digital submission with electronic signatures, but lacks automatic verification of other necessary information.
Communication system	3	3	An online portal is implemented for external stakeholders, enabling status tracking and document submissions, with internal systems integrated with the applicant's portal.
Verification of procedural data	2	3	There is a semi-digital verification process with unified software usage within the organization, as indicated by the digital checks for document completeness and compliance.
Data inspection and visualization	0	4	No information is provided regarding the use of software applications for data inspection and visualization.
Data validation for building data	0	4	No information is provided regarding the use of automated or manual validation methods for building data.
Data validation for spatial data	0	4	No information is provided regarding the use of automated or manual validation methods for

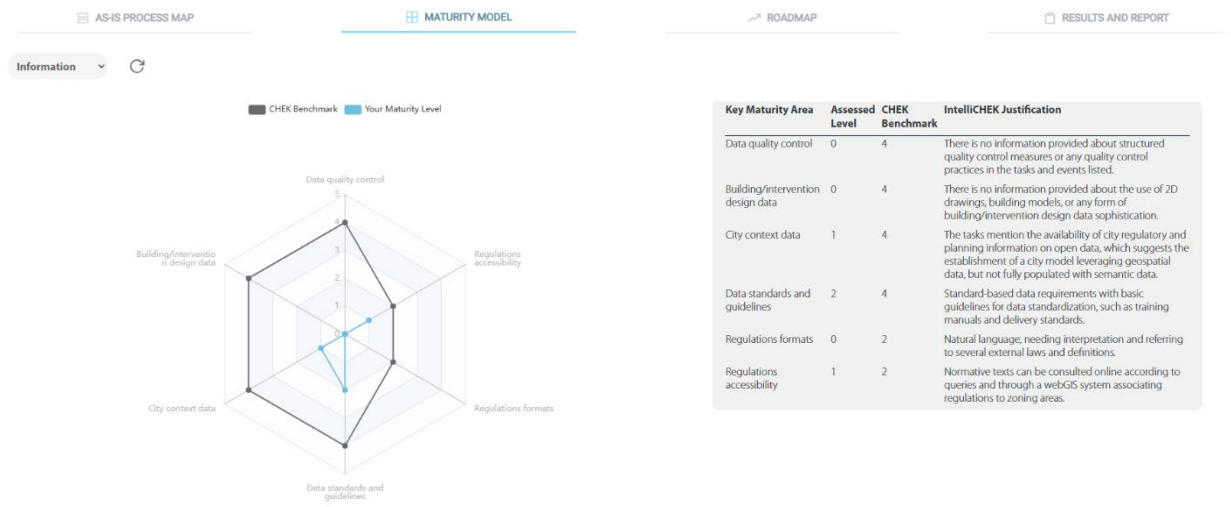
Figure 59 Technology maturity for Vila Nova de Gaia

Information (Average Maturity Level: 0.7 - Low)

Information maturity is very low, with major gaps in data quality control, design data, and standardisation. There are no structured quality control measures, and building design data (such as 2D drawings or BIM models) is absent. City context data is available through open data but lacks full semantic integration. While some data standardisation exists, it remains basic and limited. Regulatory formats are in natural language, requiring interpretation, and accessibility is minimal, though some zoning regulations can be consulted online via a webGIS system.

Conclusion

The lack of quality control, standardised design data, and structured regulations severely hinders information maturity. Improvements should focus on implementing data quality standards, introducing BIM and GIS integration, and digitising regulatory formats for better accessibility and usability.



Key Maturity Area	Assessed Level	CHEK Benchmark	IntelliCHEK Justification
Data quality control	0	4	There is no information provided about structured quality control measures or any quality control practices in the tasks and events listed.
Building/intervention design data	0	4	There is no information provided about the use of 2D drawings, building models, or any form of building/intervention design data sophistication.
City context data	1	4	The tasks mention the availability of city regulatory and planning information on open data, which suggests the establishment of a city model leveraging geospatial data, but not fully populated with semantic data.
Data standards and guidelines	2	4	Standard-based data requirements with basic guidelines for data standardization, such as training manuals and delivery standards.
Regulations formats	0	2	Natural language, needing interpretation and referring to several external laws and definitions.
Regulations accessibility	1	2	Normative texts can be consulted online according to queries and through a webGIS system associating regulations to zoning areas.

Figure 60 Information maturity for Vila Nova de Gaia

5.4 Prague

Process map

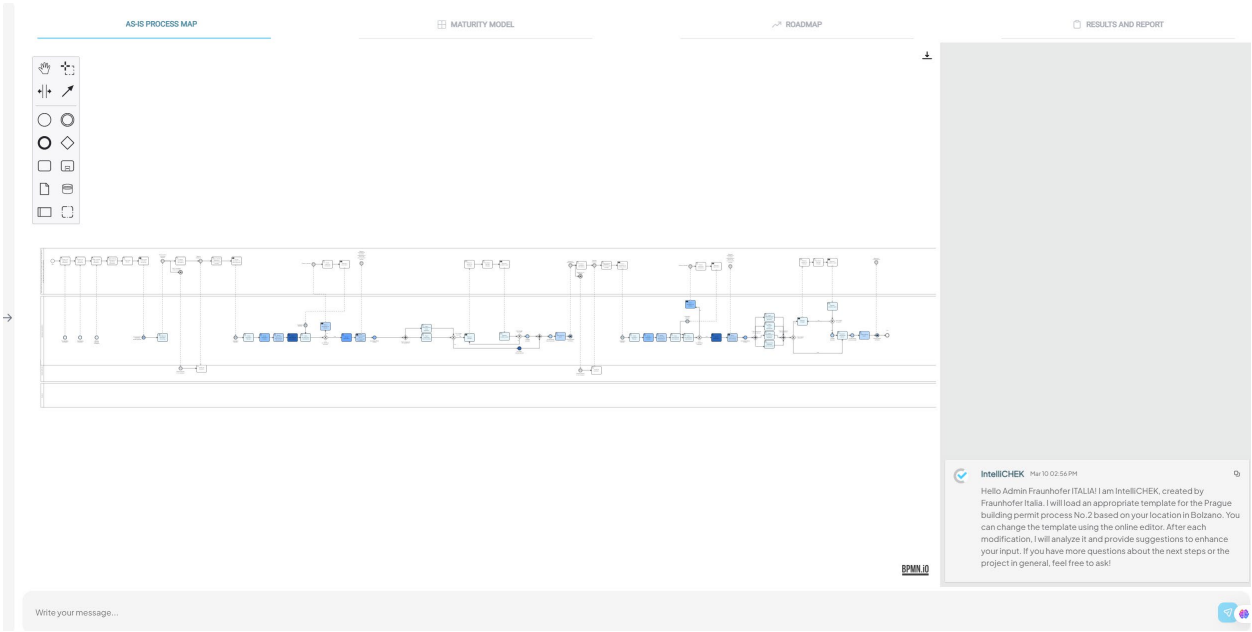


Figure 61 VA Generated Process Map of Prague

Maturity assessment

Process (Average Maturity Level: 0.4 - Very Low)

Process maturity is very low, with minimal documentation, standardisation, and performance measurement.

While there is a general mapping of steps, there is no integration into a digital environment. Stakeholders have a basic understanding of the process, but no guidelines or standards exist to ensure consistency. Benchmarks, KPIs, and predefined timelines are entirely absent.

Standardisation is limited to administrative mapping, lacking comprehensive guidelines. No data templates, common formats, or documentation requirements are defined. Additionally, there is no information on stakeholder accessibility or process transparency.

Conclusion

The lack of structured documentation, performance metrics, and digital integration severely limits process maturity. Improvements should focus on establishing clear guidelines, defining KPIs, implementing standardised documentation, and increasing transparency for stakeholders.

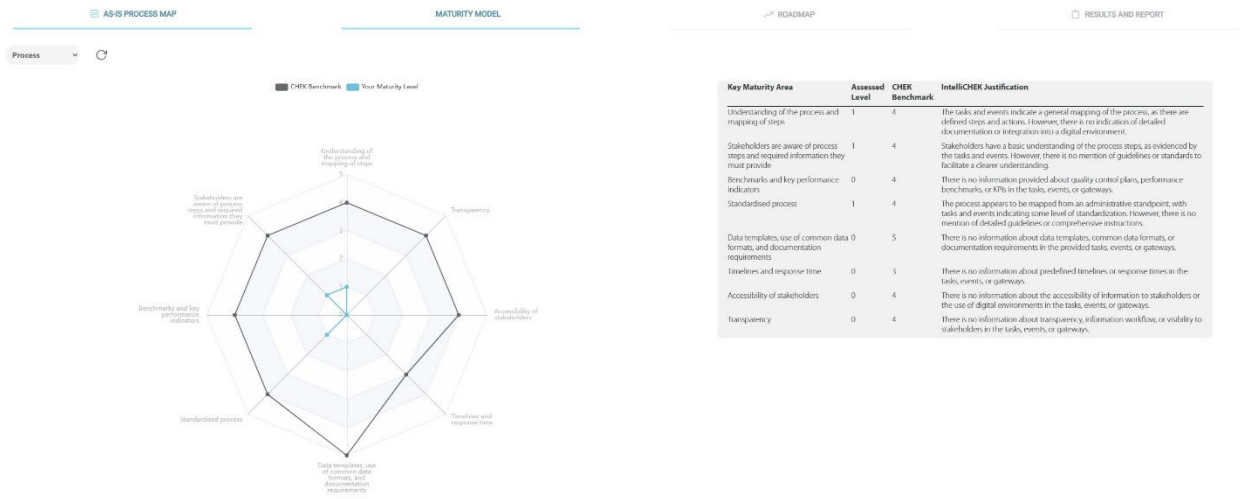


Figure 62 Process maturity for Prague

Organisation (Average Maturity Level: 0.6 - Very Low)

Organisational maturity is very low, with critical gaps in management support, infrastructure, training, and strategic planning. Less than 25% of staff acknowledge the need for digital transformation, and management does not express openness to change. The existing infrastructure is insufficient to support digital tools, and no clear implementation strategy is in place. There are minimal dedicated personnel, with only up to 20% of staff working part-time on digital initiatives. Training is inadequate, with less than 8 hours per employee per year. Technician knowledge is low, and stakeholders use basic digital data without reusing it effectively.

Conclusion

Severe weaknesses in leadership, infrastructure, and training hinder progress. To improve, the organisation must develop a digital strategy, invest in infrastructure, establish training programs, and designate staff to lead digital initiatives.

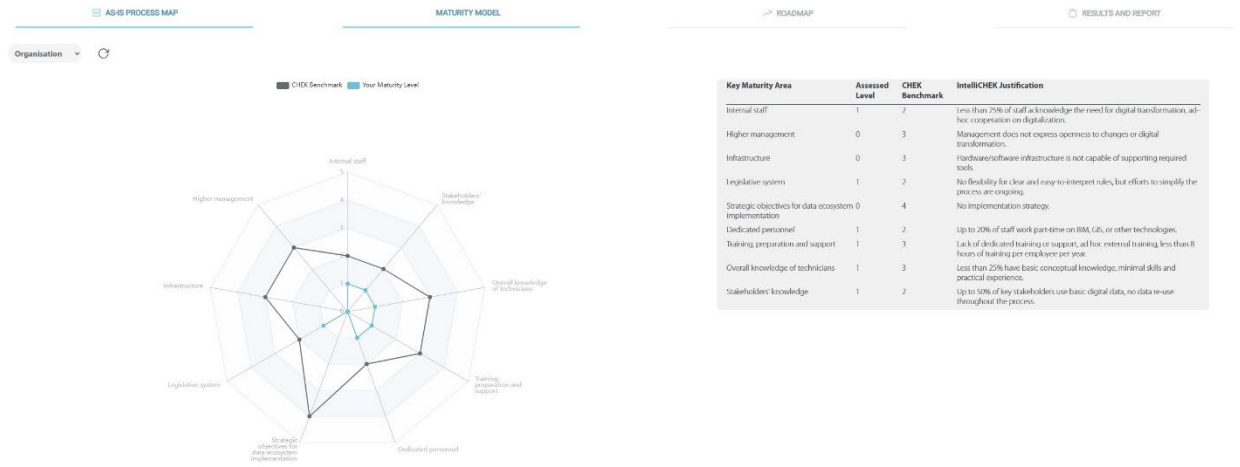


Figure 63 Organisation maturity for Prague

Technology (Average Maturity Level: 0.2 - Very Low)

Technology maturity is extremely low, with no structured digital process support, automation, or interoperability. The process relies on physical documents, paper submissions, and manual checks, with no centralised data management or storage system. Digital submission is limited to email, but documents must still be printed. Communication is primarily via email and physical mail, lacking a structured digital system. Verification, validation, and compliance checks are all performed manually, with no digital tools for data inspection or automated rule checking. There is no interoperability between systems, and no integration exists for geospatial or building data.

Conclusion

The lack of digital infrastructure, automation, and integration severely limits technological maturity. Key improvements should focus on implementing a centralised digital platform, automating validation and verification, and improving data interoperability.

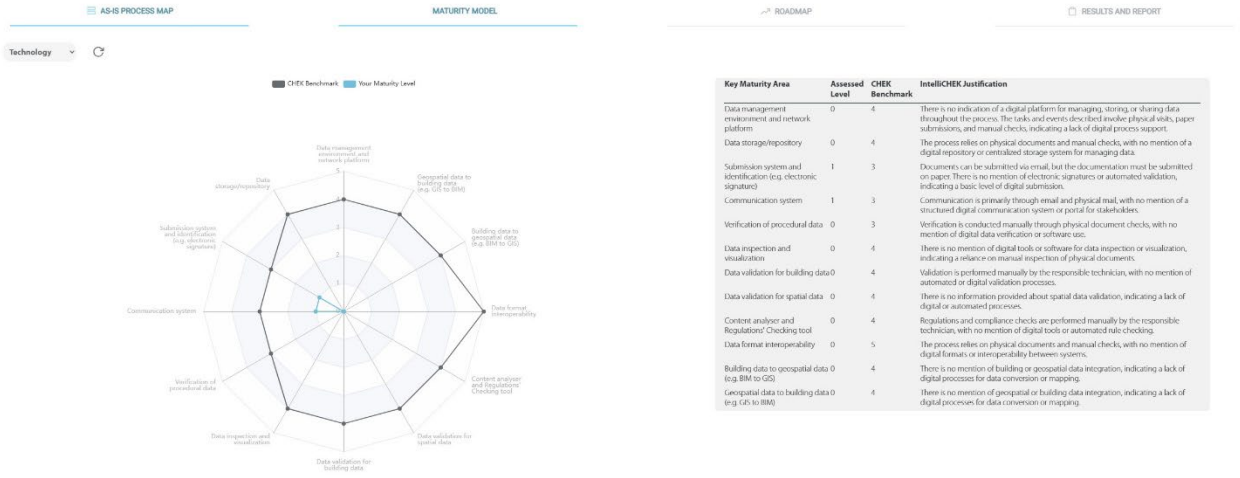


Figure 64 Technology maturity for Prague

Information (Average Maturity Level: 0.2 - Very Low)

Information maturity is extremely low, with no structured data quality control, digital formats, or accessibility measures.

There are no formal quality control practices, and data is handled manually through physical documents. Building and city context data rely on analogue methods such as paper submissions and physical visits, with no integration of digital models or geospatial data.

Data standards are minimal, consisting of basic human-readable guidelines. Regulatory formats exist only in natural language, requiring interpretation, and regulations are accessible solely through paper or PDF documents.

Conclusion

Severe limitations in data quality control, digital formats, and accessibility hinder information maturity. Improvements should focus on implementing structured data standards, adopting digital models (BIM, GIS), and ensuring regulatory information is available in an interactive digital format.

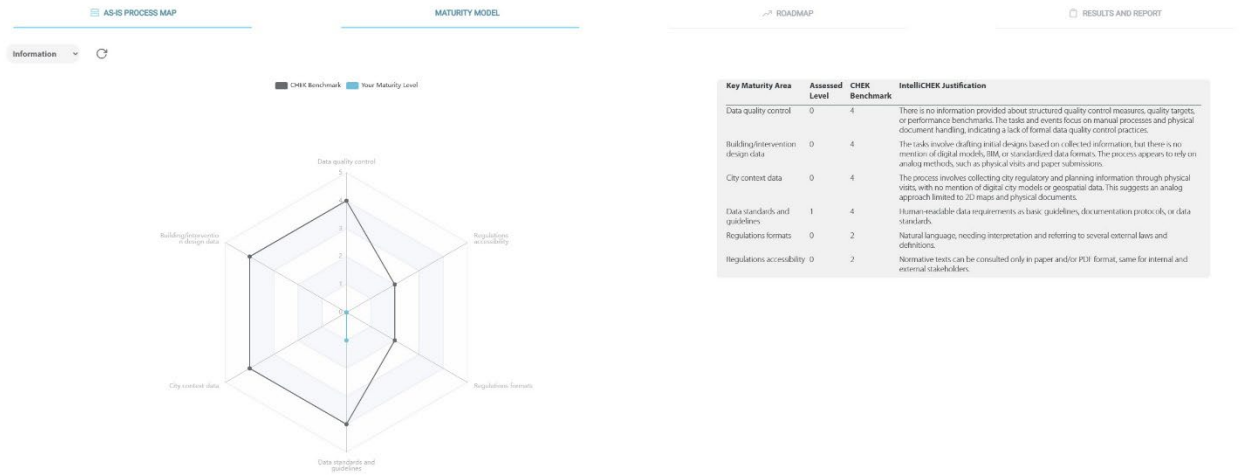


Figure 65 Information maturity for Prague

6 Discussion and analysis

Chapter summary

This chapter provides a comprehensive discussion and analysis of the digital maturity assessments conducted across four municipalities using three different methodologies: Traditional Expert-Led, VA Expert-Assisted, and VA Independent. The chapter is structured into three sections: a comparative analysis of testing phases (including per-municipality and per-category breakdowns), an evaluation of user feedback through a usability questionnaire, and a general discussion of overarching results. Findings show that expert-led assessments offer the most nuanced insights, especially in complex areas like Process and Organisation, while the VA performs well in structured categories like Technology and Information. However, VA Independent assessments tended to underestimate maturity due to user challenges with BPMN mapping and limited tool familiarity. Usability feedback highlighted the need for clearer guidance, improved navigation, and more context-aware chatbot interactions. The chapter concludes that a hybrid approach—combining expert insight with the structured efficiency of the VA—offers the most reliable path for assessing and supporting municipal digital transformation.

The assessment of digital maturity in four municipalities (Ascoli Piceno, Lisbon, Vila Nova de Gaia, and Prague) utilized four distinct methodologies:

1. **Traditional Expert-Led Method:** Conducted by experts in the field, using semi-structured interviews to assess each municipality's digital maturity.
2. **CHEK Virtual Assistant with Expert (VA Assisted):** In this phase, experts used the CHEK Virtual Assistant to assist in the maturity assessment, with the tool providing support and guidance.
3. **CHEK Virtual Assistant Independent Test (VA Independent):** Municipality experts independently used the CHEK Virtual Assistant to perform the maturity assessment, without expert intervention, to test the tool's ability to perform in a real-world, autonomous setting.
4. **Usability:** Municipality experts answer a set of questions to address their experience after using the VA.

On this section the results of all the phases will be discussed, focusing on the first moment on the analysis of the three phases of testing and later exploring the results from the usability questionnaire.

6.1 Analysis of results for the three phases of testing

6.1.1 Analysis of overall results

The assessment results across the four municipalities demonstrate that the Traditional Expert-Led Method generally produced more detailed and slightly varied results, whereas the VA-Assisted and VA-Self-Assessed Methods showed more uniformity but less precision in specific categories.

Process & Organisation Categories: The traditional method tends to show greater variation in scores, particularly in municipalities with more complex processes (e.g., Lisbon and Gaia). The VA methods tended to provide more homogeneous results, indicating that the AI-based tool follows a more standardised evaluation framework, at times using a simpler straight forward approach.

Technology & Information Categories: The VA-assisted and self-assessed methods demonstrated closer alignment with the expert method, suggesting that these categories are easier to evaluate using structured AI-based methodologies.

These observations are visually represented in Figure 66, which display the comparative results of the assessments across the three methods. The grading of the colours in the heatmaps represent the maturity levels assigned to each KMA, stronger shading colours represent higher score, lighter shading represents lower scores.

PROCESS

Traditional Method

CITY	1.1.1	1.1.2	1.2.3	1.2.4	1.2.5	1.3.6	1.3.7	1.3.8
ASCOLI	1.00	1.00	0.00	1.00	2.00	1.00	1.00	0.00
GAIA	4.00	4.00	4.00	4.00	3.00	4.00	2.00	2.00
LISBON	0.00	1.00	2.00	2.00	1.00	1.00	1.00	2.00
PRAGUE	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00

VA Expert-Assisted Method

CITY	1.1.1	1.1.2	1.2.3	1.2.4	1.2.5	1.3.6	1.3.7	1.3.8
ASCOLI	2.00	2.00	0.00	2.00	3.00	0.00	3.00	3.00
GAIA	2.00	2.00	0.00	2.00	3.00	3.00	3.00	3.00
LISBON	3.00	3.00	0.00	3.00	2.00	0.00	3.00	3.00
PRAGUE	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00

VA Self-Assessed Method

CITY	1.1.1	1.1.2	1.2.3	1.2.4	1.2.5	1.3.6	1.3.7	1.3.8
ASCOLI	2.00	2.00	0.00	2.00	2.00	3.00	3.00	3.00
GAIA	2.00	2.00	0.00	2.00	0.00	0.00	2.00	2.00
LISBON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRAGUE	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00

ORGANISATION

Traditional Method

CITY	2.4.10	2.4.11	2.4.12	2.4.9	2.5.13	2.5.14	2.5.15	2.6.16	2.6.17
ASCOLI	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00
GAIA	2.00	3.00	3.00	1.00	2.00	2.00	2.00	1.00	1.00
LISBON	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00
PRAGUE	1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00

VA Expert-Assisted Method

CITY	2.4.10	2.4.11	2.4.12	2.4.9	2.5.13	2.5.14	2.5.15	2.6.16	2.6.17
ASCOLI	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00
GAIA	1.00	4.00	0.00	4.00	5.00	2.00	1.00	1.00	2.00
LISBON	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
PRAGUE	1.00	0.00	2.00	2.00	0.00	1.00	0.00	1.00	0.00

VA Self-Assessed Method

CITY	2.4.10	2.4.11	2.4.12	2.4.9	2.5.13	2.5.14	2.5.15	2.6.16	2.6.17
ASCOLI	1.00	1.00	3.00	1.00	2.00	1.00	1.00	1.00	1.00
GAIA	2.00	5.00	1.00	4.00	3.00	2.00	1.00	1.00	1.00
LISBON	2.00	0.00	0.00	2.00	0.00	2.00	0.00	1.00	1.00
PRAGUE	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00

TECHNOLOGY

Traditional Method

CITY	3.7.18	3.7.19	3.7.20	3.7.21	3.8.22	3.8.23	3.8.24	3.8.25	3.8.26	3.9.27	3.9.28	3.9.29
ASCOLI	1.00	1.00	1.00	2.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
GAIA	3.00	4.00	3.00	1.00	2.00	1.00	2.00	2.00	1.00	2.00	1.00	1.00
LISBON	3.00	2.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	1.00
PRAGUE	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

VA Expert-Assisted Method

CITY	3.7.18	3.7.19	3.7.20	3.7.21	3.8.22	3.8.23	3.8.24	3.8.25	3.8.26	3.9.27	3.9.28	3.9.29
ASCOLI	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
GAIA	2.00	2.00	2.00	3.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
LISBON	3.00	2.00	2.00	3.00	2.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
PRAGUE	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

VA Self-Assessed Method

CITY	3.7.18	3.7.19	3.7.20	3.7.21	3.8.22	3.8.23	3.8.24	3.8.25	3.8.26	3.9.27	3.9.28	3.9.29
ASCOLI	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GAIA	1.00	2.00	2.00	3.00	2.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
LISBON	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00
PRAGUE	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

INFORMATION

Traditional Method

CITY	4.10.30	4.10.31	4.11.32	4.11.33	4.12.34	4.12.35
ASCOLI	1.00	1.00	1.00	0.00	0.00	0.00
GAIA	2.00	4.00	1.00	1.00	0.00	1.00
LISBON	0.00	1.00	0.00	1.00	0.00	0.00
PRAGUE	1.00	0.00	0.00	0.00	0.00	0.00

VA Expert-Assisted Method

CITY	4.10.30	4.10.31	4.11.32	4.11.33	4.12.34	4.12.35
ASCOLI	1.00	0.00	0.00	1.00	0.00	1.00
GAIA	2.00	1.00	1.00	1.00	0.00	1.00
LISBON	0.00	0.00	0.00	0.00	0.00	0.00
PRAGUE	0.00	0.00	0.00	1.00	0.00	0.00

VA Self-Assessed Method

CITY	4.10.30	4.10.31	4.11.32	4.11.33	4.12.34	4.12.35
ASCOLI	1.00	2.00	1.00	1.00	1.00	1.00
GAIA	0.00	0.00	1.00	2.00	0.00	1.00
LISBON	0.00	0.00	0.00	1.00	0.00	0.00
PRAGUE	0.00	0.00	0.00	1.00	0.00	0.00

Figure 66 Heatmaps of the 3 methods

6.1.2 Analysis of results by municipality

6.1.2.1 Ascoli Piceno

In Ascoli Piceno, the assessment results indicate a high level of consistency across all three methods, suggesting that the municipality's digital maturity is easier to assess systematically (Figure 67 & Figure 68).

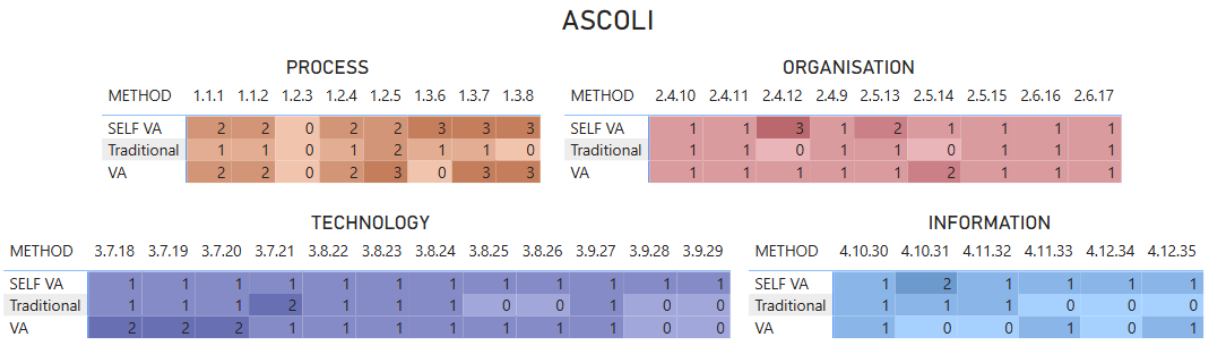


Figure 67 Ascoli Piceno results heatmap

Figure 68 Ascoli Piceno results in all KMAs

The traditional Expert-Led method provided granular insights into Ascoli's digital maturity, with slightly more variation in Process and Organisation categories compared to the VA methods. While the VA Expert-Assisted had scores closely matched the traditional expert-led method, particularly in Technology and Information categories. However, some minor overestimation in organisation was noted. The VA Self-Assessed results were largely consistent with expert assessments, though some simplifications were observed in Process assessment. This suggests that while the VA tool is effective, users may require additional context to fully grasp their process maturity.

Key Insights:

- High correlation between VA and traditional methods, particularly in structured areas (Technology & Information).
- Minimal discrepancies across methods indicate that Ascoli Piceno's maturity assessment is well-aligned with the reality, when using the CHEK DBP Maturity Model as a reference.

6.1.2.2 Vila Nova de Gaia

Gaia presented the most varied results across the three methods, particularly in Process and Organisation categories (Figure 69 & Figure 70).

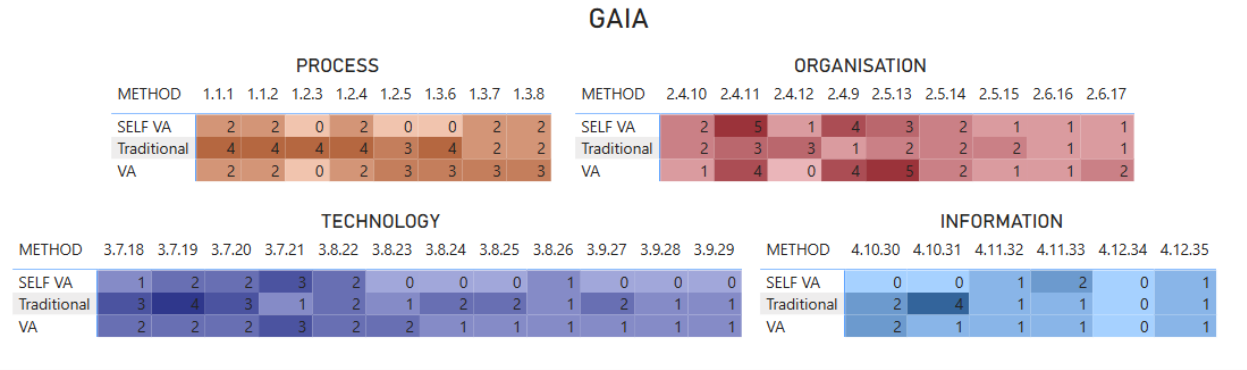


Figure 69 Vila Nova de Gaia results heatmap

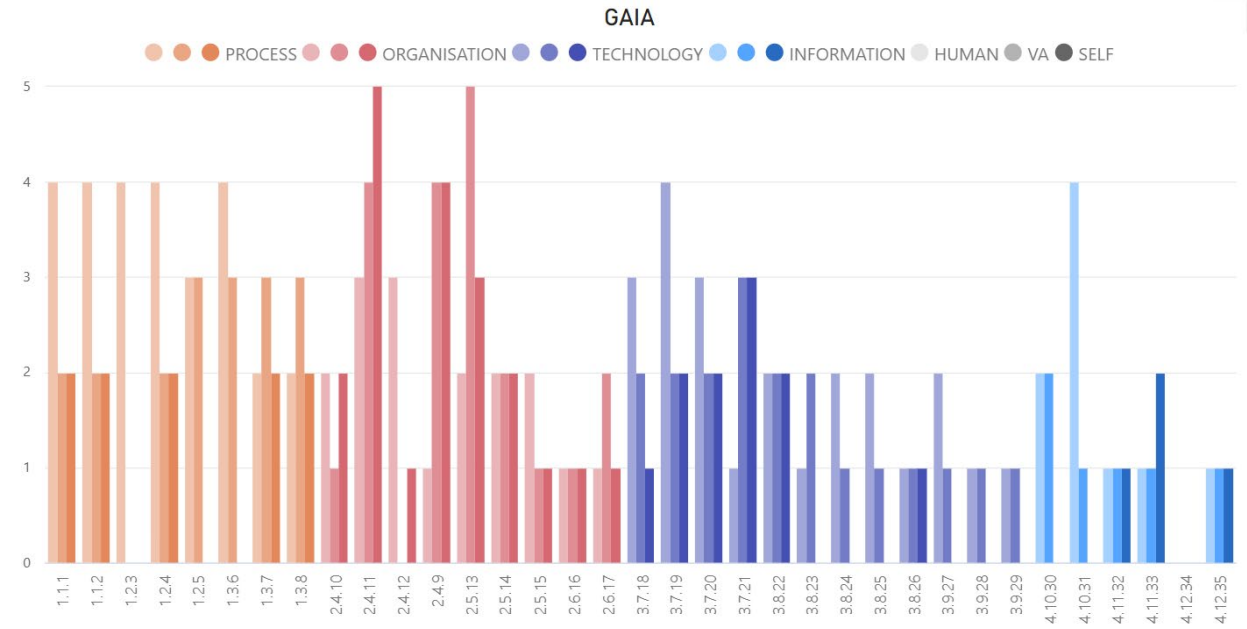


Figure 70 Vila Nova de Gaia results in all KMAs

Traditional Expert-Led assessment found a more uneven level of digital maturity, particularly highlighting complexities in organisational workflows and process mapping. The VA Expert-Assisted method showed notably higher scores in organisation maturity, possibly due to AI interpreting structured workflows as more mature than they actually are. VA Self-Assessed scores were significantly lower in Process and Organisation, indicating that users struggled to assess their own digital maturity. However, the Technology and Information scores remained consistent with expert assessments.

Key Insights:

- Traditional method highlighted more fragmentation in process maturity, suggesting that AI-based assessments may oversimplify municipality-specific complexities.

- VA Expert-Assisted produced higher Organisation scores, which might be attributed to a structured evaluation model that does not fully account for workflow inefficiencies.
- VA Self-Assessed results were significantly lower, indicating that non-expert users may lack the complexity of the tool to correctly make their assessments.

6.1.2.3 Lisbon

Lisbon's assessment revealed notable discrepancies between methods, particularly in the Process category (Figure 71 & Figure 72).

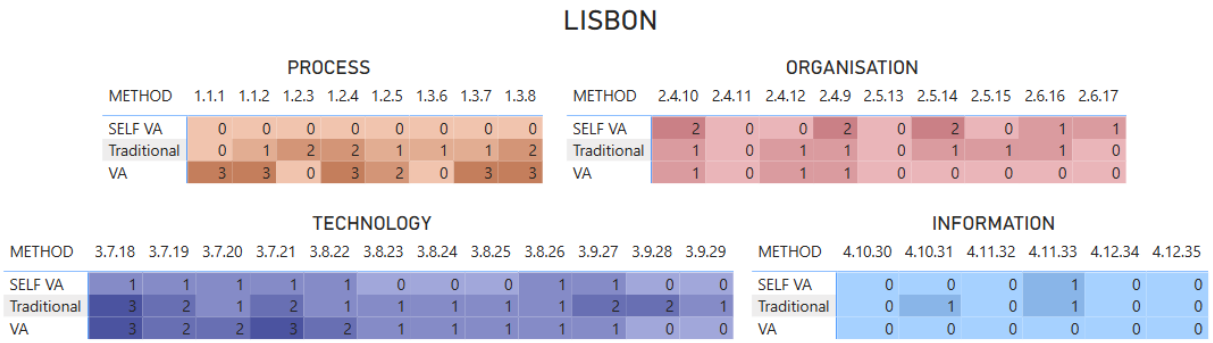


Figure 71 Lisbon results heatmap

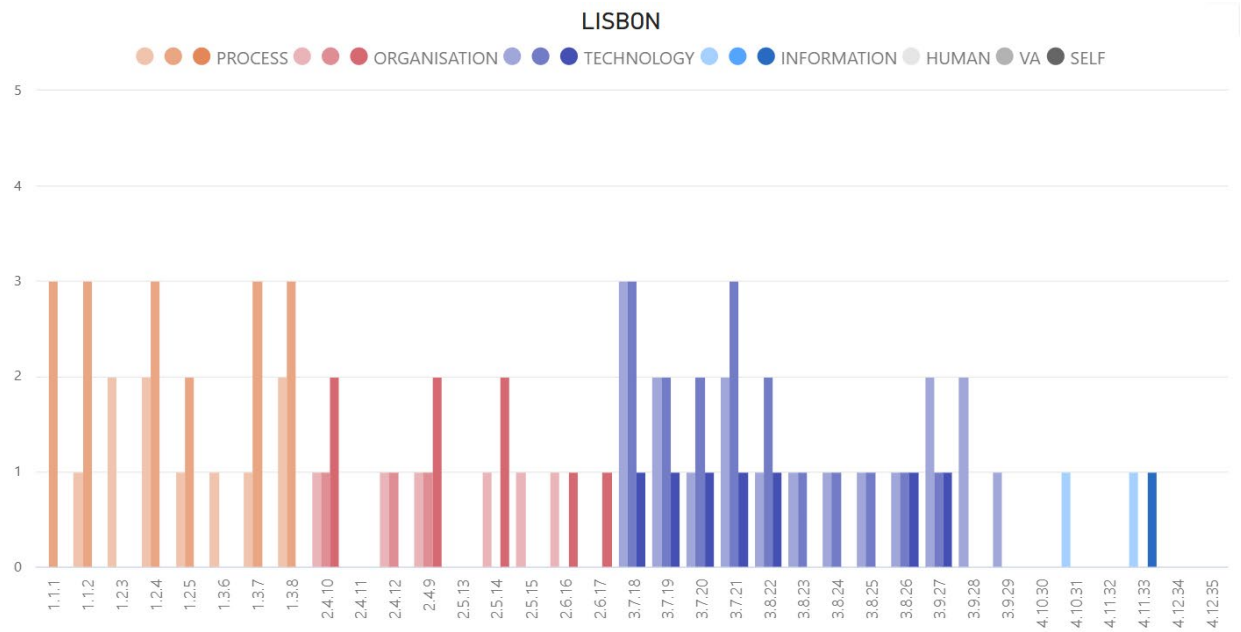


Figure 72 Lisbon results in all KMAs

At the traditional Expert-Led method, experts identified several digital maturity gaps, particularly in Process and Organisation. While with the VA Expert-Assisted, the tool provided moderate alignment with expert assessments, though it tended to smooth out variations, leading to slightly higher-than-expected scores in Process and Organisation. The VA Self-Assessed method consistently underestimated digital maturity, particularly in Process and Technology, suggesting that municipal users struggled with assessing their maturity using the tool.

Key Insights:

- VA Expert-Assisted was generally reliable but showed some bias towards higher Organisation and Process scores, likely due to its structured methodology.
- VA Self-Assessed scores were the lowest among all methods, highlighting the difficulty municipality users faced in assessing their own maturity accurately.

6.1.2.4 Prague

Prague's results exhibited a high degree of uniformity across all three methods, suggesting that the municipality's digital maturity is relatively well-defined (Figure 73; Figure 74).

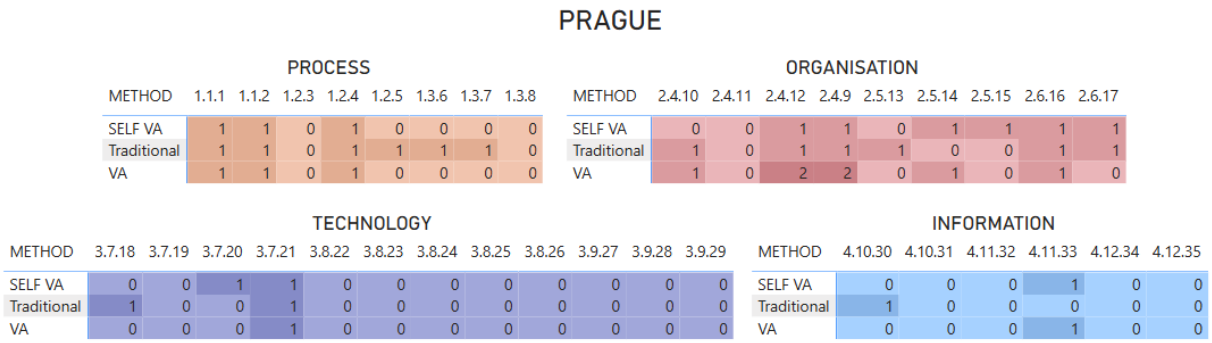


Figure 73 Prague results heatmap

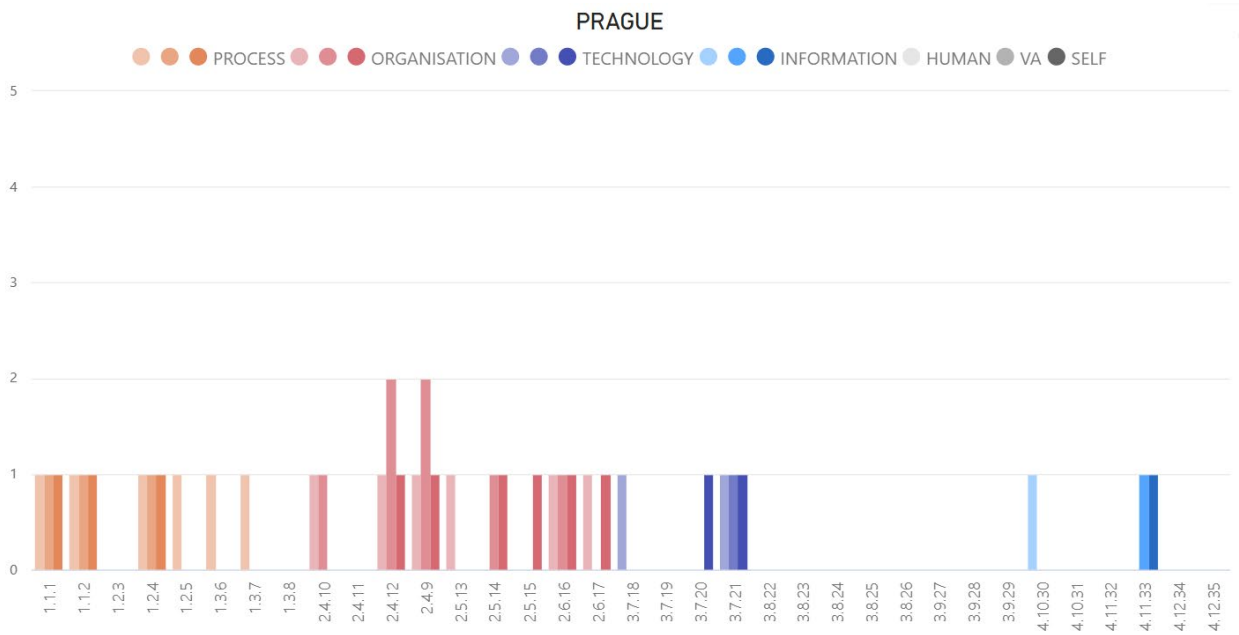


Figure 74 Prague results in all KMAs

The traditional Expert-Led method identified moderate to low digital maturity across all categories, with slightly lower scores in Technology and Information. VA Expert-Assisted method closely aligned with the traditional assessment,

confirming its ability to capture low digital maturity effectively. The VA Self-Assessed results were consistent with the expert-assisted method, though minor underestimations in Process and Organisation were observed.

Key Insights:

- VA-based methods aligned well with traditional assessments, making Prague the most consistent results regarding the three methods.
- Some slight underestimations in Process and Organisation by VA Self-Assessed users indicate that AI models still benefit from expert input in complex areas.

6.1.3 Accuracy comparison of the three methods

To evaluate the accuracy of the three methods (Traditional Expert-Led, VA with Expert, and VA Independent), the results were analysed across the four categories (Process, Organisation, Technology, and Information). Comparisons are made in pairs of two methods at time (Traditional vs. VA with Expert, Traditional vs. VA Independent, and VA with Expert vs. VA Independent). The comparison was conducted by evaluating the scores assigned by each method and calculating the percentage of **equal scores, higher scores,** and **lower scores** across all municipalities.

- **Equal Scores:** The percentage of instances where two methods that are being compared are assigned the same score for a given municipality and category. For example, when comparing Traditional vs. VA with Expert, both have the same score.
- **Higher Scores:** The percentage of cases where the first method of the two there are being compared produced a higher score than the other, indicating a potentially more favourable assessment. For example, when comparing Traditional vs. VA with Expert, Traditional has higher score.
- **Lower Scores:** The percentage of instances where the first method of the two there are being compared are assigned a lower score compared to the other, suggesting a more critical evaluation. For example, when comparing Traditional vs. VA with Expert, Traditional has lower score.

This comparative analysis provides insights into the consistency and variance between the three assessment approaches, helping to determine the reliability and alignment of AI-assisted methods with traditional expert evaluations.

Accuracy by Process category

Table 1 Accuracy in Process category

Methods Compared	% Equal Answers	% Higher Scores	% Lower Scores
Traditional vs. VA with Expert	22%	34%	44%
Traditional vs. VA Independent	31%	50%	19%
VA with Expert vs. VA Independent	63%	34%	3%

The Traditional Expert-Led Method and the VA Expert-Assisted Method showed 22% equal answers, with 34% of cases where the Traditional Method produced higher scores and 44% of cases where the VA Expert-Assisted Method assigned lower scores. This shows that the VA Expert-Assisted Method diverged more significantly from the Traditional Method in the Process category, especially in complex processes. The Traditional vs. VA Independent comparison showed 31% equal answers, with the VA Independent Method assigning higher scores (50%) and 19% lower scores,

suggesting that independent users may have overestimated digital maturity in their assessments. However, the VA with Expert vs. VA Independent comparison showed 63% equal answers, with only 34% of cases showing higher scores for the Traditional Method, and 3% lower scores for the VA Expert-Assisted Method, indicating that the VA Expert-Assisted Method performed more consistently in process when compared with the independent use.

Accuracy by Organisation category

Table 2 Accuracy in Organisation category

Methods Compared	% Equal Answers	% Higher Scores	% Lower Scores
Traditional vs. VA with Expert	53%	22%	25%
Traditional vs. VA Independent	50%	17%	33%
VA with Expert vs. VA Independent	47%	19%	33%

For Organisation Maturity, the comparison between the Traditional Expert-Led Method and the VA Expert-Assisted Method showed 53% equal answers, with 22% of cases where the Traditional Method produced higher scores, and 25% of cases where the VA Expert-Assisted Method produced lower scores. The Traditional vs. VA Independent comparison showed 50% equal answers, with 17% of cases where the Traditional Method produced higher scores, and 33% of cases where the VA Independent Method produced lower scores. The VA Expert-Assisted vs. VA Independent comparison showed 47% equal answers, showing that independent users had possibly some difficulties to assess their organisation maturity, in 19% of cases where the VA Expert-Assisted Method produced higher scores, and 33% of cases where it produced lower scores, confirming the higher variability in organisational assessments by independent users compared to those assisted by experts.

Accuracy by Technology category

Table 3 Accuracy in Technology category

Methods Compared	% Equal Answers	% Higher Scores	% Lower Scores
Traditional vs. VA with Expert	56%	23%	21%
Traditional vs. VA Independent	46%	42%	13%
VA with Expert vs. VA Independent	56%	38%	6%

In the Technology Maturity category, the Traditional Expert-Led Method and the VA Expert-Assisted Method showed 56% equal answers, with 23% of cases where the Traditional Method assigned higher scores, and 21% of cases where the VA Expert-Assisted Method assigned lower scores. The Traditional vs. VA Independent comparison showed 46% equal answers, with 42% of cases where the VA Independent Method assigned higher scores, and 13% of cases where it assigned lower scores, indicating a tendency for independent users to overestimate their technological maturity. The VA Expert-Assisted vs. VA Independent comparison showed 56% equal answers, with 38% of cases where the VA Expert-Assisted Method produced higher scores, and 6% of cases where it assigned lower scores.

Accuracy by Information category

Table 4 Accuracy in Information category

Methods Compared	% Equal Answers	% Higher Scores	% Lower Scores
Traditional vs. VA with Expert	63%	25%	13%
Traditional vs. VA Independent	58%	17%	25%
VA with Expert vs. VA Independent	71%	8%	21%

The Information Maturity category demonstrated the most consistency across methods. The Traditional Expert-Led Method and the VA Expert-Assisted Method showed 63% equal answers, with 25% of cases where the Traditional Method produced higher scores, and 13% of cases where the VA Expert-Assisted Method produced lower scores. The Traditional vs. VA Independent comparison showed 58% equal answers, with 17% of cases where the Traditional Method assigned higher scores, and 25% of cases where the VA Independent Method produced lower scores. The VA Expert-Assisted vs. VA Independent comparison showed 71% equal answers, with only 8% of cases where the VA Expert-Assisted Method produced higher scores, and 21% of cases where it produced lower scores, indicating that the VA Expert-Assisted Method delivered the most consistent and accurate assessment in this category.

Summary of accuracy comparison

Table 5 Summary of accuracy through all categories

Category	Traditional vs. VA with Expert	Traditional vs. VA Independent	VA with Expert vs. VA Independent
Process	22% ✓ 34% ⊕ 44% ⊖	31% ✓ 50% ⊕ 19% ⊖	63% ✓ 34% ⊕ 03% ⊖
Organisation	53% ✓ 22% ⊕ 25% ⊖	50% ✓ 17% ⊕ 33% ⊖	47% ✓ 19% ⊕ 33% ⊖
Technology	56% ✓ 23% ⊕ 21% ⊖	46% ✓ 42% ⊕ 13% ⊖	56% ✓ 38% ⊕ 06% ⊖
Information	63% ✓ 25% ⊕ 13% ⊖	58% ✓ 17% ⊕ 25% ⊖	71% ✓ 08% ⊕ 21% ⊖

The VA Expert-Assisted Method demonstrated stronger alignment with the Traditional Expert-Led Method than the VA Independent Method across most of the categories. The VA Expert-Assisted Method had a higher percentage of equal answers with the traditional approach on Organisation, Technology and Information, suggesting that expert guidance significantly improved the VA's ability to assess digital maturity accurately. This indicates that having an expert mediating the use of the VA method helps ensure a more precise evaluation.

Information maturity was the most consistently rated category across all three methods. The VA Expert-Assisted and VA Independent Methods had an 71% match rate in Information, indicating that this category is easier to assess objectively. However, the lowest scores on this category might indicate that the VA can easily capture low maturity but struggles to analyse more complex cases.

The VA methods, both Expert-Assisted and Independent, exhibited the greatest deviation in the Process category, with only 22% and 31% of answers matching the traditional assessment, respectively. The VA Expert-Assisted Method exhibited a 34% higher score difference compared to the traditional approach, and 44% lower. While the VA Independent method scored 50% higher in process category compared to the traditional method, the most significant variation observed in any category. This suggests that the tool faced challenges in evaluating processes according to the CHEK MM. The Process category require deeper contextual knowledge, which AI tools alone may not fully capture. From all four categories of the CHEK Maturity Model, the Process categories is probably the most difficult to access given by the analysis made by the VA. The VA analyses the actions within the process, when the users draw their

process map), but the AI might have missed the analysis of the full scenario. This might reinforce the idea that the process maturity assessment requires expert interpretation to capture workflow complexities and interdependencies accurately.

6.2 Analysis of results from usability questionnaire

This analysis summarizes the findings from the evaluation of the CHEK Virtual Assistant (VA) based on responses from four participants from the CHEK partner municipalities. The participants were tasked with using the tool for mapping building permit processes and creating their own Maturity Model assessment. After concluding the task, they answered the questions for assessing its usability, clarity, and relevance to their municipality's digitalisation efforts. The feedback provided will guide future improvements and highlight the tool's strengths and weaknesses.

The evaluation was conducted using a questionnaire consisting of both quantitative (Likert scale) and qualitative (open-ended) questions. The participants were asked to rate their experiences in areas such as navigation, process mapping (by using the BPMN tool), digital maturity assessment, and interaction with the VA. The responses were collected through an online survey. The full report with the answers can be found on Annex IV of this deliverable.

6.2.1 Findings

The findings on the usability questionnaire are aggregated by theme, the following report summarizes the answers from all participants.

Usability, Navigation, and Layout

- Q1: Ease of navigating the interface
  Average score: 3.0
  Most respondents found the navigation moderately easy, with some challenges. One participant mentioned that the interface was somewhat confusing, requiring guidance or repeated attempts. Issues mentioned include difficulty undoing changes in the map and problems with the zooming function.
- Q2: Intuitiveness of the layout
  Average score: 3.5
  Participants found the layout relatively intuitive, but not without challenges. One participant suggested providing more detailed instructions on using icons and features.
- Q4: Difficulties finding or using features
  Several respondents experienced issues with basic functions, such as undoing changes and the lack of guidance regarding the features of the tool.

Process Mapping and Relevance

- Q6: Relevance of the process mapping template
  Average score: 4.0
  The template was considered relevant but needed some customisation to fit the specific needs of participants' processes. One participant suggested that it would be useful if the VA prompted for missing data during the mapping.
- Q7: Ease of completing the process map

Average score: 3.0
Participants encountered challenges while completing the map, citing issues with the tool's responsiveness, the lack of clear instructions on using features, and the absence of a clear timeline for mapping. Some participants suggested that the tool could benefit from providing more concrete and detailed prompts.

- Q10: Were the steps to finish the process map clearly defined?
  Some respondents indicated that the steps were not clearly defined, especially in the context of the actions required for completing the map. One respondent noted that the steps were too complex and difficult to apply in their specific administrative context.

Digital Maturity Assessment

- Q12: Assessment of digital maturity
  Average score: 3.0
  The tool's ability to assess digital maturity was seen as somewhat useful, but several participants felt that it did not fully align with their municipality's needs. More detail about how digital maturity factors into the building permit process was requested.

Interaction with the VA

- Q19: Helpfulness of the VA's interactions
  Average score: 3.0
  The VA's questions were generally considered relevant but somewhat generic. Participants suggested that the assistant should ask more concrete questions and prompt users for missing information.
- Q20: Clarity of the questions posed by the VA
  Average score: 4.0
  Most respondents found the questions to be clear and understandable. However, one participant suggested that more context-specific questions would improve the interaction.
- Q22: Effectiveness of the VA in helping to map the process
  Average score: 2.5
  The VA was not deemed very effective in guiding participants through the process mapping. One participant indicated that the guidance was difficult to follow, and another mentioned that the tool was difficult to use and contained inaccurate information.

Qualitative Insights

Several recurring themes emerged from the open-ended responses:

- **More of detailed instructions:** Participants highlighted the need for more specific guidance at the beginning of the process. Clearer instructions on how to use each feature and icon, as well as an explanation of how to proceed after finishing the process map, were requested.
- **Confusion in the VA's questions:** There was a concern that the questions posed by the VA were too general and repetitive. Respondents suggested that the assistant could improve by asking more concrete questions and prompting for missing details such as time criteria or specific steps in the building permit process. The prompting strategy may be need to me better explained to users before the access to the VA.

- **Tool usability challenges:** Users experienced frustration with certain features, such as the inability to undo actions and zooming difficulties. Some participants also mentioned that the BPMN drawing tool was too rigid, with a lack of flexibility in adapting to complex processes.
- **Tool potential:** Despite the challenges, several respondents recognized the potential of the CHEK VA to streamline process mapping and digital maturity assessments. Suggestions included improving the tool's accuracy and expanding its ability to understand and adapt to the nuances of the municipality's processes.

6.2.2 Recommendations and improvements

The evaluation of the CHEK Virtual Assistant reveals a tool with significant potential to transform municipal building permit processes, yet one that currently faces substantial usability challenges. Through careful analysis of feedback from four partner municipalities, we have identified critical areas for improvement that, when addressed, will enhance the tool's effectiveness and adoption. The improvements will focus on:

- **Improve user guidance:** Provide clearer instructions and a comprehensive tutorial at the start of the tool's use. Users should be informed about the features, icons, and specific actions that can be performed.
- **Enhance the VA:** The VA should ask more specific and contextual questions, particularly about missing information that is critical to the process or assessment. Additionally, the assistant should have a better understanding of the business context and be able to guide users more effectively.
- **Fix usability issues:** Address problems such as the inability to undo changes, difficulties with zooming, and the lack of flexibility in replicating elements. Consider adding a timeline feature, as some participants mentioned the importance of this in the context of regulatory requirements.
- **Refine the process mapping tool:** Make the mapping tool more adaptable to different contexts, particularly administrative ones. Consider breaking down the steps into smaller, more manageable actions and provide clear prompts when users leave gaps in the process map.

6.2.3 Usability report summary

The current iteration of the CHEK Virtual Assistant (VA) shows potential in facilitating digital maturity assessments. However, users have faced challenges related to navigation, unclear instructions, and overly generic guidance. These issues, along with the difficulty in manipulating and understanding BPMN (Business Process Model and Notation) maps, hinder municipalities from fully utilizing the VA's capabilities and potential. The difficulty with BPMN maps, which are a central feature of the tool, has been identified as one of the major obstacles. Users mostly didn't have prior expertise in BPMN and struggled to effectively engage with the mapping features, leading to confusion and a lack of confidence in the tool's functionality. The first task to be achieved in the VA is to map the digital permit process and from there the VA analyses the actions to give the maturity assessment. Therefore, the mapping of the process has a big impact on the usability of the tool, and the limited knowledge in process mapping tools was identified as one of the biggest challenges for some of the users.

The usability evaluation suggests that while the tool performs its basic functions, it does not yet provide the level of intuitiveness and effectiveness that was targeted for. The score for the VA's effectiveness in guiding users through the process mapping exercise indicates that this core feature requires more attention, especially in training users on the use of the BPMN features.

Despite these challenges, participants acknowledged the value the tool could bring, particularly in terms of standardising process mapping and offering a framework for digital maturity assessment. To unlock the tool's full potential, it is essential to address the technical limitations and enhance the user experience, ensuring that the tool can effectively serve both expert and novice users. The recommendations outlined in this report aim to make the CHEK VA more user-friendly by providing clearer guidance, more contextually aware assistance, and improving the process mapping navigation. By focusing on resolving key issues along with introducing features that assist users with mapping expertise, the tool can be transformed into a more effective resource for municipalities.

With thoughtful and targeted enhancements, especially in terms of BPMN map manipulation and support for users with different levels of expertise, the tool has the potential to become a valuable asset for municipalities navigating the complex process of building permit optimisation.

6.3 Discussion of general results

The analysis of the digital maturity assessment across municipalities indicates distinct trends in the performance of each evaluation method. Ascoli Piceno and Prague demonstrated the highest consistency across all three methods, suggesting that their digital maturity is easier to assess systematically. In contrast, Vila Nova de Gaia and Lisbon showed greater variation, particularly in Process and Organisation, highlighting the complexity of their workflows.

The VA assessment done by the users independently exhibited a tendency to underestimate digital maturity, especially in Process and Organisation. This suggests that municipality users, without expert input, faced some difficulty to input their process in the VA with all the intricacies. However, Technology and Information assessments were more reliable, as these categories rely on more objective, structured factors, making them more suitable for AI-driven evaluation.

The usability test and self-assessment results showed that training for using the VA and the BPMN tools is essential. Municipalities should receive better training on using VA tools to improve self-assessment reliability. Especially in BPMN mapping, where understanding process flows is critical to accurate evaluation, given by the fact that the VA analyses the actions to gather the maturity of the process. Most of the difficulties on using the tools were more related to the level of knowledge in using a new process mapping tool, rather than the maturity or digital maturity assessment.

The VA Expert-Assisted Method, in contrast, provided more structured and consistent results but tended to slightly underestimate maturity in more complex cases, such as Vila Nova de Gaia. It performed best in Prague and Ascoli, where the process was less complex and the overall digital maturity was lower, indicating that the AI-assisted approach aligns well with structured environments. However, the AI model should be refined to better capture workflow complexities, particularly in large municipalities, where organisational and procedural intricacies require deeper contextual understanding. Meanwhile, the Traditional Expert-Led Method remained the most precise, particularly in Lisbon and Gaia, where experts were able to identify more challenges and workflow inefficiencies that were not fully captured by the VA-based methods.

Despite these differences, the assessment of the CHEK Maturity Model using AI-based methods showed notable potential. The VA tool proved more effectiveness in assessing Technology maturity, suggesting that AI-driven approaches can reliably evaluate quantifiable, structured elements like digital procedures. The findings suggest that the VA would benefit from a hybrid approach, where a combination of Traditional and VA Expert-Assisted methods provides the best balance between efficiency and accuracy. While the Traditional manual-led method ensures granular, context-aware evaluations, the VA Expert-Assisted approach offers scalability and consistency, making it a highly effective alternative for structured aspects of digital maturity assessments.

7 Conclusion

This deliverable presented a comprehensive overview of the testing and validation activities carried out within Work Package 1 (WP1) of the CHEK project, dedicated to assessing and enhancing the digital maturity of building permit processes in local municipalities. Through structured and rigorous testing, the effectiveness and applicability of various methodologies designed to evaluate digital maturity were thoroughly examined. Three distinct methodologies were employed across four municipalities — Ascoli Piceno (Italy), Lisbon and Vila Nova de Gaia (Portugal), and Prague (Czech Republic) — to capture a complete view of current capabilities and challenges related to the digital transformation of the building permit process.

The first methodology applied was the traditional expert-led assessment, presented on previous deliverable D1.4, which provided an essential baseline for understanding the municipalities' existing digital maturity. Experts conducted semi-structured interviews and manual evaluations, ensuring detailed, context-rich insights. This approach allowed for the identification of specific procedural complexities, organisational challenges, and digital adoption barriers unique to each municipality. The expert-led evaluations highlighted the depth of context and complexity that manual assessments could achieve, although these assessments inherently involve subjective interpretations by experts.

Following the traditional method, the second testing phase introduced the CHEK Virtual Assistant (VA), an innovative AI-driven tool designed to streamline and standardise the digital maturity assessment process. In this phase, domain experts assessed municipality maturity by using the CHEK VA, ensuring accurate data collection and facilitating the interpretation of nuanced details. The CHEK VA was able to provide standardised and objective assessments, particularly in easier to measure dimensions such as Technology and Information requirements, given that they have benchmarks that are easier to define, such as the presence of certain types of software or digital data. This expert-assisted method proved effective in aligning closely with the expert-led evaluations, indicating that the VA, giving some future calibration, could reliably replicate expert judgments in structured areas. The tool’s real-time feedback, interactive prompts, and automated maturity assessments demonstrated its significant potential to evaluate digital maturity efficiently.

The third testing phase further validated the CHEK VA through independent assessments conducted autonomously by municipality representatives. This phase provided crucial insights into the tool's usability, scalability, and reliability in real-world scenarios without direct expert support. Feedback from independent users highlighted the tool's potential for enabling consistent digital maturity assessments, with additional refinements and continuous enhancement of the tool to further improve its effectiveness. In contrast, the usability questionnaire identified critical challenges. Participants reported difficulties with functionalities such as process mapping, undoing actions, and comprehending prompts provided by the virtual assistant. These usability issues underscored the necessity for clearer instructions, enhanced interface design, and improved user guidance mechanisms within the CHEK VA and process mapping.

However, the testing phases underscores the tool’s potential to deliver consistent and objective maturity assessments, particularly when facilitated by domain experts who could contextualise inputs and interpret nuanced details accurately, recognizing its capability to streamline the maturity assessment process effectively.

Throughout these testing phases, the CHEK VA effectively demonstrated its capabilities to be a scalable digital maturity assessment tool. Its structured assessment approach delivered consistent, replicable results that aligned with expert evaluations, particularly in quantifiable categories. The automated roadmap and reporting functionalities further enhanced its utility, offering municipalities actionable insights and clear steps toward achieving targeted digital maturity levels. Additionally, the interactive IntelliCHEK chatbot facilitated data collection, guiding users through the assessment process in most cases.

Moving forward, ongoing refinements based on user feedback and usability analysis will strengthen the CHEK VA's capabilities, making it increasingly accessible and effective for municipalities. Enhanced user guidance, comprehensive training resources, and advanced support for complex BPMN process mapping can ensure municipalities fully leverage the CHEK VA's potential, further reducing reliance on external expert input. These improvements will ensure that municipalities can independently achieve accurate and efficient assessments of their digital maturity, supporting continuous improvement in building permit processes.

The forthcoming phases will continue to build upon these initial outcomes, further refining and validating the CHEK VA's capabilities. After the ending of the CHEK project, future developments on the VA can focus on ensuring that the tool can accommodate a variety of regulatory and organisational contexts, ultimately providing a flexible, accurate, and user-friendly solution for municipal digital transformation. Through continued iterative development, incorporating both user feedback and expert insights, the CHEK Virtual Assistant is poised to become an essential resource for municipalities striving towards optimised, transparent, and digitally advanced building permit processes.

In conclusion, the structured testing phases described in this document have successfully demonstrated the CHEK Virtual Assistant's potential as an innovative tool in supporting digital transformation within municipal building permit processes. The methodology employed, particularly the AI-assisted approach, proves to be highly effective in offering municipalities a clear, scalable, and reliable assessment method. This contributes significantly to advancing municipalities toward greater transparency, efficiency, and digital maturity.

8 References

Ataide, M., Braholli, O., Siegele, D., 2023. CHEK - Maturity model for digital building process. https://doi.org/10.5281/ZENODO.10277474

Braholli, O., Ataide, M., Di Blasio, I., Raj, K., Siegele, D., 2023. CHEK To-be Digital Building Permit process map. https://doi.org/10.5281/ZENODO.7789035

8.1 List of Figures

8.2 List of Tables

8.3 List of used abbreviations

AECO	Architecture, Engineering, Construction, and Operations
AI	Artificial Intelligence
BIM	Building Information Modelling
BP	Building Permit
BPMN	Business Process Model and Notation
CDBPMM	CHEK DBP Maturity Model
DBP	Digital Building Permit
DoA	Description of the Action
EC	European Commission
EU	European Union
GA	Grant Agreement
GIS	Geographic Information System
KMA	Key Maturity Area
KPI	Key Performance Indicator
LLM	Large Language Model
VA	CHEK Virtual Assistant
WP	Work Package

APPENDIX 01 – Organisation Questionnaire from CHEK Virtual Assistant

1. How open to changes are internal staff involved in the building permit process?

- Staff does not express openness to change or digitalization.
- Less than 25% of staff acknowledge the need for digital transformation, ad-hoc cooperation on digitalization.
- 25-50% of staff participate in cross-functional teams to identify digitalization needs and benefits, regular meetings on digital technology opportunities.
- 50-75% of staff exhibit a proactive mindset about adopting digital innovations, training incorporates adaptability and readiness for new technologies.
- Over 75% of staff are open to digitalization, some participate in networks to promote digital innovation, defined processes for cooperation on digital best practices.
- Staff constantly seeks new digital innovations to improve operations, knowledge sharing programs across stakeholders to spread digital best practices.

2. How does higher management approach organizational changes and digital transformation in the building permit process?

- Management does not express openness to changes or digital transformation.
- Management supports the vision but lacks a strategy for utilizing digital processes like BIM and GIS.
- Movement to kickstart digital processes (BIM, GIS) is bottom-up, with no clear management plans.
- Management recognizes digital innovation (BIM, GIS) as important and supports a top-down implementation approach.
- Digital innovations (BIM, GIS) are part of the IT strategy, with a promoted implementation plan at all organizational levels.
- Digital innovation planning is fully integrated into strategic planning, with visionary awareness supporting service development.

3. How capable is your infrastructure in supporting the digital permitting process?

- Hardware/software infrastructure is not capable of supporting required tools.
- Less than 20% of infrastructure supports required software, limited pilot software and test servers used by less than 20% of staff.
- 20-50% of infrastructure supports required software, 20-50% of staff have access to software licenses or installed software, internal network available for file sharing.
- Up to 80% of infrastructure supports required software, all core permitting software purchased or installed, redundant servers, cloud backup, common data environment for management of data and files.
- 100% of hardware can run required software and platforms, all hardware/software for digital permit system are fully implemented.

- There are programs for continuous infrastructure upgrades, regular server refreshes, software updates, new feature additions.

4. How flexible is the legislative system in creating clear and easily interpretable rules for the building permit process?

- Not open for changes.
- No flexibility for clear and easy-to-interpret rules, but efforts to simplify the process are ongoing.
- Few technical requirements are clearly formulated, with more than 50% subject to human interpretation.
- Municipal efforts to ensure technical requirements are clearly and directly formulated, reducing subjective interpretation.
- More than 50% of regulations under municipal scope have clear, easily interpretable texts, simplifying compliance checks.
- Regional or national efforts to minimize subjective interpretability of texts, facilitating rule interpretation and simplifying compliance checks.

5. What is the state of your strategy for implementing a data ecosystem in the building permit process?

- No implementation strategy.
- Implementation without a guiding strategy, limited awareness, understanding, and use of tools, processes not integrated, lack of standardized practices.
- Implementation strategy has some actionable details, general plan but processes not fully integrated, no formal standardized guidelines.
- Implementation strategy includes comprehensive action plans and monitoring, recognizes data ecosystem involves technology, process, and policy improvements.
- Vision shared by staff and external stakeholders, organization seeks maximum efficiency and effectiveness, integration of processes using multiple technologies (e.g., BIM-GIS).
- Culture of innovation and continuous improvement in data ecosystem practices, organization integrates recent innovative tools (e.g., AI, AR, data spaces).

6. How much of your staff is working on BIM, GIS, or other technologies in the building permit process?

- No staff is dedicated to BIM, GIS, or other technologies.
- Up to 20% of staff work part-time on BIM, GIS, or other technologies.
- Small team of 3-5 staff dedicated to implementing BIM, GIS, or other technologies within the organization and internal processes.
- Multiple teams working full-time with BIM, GIS, or other technologies, each team dedicated to a specific part of the process or data technology, high individual and collective knowledge on digital processes and tools.
- Department dedicated to digital data (BIM, GIS, etc.) with internal teams for distinct parts of processes or technologies, high individual and collective knowledge, and encouraged sharing.

- Team within the department dedicated to maintaining the quality of processes, data, standards, and guidelines.

7. How does your organization handle training, preparation, and support for staff working with BIM, GIS, or other technologies?

- No training or support.
- Lack of dedicated training or support, ad hoc external training, less than 8 hours of training per employee per year.
- Documented training requirements, annual training provided as needed, 8-16 hours of training per employee per year.
- Training managed to meet competency and performance objectives, regular training provided, 16-24 hours of training per employee per year.
- Training plans based on roles and competencies, program uses real work examples, internal support and collaboration with partners, 24-40 hours of training per employee per year.
- Training integrated into organizational strategies, on-demand training programs, more than 40 hours average training per employee per year.

8. What is the overall knowledge and practical experience (with BIM/GIS) of technicians involved on the steps of the building permit process?

- No technicians have knowledge or practical experience in data technology.
- Less than 25% have basic conceptual knowledge, minimal skills and practical experience.
- 25-50% have basic knowledge, with low practical skills on the tools.
- 50-75% of staff regularly use data tools and spatial analysis, tend to pursue formal certifications to expand capabilities.
- Over 75% have good working knowledge and practical skills, 20% are experts in BIM, GIS, or other technology.
- 50% of technicians are experts, possess extensive knowledge and experience, serve as mentors or trainers, and share knowledge to build a strong digital ecosystem competency.

9. How is the knowledge of the stakeholders in using data technologies (BIM, GIS, or other) within their **participation on building permit process?**

- None of the stakeholders work with data technologies.
- Up to 50% of key stakeholders use basic digital data, no data re-use throughout the process.
- 50-80% of key stakeholders use digital data such as BIM or GIS, primarily isolated use, minimal interoperability, collaboration, and little communication or data re-use.
- More than 80% of key stakeholders use shared data in a digital ecosystem, model data accessible to multiple stakeholders.

- 100% of key stakeholders use an integrated digital ecosystem, all parties have access to the same source of information through digital data (e.g., BIM-GIS) in their specific domain.
- Data fully integrated across all stakeholders and steps, real-time data sharing and collaboration, consistent data throughout the digital ecosystem, metrics on data re-use and value creation.

10. How does your organization handle data standards and guidelines in the building permit process?

- No guidelines or data requirements specification.
- Human-readable data requirements as basic guidelines, documentation protocols, or data standards.
- Standard-based data requirements with basic guidelines for data standardization, such as training manuals and delivery standards.
- Standard-based and machine-readable data requirements, organizational standards aligned with industry standards.
- Detailed and comprehensive standard-based and formal data requirements covering geometrical, semantical, structural, syntactical, organizational, and legal aspects, enabling easy interoperability and usability.
- Organizational modifications to Model View Definitions and Information Delivery Manuals are balloted for inclusion in industry standards, data standards and guidelines fully integrated into organizational policies.

11. How are regulations regarding in the building permit process formatted?

- Natural language, needing interpretation and referring to several external laws and definitions.
- Unambiguous natural language, containing needed definitions and related rules, including exceptions, clear governance level priorities, no reference to customs.
- Regulations defined as (semi)formalized language or pseudocode.
- Regulations are machine-readable.
- Regulations are machine-readable and refer to standardized information, fully parameterized rules integrated across platforms.
- Database used as a repository of rules, allowing creation of new rules according to regulatory updates.

12. How is the access to regulations needed for the building permit process?

- Normative texts can be consulted only in paper and/or PDF format, same for internal and external stakeholders.
- Normative texts can be consulted online according to queries and through a webGIS system associating regulations to zoning areas.
- Normative texts can be consulted online according to specific queries in a geographic system, limited integration, and dependencies managed manually.
- Validation rule sets formalized with version control, central repository with some real-time updating, web-based portals for external access, data can be imported into checking software directly or via APIs.

- Tool allows automated analysis of data contents and compliance checks according to defined rules, automated synchronization and versioning from centralized repository.
- Codes available in a machine-readable format, tools support translation of non-translated rules or modification of parameters in existing rules.

ANNEX I

ASCOLI PICENO

ASCOLI PICENO

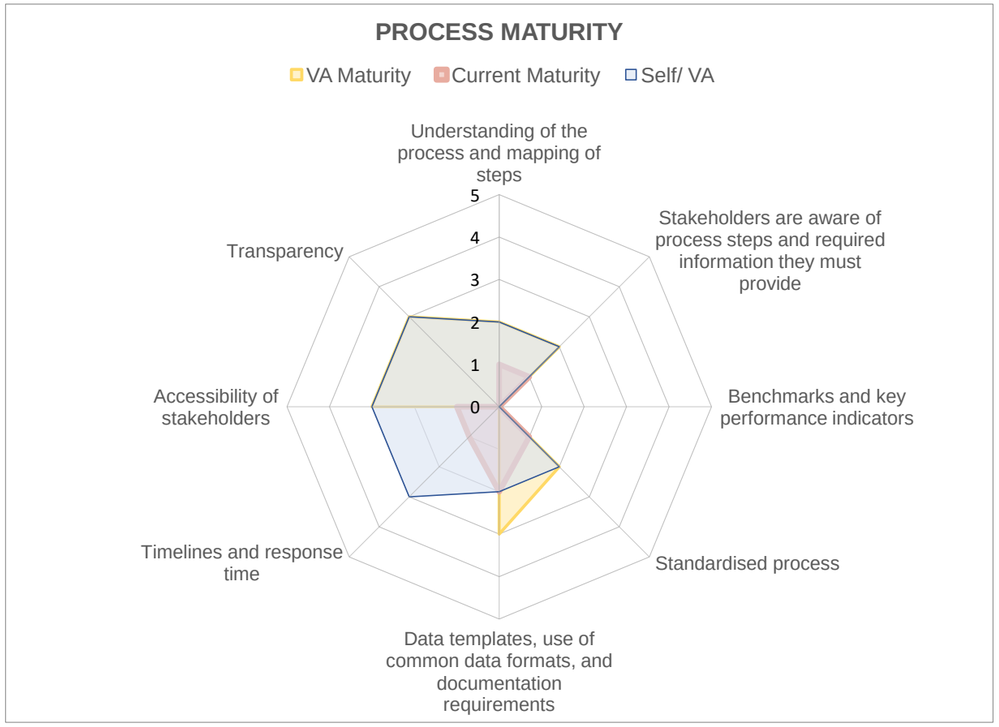
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY
Process and Methods	1.1.1	Understanding of the process and mapping of steps	There is no clear understanding and the process is not formally mapped.	The process is mapped at a general level and publicly available.	The process steps are identified and documented, providing a clear understanding of the process. The digitalized process is defined and it is on initial steps.	The process is mapped in detail and is integrated into a digital environment for the management of all technical-administrative processes. However, not all steps are fully implemented.	The whole process is mapped and coordinated in central digital environment. All steps are implemented and technical-administrative process can be monitored with the aim of constantly simplifying it.	The whole process is mapped and coordinated in a central digital environment. There is automation throughout the steps in order to increase efficiency, constant monitoring for feedback and lessons learned.	1	2	2	4
Process and Methods	1.1.2	Stakeholders are aware of process steps and required information they must provide	There is no clear understanding and the process is not formally mapped.	Stakeholders have limited understanding of the process steps. Lack of awareness regarding the required information and documentation needed to complete the process. Minimal guidance provided about their roles and responsibilities in the process.	Stakeholders have clear understanding of the process steps. There are guidelines and standards to assist about their roles and responsibilities in the process.	Comprehensive process documentation and checklists enable stakeholders to self-serve. Online resources help stakeholders prepare required information. The digital solution reduces ambiguity.	Stakeholders are fully aware of the steps, the required information and documentation needed to complete the process. Data can be visualised and shared digitally; however, they work in their own digital environment.	Stakeholders are fully aware of their roles the process. There is simultaneous communication and support allowing all different stakeholders to follow the process progression and access the same source of data.	1	2	2	4
Regulatory	1.2.3	Benchmarks and key performance indicators	There is informal or no quality control plans; neither for process, data, or documentation. There are no performance benchmarks for processes or services.	Process, data, and documentation standards are initially defined. Quality targets and performance benchmarks are set; however, there is no official measuring.	Process, data, and documentation standards are defined and established for quality plans. KPIs and benchmarks are clear defined, but not officially measured.	Proactive quality monitoring is conducted through spot checks and structured reviews. Some KPIs are measure, but not all implemented. Metrics provide visibility into performance vs targets.	Performance against benchmarks and KPIs are measured and monitored. KPIs and performance benchmarks are incorporated into quality management and performance improvement systems.	Quality improvement and adherence to regulations and codes are continuously aligned and refined. Benchmarks and KPIs are repetitively revisited to insure highest possible quality in processes and services.	0	0	0	4
Regulatory	1.2.4	Standardised process	There are no guidelines or standards for the processes.	The process is mapped primarily from an administrative perspective. The technical checks within the process are performed by individual knowledge of technicians based on the normative documents. There are informal internal guidelines to help technicians on the steps of process to follow.	In addition to the process map and the normative documents, technicians receive support from a detailed guideline that outlines the specific checks to be performed for each step of the process, with comprehensive instructions and specifying the aspects that need to be examined during each stage.	The supporting guideline for technicians provides a comprehensive list of urban planning and construction aspects that need to be checked for each phase of the building permit process. The guideline serves as a reference tool, ensuring that technicians have clear instructions on the specific aspects they need to assess.	The guideline is continuously refined to reflect lessons learned. Quality improvement and adherence to regulations and codes are continuously aligned and refined. The guideline to support the technicians is updated and monitored based on the KPIs and benchmark measures to simplify the process.	There is a detailed standardised procedure, defined at municipality level for all stakeholders involved in the process whose use is constantly monitored and content updated.	1	2	2	4
Regulatory	1.2.5	Data templates, use of common data formats, and documentation requirements	There are no data templates, use of common data formats, or documentation requirements.	Limited standardisation of data formats, templates, or documentation requirements. Inconsistency in data formats and documentation across different permit processes or projects.	Some steps of the process have standardised data formats, templates and documentation. However, the effort to create single standardised data is ongoing.	There are standardised data formats and templates internally. They are not followed by external stakeholders and there is only an informal quality control verification.	There are standardised data formats and templates. They are easily accessible by all stakeholders and there is a control to maintain the standardisation across the process. Best practices are identified and shared across all the stakeholders.	There are standardised data formats and templates following open data standards. Continuous improvement are implemented to enhance the use of the open formats. Automatised control is done during the process.	2	3	2	5
Procedure	1.3.6	Timelines and response time	There is no clear knowledge of timelines and response time is not pre-defined.	There is an informal understanding of the timelines, but they are not clearly communicated and mostly not followed.	There are defined timelines for each step of the process, they are internally shared, but not clear communicated to all stakeholders.	The timelines are clear defined and communicated. They are followed in more than 80% of the processes; however, there are no official measurement or no efforts to optimise the timelines.	Timelines and response time are clear defined and communicated. They can be monitored by all stakeholders. Measurements are done to allow optimisation of timelines.	Timelines are monitored and measured in all steps of the process. They are continuously open by all stakeholders, they are constantly reviewed and improved based on performance metrics and feedback.	1	0	3	3
Procedure	1.3.7	Accessibility of stakeholders	The information may be accessible through physical documents.	Limited accessibility to the stakeholders involved in the process. The information has a different source and changes workflow for each stakeholder.	Stakeholders can have access to the same source of information and the defined workflows are standardised. However, changes made in the data have to be reloaded by other participants in the process.	Automated workflows push permit status alerts and relevant information to some stakeholders (e.g. applicants).	There is a unique source of data where all stakeholders can retrieve their data. All exchanges happens inside the same digital ecosystem, the data is shared and updated to all stakeholders.	A digital ecosystem enables access to information, include real-time data updates, interactive interfaces, personalised notifications, and collaborative features, allowing stakeholders to actively engage and retrieve the necessary information efficiently from the same source of data.	1	3	3	4
Procedure	1.3.8	Transparency	There is no transparency on the information workflow. Different stakeholders are not able to access or visualise any information not owned by them, other than the final outcome.	There is limited access to information, and stakeholders have difficulty tracking and understanding the flow of information. The documentation and communication processes may be fragmented and limited accessible to stakeholders.	Stakeholders have access to the information that influences their workflow. Information on the process are not clearly communicated or documented. Applicants can check status online throughout process. Basic process metrics reported occasionally.	Real-time permit tracking with notifications to stakeholders(e.g. applicants) and internal staff. Performance trends regularly monitored. Improved transparency.	The information is visible to all stakeholders, with the defined permissions. There is a clear workflow for documentation and communication that can be followed by all stakeholders. External transparency might be through APIs.	Automated workflow tracking and advanced data analytics provide visibility. The information workflow is transparent and collaborative. Reporting tools are utilised to gather insights and monitor the performances while continuous improvement initiatives are implemented to enhance the transparency of the process.	0	3	3	4

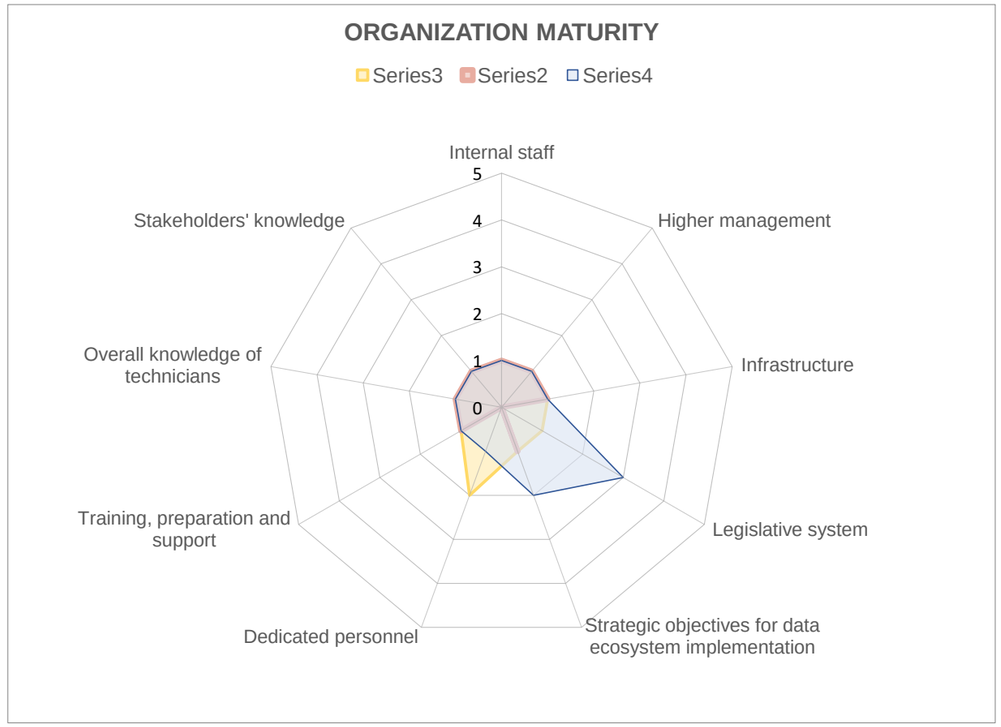
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY
Readiness for changes	2.4.9	Internal staff	Staff does not express openness to change or digitalisation.	Less than 25% of staff acknowledge the need for digital transformation. There is ad-hoc cooperation between limited individuals on digitalisation.	25-50% of staff participate in cross-functional team to identify digitalisation needs and benefits. Regular meetings are held to discuss digital technology opportunities.	50-75% of staff exhibit proactive mindset about adopting digital innovations. Training incorporates adaptability and readiness for new technologies.	Over 75% of staff are open to digitalisation, some participate in networks to promote digital innovation. Defined processes in place for cooperation on digital best practices.	Staff members are constantly seeking new digital innovations to improve operations. There are knowledge sharing programs across stakeholders to spread digital best practices.	1	1	1	2
Readiness for changes	2.4.10	Higher management	Management does not express openness to organisational changes or digital transformation.	The management supports the vision; however, a strategy is needed to direct the utilisation of digital process including technologies such as BIM and GIS.	There is a movement to kickstart the implementation of digital processes, including BIM, GIS, or other technology. However, the initiative starts from the bottom-up. Management does not have clear plans supporting the implementation.	The management recognises digital innovation and processes advancements including BIM, GIS, or other technology as important strategic plan for the organisation. The efforts for implementation start from a top-down approach.	Digital innovations such as BIM, GIS, and/or other technologies are a part of the IT strategy. An implementation plan of the strategic goals has been promoted at all levels in the organisation.	Digital innovation planning is fully integrated into organisational strategic planning decisions. Visionary awareness of the possibilities of the utilisation of digital technology supports the development of services provided.	1	1	1	3
Readiness for changes	2.4.11	Infrastructure	Hardware/software infrastructure is not capable of supporting required tools for the digital permitting process.	Less than 20% of infrastructure can support required software. There are limited pilot permitting software and test servers, used by less than 20% members of the staff.	20-50% of infrastructure capable of supporting required software. 20-50% of staff have access to software licenses or have it installed. There is an internal network available for file sharing.	Up to 80% of infrastructure is capable of supporting required software. All core permitting software purchased or installed. Redundant permitting servers, cloud backup, common data environment for management of data and files.	100% of hardware can run required software and platforms. All hardware/software for digital permit system fully implemented. Permits database cluster, software integration, online network enables sharing within and outside organisation.	Continuous lifecycle upgrades of hardware/software. Established program for continuous infrastructure upgrades. Regular server refreshes, software updates, new feature additions.	1	1	1	3
Readiness for changes	2.4.12	Legislative system	Not open for changes.	There is no flexibility for creating clear and easy to interpreted rules from the existing regulation. However, there might be current ongoing efforts to simplify the process.	There are a few technical requirements within rule texts that are clearly formulated. However, more than 50% of requirements are subject to human interpretation.	There is an effort at municipal level to ensure that the technical requirements in the normative texts are formulated in a clear and direct way, reducing subjective interpretation.	More than 50% of the regulation under the scope of the municipality have clear and easily interpretable normative text. Facilitating rule interpretation and simplifying the compliance checks.	There is an effort at regional or national level to minimise the subjective interpretability of the texts, facilitating the rule interpretation and simplifying the compliance checks.	0	1	3	2
Organisational structure of units	2.5.13	Strategic objectives for data ecosystem implementation	There is no implementation strategy.	Implementation is conducted without a guiding strategy. There is a lack of awareness and understanding and limited use of tools. Processes are limited integrated into the workflow, and there is a lack of standardised practices.	The implementation strategy has some specific actionable details. There is a general plan of implementation, but processes are not fully integrated and there are no formal standardised guidelines for the implementation.	The implementation strategy is accompanied by comprehensive action plans and a monitoring regime. The organisation recognises that data ecosystem encompasses technological advancements, process improvements, and policy changes.	The vision is shared by staff across the organisation and external stakeholders. The organisations seeks maximum efficiency and effectiveness in data ecosystem implementation. There is integration on process using multiple technologies, e.g. BIM-GIS.	There is a culture of innovation and continuous improvement in data ecosystem practices. The organization seeks for integrating recent innovative tools in their processes (e.g. AI, AR, data spaces).	1	1	2	4
Organisational structure of units	2.5.14	Dedicated personnel	There is no staff fully dedicated to work on BIM, GIS, or other technologies.	Up to 20% staff work part-time on BIM, GIS, or other technologies.	Small team of 3-5 staff dedicated to implementing BIM, GIS, or other technologies within the organisation and internal processes.	Multiple teams working full-time with BIM, GIS, or other technologies. Each team is dedicated to a specific part of the process or data technology. There are high individual and collective knowledge on digital processes and tools.	There is a department dedicated to digital data, such as BIM, GIS or others. With internal teams dedicated to distinct parts of the processes or technologies. There is high individual and collective knowledge, and sharing is stimulated.	There is a team inside the department working with digital process dedicated to maintaining the quality of process, data, standards, and guidelines.	0	2	1	2
Organisational structure of units	2.5.15	Training, preparation and support	There is no type of training or support.	There is a lack of dedicated training or support for technicians to resolve BIM, GIS, or other technologies related issues. There is ad hoc external training as needed. However, less than 8 hours of training per employee per year is stipulated.	There are documented training requirements for digital and data technologies related roles. Annual training is provided to staff members that work directly with BIM, GIS, or other technologies, when needed. 8-16 hours of training per employee per year is stipulated.	Training requirements are managed to meet competency and performance objectives. Regular training is provided to staff members that work directly with BIM, GIS, or other technologies. 16-24 hours of training per employee per year is stipulated.	Training plans based on roles and competencies; training program uses real work examples and lessons learned. There is support inside the organization and fostering collaboration with internal and external partners. 24-40 hours of training per employee per year.	Training is integrated into organizational strategies. On-demand training program are established to cater to the organization's needs and requirements, allowing personnel to access training resources when necessary. More than 40 hours average training per employee per year.	1	1	1	3
Social aspect	2.6.16	Overall knowledge of technicians	No technicians have knowledge or practical experience in data technology (BIM, GIS, or other).	Less than 25% have basic conceptual knowledge, minimal skills. They may have a basic understanding of concepts but lack practical skills and experience in using it.	25-50% have basic knowledge, while less than 20% have practical skills on the tools.	50-75% of staff members regularly use data tools and spatial analysis to enrich permit workflows. There is a tendence to pursue formal certifications to expand capabilities.	Over 75% have good working knowledge and skills on required data technologies with good practical skills. 20% of individuals are experts in BIM, GIS, or other technology.	50% of the technicians are experts in BIM, GIS, or other technology. They possess extensive knowledge and experience and serve as mentors or trainers for other technicians. They are constantly sharing their knowledge and expertise to build a strong digital ecosystem competency for the organisation.	1	1	1	3
Social aspect	2.6.17	Stakeholders' knowledge	None of the stakeholders work with data technologies (BIM, GIS, or other).	Up to 50% of key stakeholders use basic digital data. However, there is no data re-use throughout the process between stakeholders.	50-80% of key stakeholders use digital data such as BIM or GIS. Primarily isolated use, minimal interoperability, collaboration, and little communication or data re-use.	More than 80% of key stakeholders use shared data in a digital ecosystem. Model data is accessible to multiple stakeholders.	100% of key stakeholders use integrated digital ecosystem. All involved parties have access to the same source of information through digital data (e.g. BIM-GIS) in their specific domain.	Data fully integrated across all stakeholders and steps in process with real-time data sharing and collaboration. Data is consistent throughout the multiple stakeholders' digital ecosystem. There are metrics on data re-use and value creation.	1	1	1	2

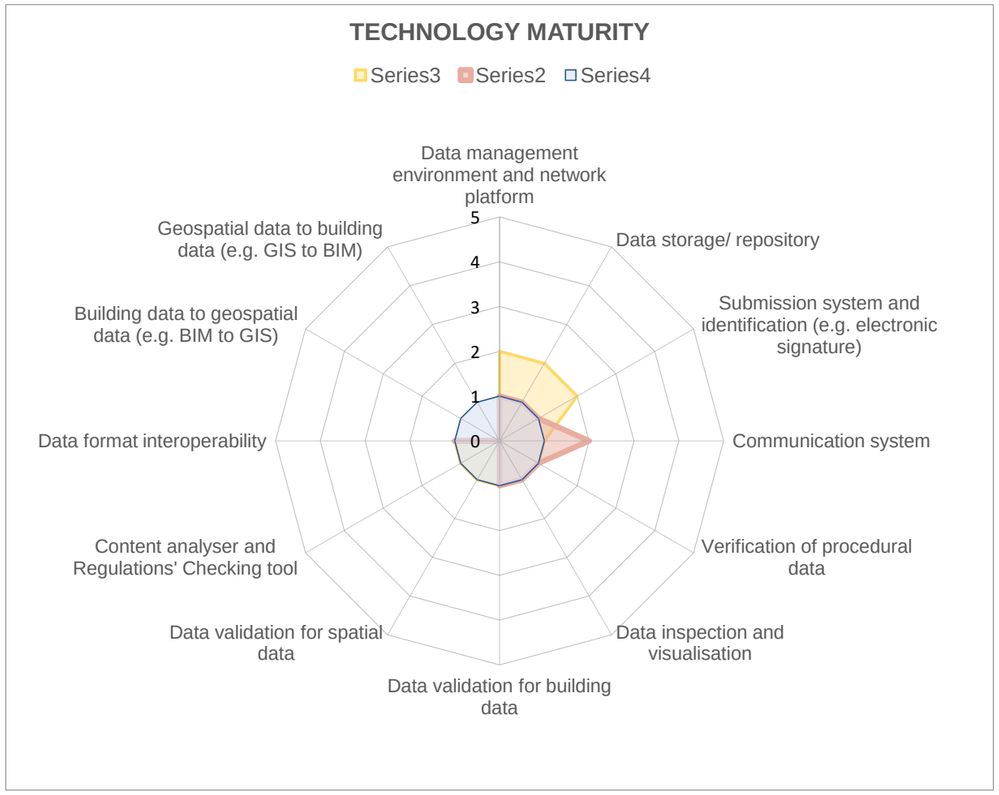
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY
Technology for data management	3.7.18	Data management environment and network platform	No platform support.	Digital platform only for submission, communications and data exchanges between applicant and building authority. There is no digital process for data management.	Closed or proprietary tools supporting the different steps. There is a digital tool for managing data; however, not 100% of the information is digitally accessible through it. There are different sources of data depending on the step of the process.	Modular platform. The digital tool stores and manages the data through the whole process. Staff members of the organisation have access to the same data, but external stakeholders' data is not integrated.	Open API-based microservices ecosystem. The tool for data management, works for sharing, storing and managing the data. All internal staff of the organisation can collaborate, while external stakeholders can interact with the data according to defined permissions.	Distributed data space based ecosystem. There is simultaneous working collaboration within all stakeholders of the process and automated workflows.	1	2	1	4
Technology for data management	3.7.19	Data storage/ repository	The process is analogue. Information is stored in paper files and documents.	There is a repository for files of archived processes. There are digital document storage but no centralised repository. Multiple disparate drives and shares.	There is a centralised repository for files that stores ongoing and archived processes that serves as a database and can be accessible by internal staff.	Formal data governance for repository. Lifecycle management with archiving and retention policies.	Centralised digital repository integrates all data throughout the process with backups, archiving, and governance. Integrated with data ecosystems and accessible by all stakeholders according to assigned permissions. Automated backups, archiving and governance.	There is possibility of automatising tasks and workflows in the platform within the data ecosystem increasing the effectiveness of the process. Harmonised access and structures within data space between various data hubs.	1	2	1	4
Technology for data management	3.7.20	Submission system and identification (e.g. electronic signature)	There is not a submission platform. Signature is done manually.	Documents are submitted digitally using non machine-readable formats. The signature is not machine recognisable.	Required information is submitted in a digital ecosystem, using machine-readable data. Models are electronic signed; however, other required information is not automatically verified.	Signature application is available combining all the required information but no automatic validation is performed. Internal systems are integrated with the applicant's portal, directly or via API.	Integrated validation of submission packages (required files and data). There is an application integrated in the process ecosystem that allows digitally sign correspondent submitted content.	Documents and models are digitally signed, integrated within submission process and with the ID authorities. There is automated checking of the identification validation embedded in the process.	1	2	1	3
Technology for data management	3.7.21	Communication system	The communication is done in an analogue way.	The communication is done digitally. However, there is a lack of clear channels and procedures for timely and effective communication between stakeholders.	There is a tool that allows communication internally on the organisation. However, external communication is done in a separate digital environment.	An online portal is introduced for external stakeholders to track permit status, submit documents, communicate with staff. Internal systems are integrated with the applicant's portal, directly or via API.	There is an official tool that allows communication between different stakeholders, both internally and externally to the organisation. Standard API enables communication with other external databases.	There is an official integrated tool that allows live communication between different stakeholders, both internally and externally to the organisation. Automation and digital tools are utilised to streamline communication and enhance responsiveness.	2	1	1	3
Technology for data analysis	3.8.22	Verification of procedural data	Manual inspection of physical formats and documents. Analog process.	Data can be obtained in a digital format to be verified. Electronic infrastructure available but usage of software is unmonitored and irregulated.	Digitisation of data with semi-digital verification process. Software usage is unified within organisation.	Procedural data is provided in machine readable formats. Basic analytical functionalities for data verification.	Advanced analytical functionalities for data verification. Possibility of operational and decision-making actions. Standard API enables automatic connection with databases representing different systems' information (e.g. IDs, professionals registrations and certifications, etc.).	Fully digitalised and automated verification process. Information submitted can be automatically verified against the connected databases. Procedural data is integrated in the cloud and supported by high-performance computing for decision making.	1	1	1	3
Technology for data analysis	3.8.23	Data inspection and visualisation	Manual inspection of physical models or drawings of planned objects. No use of software applications.	2D map data can be obtained to produce 2D deliverables. Proprietary Software is used to produce 2D renderings of planned objects. Usage of software is unmonitored and irregulated.	3D city models can be obtained to produce 3D deliverables. Proprietary Software is used to produce and visualize 3D models of planned objects in specified proprietary formats. Software usage is unified within an organisation or team.	Deliverables are provided in open file formats. Web-based viewers enable dynamic and seamless visualisation in 2D and 3D space by all stakeholders as well as basic analysis functionalities.	Advanced analysis functionalities for operational decision-making are introduced. Open interfaces allow for exchange of data between specialised software applications and multidisciplinary applications in a system-of-systems infrastructure.	Powerful numerical simulation through cloud and high-performance computing model the expected impacts of potential change to make evidence-based strategical decisions. Integration with immersive visualisation technologies, such as AR/VR, to support decision making for non-quantifiable phenomena (e.g. perception of safety due to urban density/lighting)	1	1	1	4
Technology for data analysis	3.8.24	Data validation for building data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data.	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	1	1	1	4

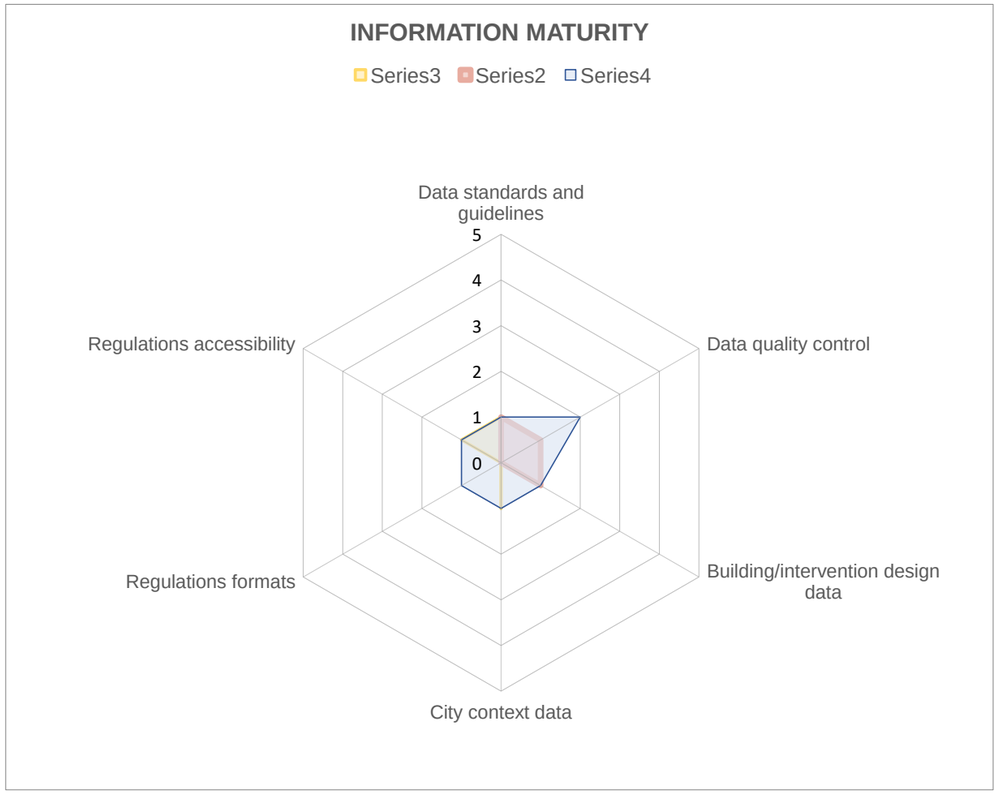
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY
Technology for data analysis	3.8.25	Data validation for spatial data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data (including consistency and clash-detection).	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	0	1	1	4
Technology for data analysis	3.8.26	Content analyser and Regulations' Checking tool	Manual inspection of rules and regulations.	Manual checking, the content analysis and checking of rules is done in a digital environment; supported by data viewers or inspectors.	Semi-automatic checking of rules and regulations, based on digital building data.	Automatic checking based on digital data. Automated rule-checking is done based on project for a limited number or rules.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including mostly simple analysis.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including all possible regulations and complex analysis.	0	1	1	4
Interoperability and open format	3.9.27	Data format interoperability	No use of digital formats	Use of mainly proprietary formats, reduced capacity to manage and create open format files. Limited support for exchanging data with external systems using standard formats.	Possible use of open formats; however, proprietary formats are still the main practice.	Use of open formats in internal processes is mandatory; however, there are still interoperability related issues when exchanging with external stakeholders.	Support of only open format files, following the standards and best practices for data exchange. Full capability of data exchange within the process and among the different stakeholders.	There are APIs to facilitate interoperability by establishing a common language and protocol for different systems to communicate and exchange data internally and externally.	1	1	1	5
Interoperability and open format	3.9.28	Building data to geospatial data (e.g. BIM to GIS)	No use of building or geospatial data.	Joint visualisation in a geospatial environment, with manual location of building data into geospatial data.	Joint visualisation in a geospatial environment, with correct building data georeferencing.	Conversion of building to geospatial data through semantic mapping and building data georeferencing.	Thorough automatic mapping, generalisation and conversion of building to geospatial data (georeferencing, geometry, semantics, structure).	Automatic communication and real time / on-the-flight thorough mapping, generalisation and conversion of the two models in the respective environments.	0	0	1	4
Interoperability and open format	3.9.29	Geospatial data to building data (e.g. GIS to BIM)	No use of building or geospatial data.	Joint visualisation in a building data environment, with manual location of geospatial data respect building data.	Joint visualisation of geospatial data in a building data environment, with automatic reciprocal registration.	Conversion of geospatial to building data through semantic mapping and automatic reciprocal registration.	Thorough conversion of geospatial to building data (georeferencing, geometry, semantics, structure) via manual enrichment, possibly supported by partially automated routines.	Automatic thorough mapping, enrichment and conversion using Artificial intelligence and Machine Learning methods, implying possible connection to further data sources to achieve reliable resulting building data.	0	0	1	4

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY
Data standardisation and quality	4.10.30	Data standards and guidelines	There are no guidelines or data requirements specification.	Human readable data requirements specification as basic guidelines, documentation protocols or data standards.	Standard-based data requirements. There are basic guidelines for data standardisation, such as training manual and delivery standards.	Standard-based and Machine-readable data requirements. The organisational standards are aligned with industry standards.	Detailed and comprehensive standard-based and formal data requirements covering geometrical, semantical, structural, syntactical, organisational, and legal aspects enabling easy interoperability and usability.	Organisational modification to Model View Definitions and Information Delivery Manuals are balloted for inclusion in industry standards. Data standards and guidelines are fully integrated into the organisation's policies.	1	1	1	4
Data standardisation and quality	4.10.31	Data quality control	There are no quality control of data.	There are informal quality control plans.	Quality targets and performance benchmarks have been set to maintain high standards.	Proactive processes for monitoring guidelines through audits and spot checks. Metrics track quality trends.	There are comprehensive quality plans to ensure accuracy and consistency. Guidelines are tightly integrated with data validation workflows. Automated reporting on adherence and anomalies.	Quality improvement and adherence to data standards are consistently prioritised and refined. Automated feedback loop from lessons learned.	1	0	2	4
Data and information	4.11.32	Building/intervention design data	The data is analogue. Use only of 2D drawings.	2D drawings, with basic semantic data information.	Building model with geometric data and semantic data. (e.g. BIM)	Building model with standardised data.	Building data is compliant to open standard formats (e.g. IFC) and to specific standard-based data requirements (e.g. MVD, IDS etc.) including metadata.	Integrated dynamic building model. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	1	0	1	4
Data and information	4.11.33	City context data	The data are analogue. Use of only 2D maps	There is a city model; however not all model is populated with the correspondent semantic data. Use of geospatial data, e.g. GIS.	3D city model is more than 80% loaded with semantic data; however the data is not standardised.	3D semantic city model with standardised data.	Open-standard based 3D city model. Specific data requirement compliant. City model with relevant information loaded with metadata however, not linked to other data systems (e.g. BIM).	Integrated dynamic 3D city model, digital twin. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	0	1	1	4
Codes and regulation	4.12.34	Regulations formats	Natural language, needing interpretation and referring to several external laws and definitions.	Unambiguous natural language, containing the needed definitions and related rules, including exceptions. No reference to customs, priorities of different governance levels (municipal, regional, national) are clear.	Regulations are also defined as (semi)formalised language or pseudocode	Regulations are machine-readable	Regulations are machine-readable and refer to standardised information. Fully parameterised rules integrated across platforms.	There is a database used as repository of rules, allowing the creation of new rules according to the updates in the regulation.	0	0	1	2
Codes and regulation	4.12.35	Regulations accessibility	Normative texts can be consulted only in paper and/or pdf format, in the same way by both internal and external stakeholders.	The normative texts can be consulted online according to queries and through a webGIS system associating the regulations to zoning areas	The normative texts can be consulted online according to specific queries in a geographic system. Limited integration and dependencies are managed manually.	Validation rule sets formalised with version control. Central repository established with some real-time updating. Web-based portals for external access, data can be imported into checking software, directly or via APIs.	There is a tool allowing the automatised analysis of data contents and check compliances according to the defined rules. Automated synchronisation and versioning from centralised repository.	The codes are available in a machine-readable format and there are available tools to support the translation of non-translated rules, or to modify parameters in the existing available rules.	0	1	1	2


PROCESS MATURITY
VA Maturity
Current Maturity
Self/ VA
Understanding of the process and mapping of steps
Stakeholders are aware of process steps and required information they must provide
Benchmarks and key performance indicators
Standardised process
Data templates, use of common data formats, and documentation requirements
Timelines and response time
Accessibility of stakeholders
Transparency
0
1
2
3
4
5


ORGANIZATION MATURITY
Series3
Series2
Series4
Internal staff
Higher management
Infrastructure
Legislative system
Strategic objectives for data ecosystem implementation
Dedicated personnel
Training, preparation and support
Overall knowledge of technicians
Stakeholders' knowledge
0
1
2
3
4
5


TECHNOLOGY MATURITY
Series3
Series2
Series4
Data management environment and network platform
Data storage/ repository
Submission system and identification (e.g. electronic signature)
Communication system
Verification of procedural data
Data inspection and visualisation
Data validation for building data
Data validation for spatial data
Content analyser and Regulations' Checking tool
Data format interoperability
Building data to geospatial data (e.g. BIM to GIS)
Geospatial data to building data (e.g. GIS to BIM)
0
1
2
3
4
5


INFORMATION MATURITY
Series3
Series2
Series4
Data standards and guidelines
Data quality control
Building/intervention design data
City context data
Regulations formats
Regulations accessibility
0
1
2
3
4
5

LISBON

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Process and Methods	1.1.1	Understanding of the process and mapping of steps	There is no clear understanding and the process is not formally mapped.	The process is mapped at a general level and publicly available.	The process steps are identified and documented, providing a clear understanding of the process. The digitalized process is defined and it is on initial steps.	The process is mapped in detail and is integrated into a digital environment for the management of all technical-administrative processes. However, not all steps are fully implemented.	The whole process is mapped and coordinated in central digital environment. All steps are implemented and technical-administrative process can be monitored with the aim of constantly simplifying it.	The whole process is mapped and coordinated in a central digital environment. There is automation throughout the steps in order to increase efficiency, constant monitoring for feedback and lessons learned.	0	3	0	4
Process and Methods	1.1.2	Stakeholders are aware of process steps and required information they must provide	There is no clear understanding and the process is not formally mapped.	Stakeholders have limited understanding of the process steps. Lack of awareness regarding the required information and documentation needed to complete the process. Minimal guidance provided about their roles and responsibilities in the process.	Stakeholders have clear understanding of the process steps. There are guidelines and standards to assist about their roles and responsibilities in the process.	Comprehensive process documentation and checklists enable stakeholders to self-serve. Online resources help stakeholders prepare required information. The digital solution reduces ambiguity.	Stakeholders are fully aware of the steps, the required information and documentation needed to complete the process. Data can be visualised and shared digitally; however, they work in their own digital environment.	Stakeholders are fully aware of their roles the process. There is simultaneous communication and support allowing all different stakeholders to follow the process progression and access the same source of data.	1	3	0	4
Regulatory	1.2.3	Benchmarks and key performance indicators	There is informal or no quality control plans; neither for process, data, or documentation. There are no performance benchmarks for processes or services.	Process, data, and documentation standards are initially defined. Quality targets and performance benchmarks are set; however, there is no official measuring.	Process, data, and documentation standards are defined and established for quality plans. KPIs and benchmarks are clear defined, but not officially measured.	Proactive quality monitoring is conducted through spot checks and structured reviews. Some KPIs are measure, but not all implemented. Metrics provide visibility into performance vs targets.	Performance against benchmarks and KPIs are measured and monitored. KPIs and performance benchmarks are incorporated into quality management and performance improvement systems.	Quality improvement and adherence to regulations and codes are continuously aligned and refined. Benchmarks and KPIs are repetitively revisited to insure highest possible quality in processes and services.	2	0	0	4
Regulatory	1.2.4	Standardised process	There are no guidelines or standards for the processes.	The process is mapped primarily from an administrative perspective. The technical checks within the process are performed by individual knowledge of technicians based on the normative documents. There are informal internal guidelines to help technicians on the steps of process to follow.	In addition to the process map and the normative documents, technicians receive support from a detailed guideline that outlines the specific checks to be performed for each step of the process, with comprehensive instructions and specifying the aspects that need to be examined during each stage.	The supporting guideline for technicians provides a comprehensive list of urban planning and construction aspects that need to be checked for each phase of the building permit process. The guideline serves as a reference tool, ensuring that technicians have clear instructions on the specific aspects they need to assess.	The guideline is continuously refined to reflect lessons learned. Quality improvement and adherence to regulations and codes are continuously aligned and refined. The guideline to support the technicians is updated and monitored based on the KPIs and benchmark measures to simplify the process.	There is a detailed standardised procedure, defined at municipality level for all stakeholders involved in the process whose use is constantly monitored and content updated.	2	3	0	4
Regulatory	1.2.5	Data templates, use of common data formats, and documentation requirements	There are no data templates, use of common data formats, or documentation requirements.	Limited standardisation of data formats, templates, or documentation requirements. Inconsistency in data formats and documentation across different permit processes or projects.	Some steps of the process have standardised data formats, templates and documentation. However, the effort to create single standardised data is ongoing.	There are standardised data formats and templates internally. They are not followed by external stakeholders and there is only an informal quality control verification.	There are standardised data formats and templates. They are easily accessible by all stakeholders and there is a control to maintain the standardisation across the process. Best practices are identified and shared across all the stakeholders.	There are standardised data formats and templates following open data standards. Continuous improvement are implemented to enhance the use of the open formats. Automatised control is done during the process.	1	2	0	5
Procedure	1.3.6	Timelines and response time	There is no clear knowledge of timelines and response time is not pre-defined.	There is an informal understanding of the timelines, but they are not clearly communicated and mostly not followed.	There are defined timelines for each step of the process, they are internally shared, but not clear communicated to all stakeholders.	The timelines are clear defined and communicated. They are followed in more than 80% of the processes; however, there are no official measurement or no efforts to optimise the timelines.	Timelines and response time are clear defined and communicated. They can be monitored by all stakeholders. Measurements are done to allow optimisation of timelines.	Timelines are monitored and measured in all steps of the process. They are continuously open by all stakeholders, they are constantly reviewed and improved based on performance metrics and feedback.	1	0	0	3
Procedure	1.3.7	Accessibility of stakeholders	The information may be accessible through physical documents.	Limited accessibility to the stakeholders involved in the process. The information has a different source and changes workflow for each stakeholder.	Stakeholders can have access to the same source of information and the defined workflows are standardised. However, changes made in the data have to be reloaded by other participants in the process.	Automated workflows push permit status alerts and relevant information to some stakeholders (e.g. applicants).	There is a unique source of data where all stakeholders can retrieve their data. All exchanges happens inside the same digital ecosystem, the data is shared and updated to all stakeholders.	A digital ecosystem enables access to information, include real-time data updates, interactive interfaces, personalised notifications, and collaborative features, allowing stakeholders to actively engage and retrieve the necessary information efficiently from the same source of data.	1	3	0	4
Procedure	1.3.8	Transparency	There is no transparency on the information workflow. Different stakeholders are not able to access or visualise any information not owned by them, other than the final outcome.	There is limited access to information, and stakeholders have difficulty tracking and understanding the flow of information. The documentation and communication processes may be fragmented and limited accessible to stakeholders.	Stakeholders have access to the information that influences their workflow. Information on the process are not clearly communicated or documented. Applicants can check status online throughout process. Basic process metrics reported occasionally.	Real-time permit tracking with notifications to stakeholders(e.g. applicants) and internal staff. Performance trends regularly monitored. Improved transparency.	The information is visible to all stakeholders, with the defined permissions. There is a clear workflow for documentation and communication that can be followed by all stakeholders. External transparency might be through APIs.	Automated workflow tracking and advanced data analytics provide visibility. The information workflow is transparent and collaborative. Reporting tools are utilised to gather insights and monitor the performances while continuous improvement initiatives are implemented to enhance the transparency of the process.	2	3	0	4

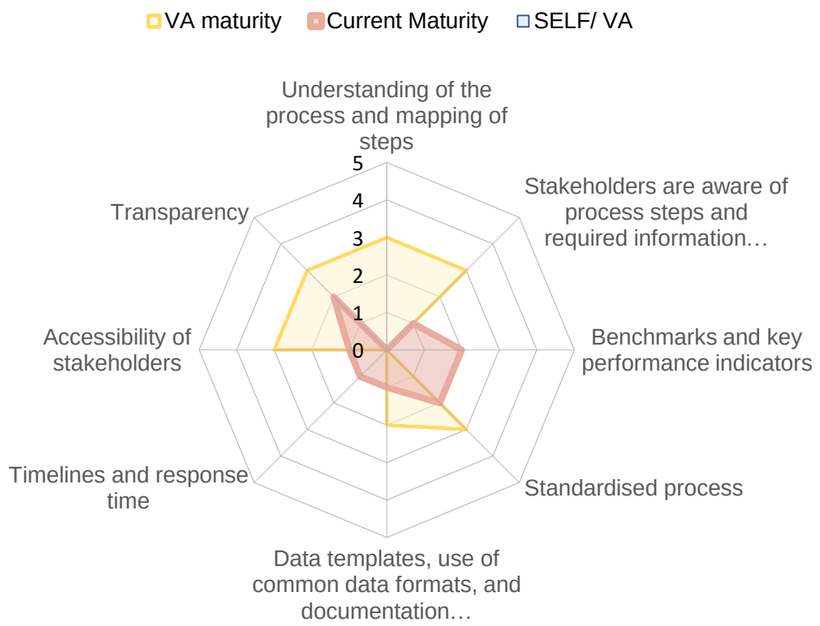
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Readiness for changes	2.4.9	Internal staff	Staff does not express openness to change or digitalisation.	Less than 25% of staff acknowledge the need for digital transformation. There is ad-hoc cooperation between limited individuals on digitalisation.	25-50% of staff participate in cross-functional team to identify digitalisation needs and benefits. Regular meetings are held to discuss digital technology opportunities.	50-75% of staff exhibit proactive mindset about adopting digital innovations. Training incorporates adaptability and readiness for new technologies.	Over 75% of staff are open to digitalisation, some participate in networks to promote digital innovation. Defined processes in place for cooperation on digital best practices.	Staff members are constantly seeking new digital innovations to improve operations. There are knowledge sharing programs across stakeholders to spread digital best practices.	1	1	2	2
Readiness for changes	2.4.10	Higher management	Management does not express openness to organisational changes or digital transformation.	The management supports the vision; however, a strategy is needed to direct the utilisation of digital process including technologies such as BIM and GIS.	There is a movement to kickstart the implementation of digital processes, including BIM, GIS, or other technology. However, the initiative starts from the bottom-up. Management does not have clear plans supporting the implementation.	The management recognises digital innovation and processes advancements including BIM, GIS, or other technology as important strategic plan for the organisation. The efforts for implementation start from a top-down approach.	Digital innovations such as BIM, GIS, and/or other technologies are a part of the IT strategy. An implementation plan of the strategic goals has been promoted at all levels in the organisation.	Digital innovation planning is fully integrated into organisational strategic planning decisions. Visionary awareness of the possibilities of the utilisation of digital technology supports the development of services provided.	1	1	2	3
Readiness for changes	2.4.11	Infrastructure	Hardware/software infrastructure is not capable of supporting required tools for the digital permitting process.	Less than 20% of infrastructure can support required software. There are limited pilot permitting software and test servers, used by less than 20% members of the staff.	20-50% of infrastructure capable of supporting required software. 20-50% of staff have access to software licenses or have it installed. There is an internal network available for file sharing.	Up to 80% of infrastructure is capable of supporting required software. All core permitting software purchased or installed. Redundant permitting servers, cloud backup, common data environment for management of data and files.	100% of hardware can run required software and platforms. All hardware/software for digital permit system fully implemented. Permits database cluster, software integration, online network enables sharing within and outside organisation.	Continuous lifecycle upgrades of hardware/software. Established program for continuous infrastructure upgrades. Regular server refreshes, software updates, new feature additions.	0	0	0	3
Readiness for changes	2.4.12	Legislative system	Not open for changes.	There is no flexibility for creating clear and easy to interpreted rules from the existing regulation. However, there might be current ongoing efforts to simplify the process.	There are a few technical requirements within rule texts that are clearly formulated. However, more than 50% of requirements are subject to human interpretation.	There is an effort at municipal level to ensure that the technical requirements in the normative texts are formulated in a clear and direct way, reducing subjective interpretation.	More than 50% of the regulation under the scope of the municipality have clear and easily interpretable normative text. Facilitating rule interpretation and simplifying the compliance checks.	There is an effort at regional or national level to minimise the subjective interpretability of the texts, facilitating the rule interpretation and simplifying the compliance checks.	1	1	0	2
Organisational structure of units	2.5.13	Strategic objectives for data ecosystem implementation	There is no implementation strategy.	Implementation is conducted without a guiding strategy. There is a lack of awareness and understanding and limited use of tools. Processes are limited integrated into the workflow, and there is a lack of standardised practices.	The implementation strategy has some specific actionable details. There is a general plan of implementation, but processes are not fully integrated and there are no formal standardised guidelines for the implementation.	The implementation strategy is accompanied by comprehensive action plans and a monitoring regime. The organisation recognises that data ecosystem encompasses technological advancements, process improvements, and policy changes.	The vision is shared by staff across the organisation and external stakeholders. The organisations seeks maximum efficiency and effectiveness in data ecosystem implementation. There is integration on process using multiple technologies, e.g. BIM-GIS.	There is a culture of innovation and continuous improvement in data ecosystem practices. The organization seeks for integrating recent innovative tools in their processes (e.g. AI, AR, data spaces).	0	0	0	4
Organisational structure of units	2.5.14	Dedicated personnel	There is no staff fully dedicated to work on BIM, GIS, or other technologies.	Up to 20% staff work part-time on BIM, GIS, or other technologies.	Small team of 3-5 staff dedicated to implementing BIM, GIS, or other technologies within the organisation and internal processes.	Multiple teams working full-time with BIM, GIS, or other technologies. Each team is dedicated to a specific part of the process or data technology. There are high individual and collective knowledge on digital processes and tools.	There is a department dedicated to digital data, such as BIM, GIS or others. With internal teams dedicated to distinct parts of the processes or technologies. There is high individual and collective knowledge, and sharing is stimulated.	There is a team inside the department working with digital process dedicated to maintaining the quality of process, data, standards, and guidelines.	1	0	2	2
Organisational structure of units	2.5.15	Training, preparation and support	There is no type of training or support.	There is a lack of dedicated training or support for technicians to resolve BIM, GIS, or other technologies related issues. There is ad hoc external training as needed. However, less than 8 hours of training per employee per year is stipulated.	There are documented training requirements for digital and data technologies related roles. Annual training is provided to staff members that work directly with BIM, GIS, or other technologies, when needed. 8-16 hours of training per employee per year is stipulated.	Training requirements are managed to meet competency and performance objectives. Regular training is provided to staff members that work directly with BIM, GIS, or other technologies. 16-24 hours of training per employee per year is stipulated.	Training plans based on roles and competencies; training program uses real work examples and lessons learned. There is support inside the organization and fostering collaboration with internal and external partners. 24-40 hours of training per employee per year.	Training is integrated into organizational strategies. On-demand training program are established to cater to the organization's needs and requirements, allowing personnel to access training resources when necessary. More than 40 hours average training per employee per year.	1	0	0	3
Social aspect	2.6.16	Overall knowledge of technicians	No technicians have knowledge or practical experience in data technology (BIM, GIS, or other).	Less than 25% have basic conceptual knowledge, minimal skills. They may have a basic understanding of concepts but lack practical skills and experience in using it.	25-50% have basic knowledge, while less than 20% have practical skills on the tools.	50-75% of staff members regularly use data tools and spatial analysis to enrich permit workflows. There is a tendence to pursue formal certifications to expand capabilities.	Over 75% have good working knowledge and skills on required data technologies with good practical skills. 20% of individuals are experts in BIM, GIS, or other technology.	50% of the technicians are experts in BIM, GIS, or other technology. They possess extensive knowledge and experience and serve as mentors or trainers for other technicians. They are constantly sharing their knowledge and expertise to build a strong digital ecosystem competency for the organisation.	1	0	1	3
Social aspect	2.6.17	Stakeholders' knowledge	None of the stakeholders work with data technologies (BIM, GIS, or other).	Up to 50% of key stakeholders use basic digital data. However, there is no data re-use throughout the process between stakeholders.	50-80% of key stakeholders use digital data such as BIM or GIS. Primarily isolated use, minimal interoperability, collaboration, and little communication or data re-use.	More than 80% of key stakeholders use shared data in a digital ecosystem. Model data is accessible to multiple stakeholders.	100% of key stakeholders use integrated digital ecosystem. All involved parties have access to the same source of information through digital data (e.g. BIM-GIS) in their specific domain.	Data fully integrated across all stakeholders and steps in process with real-time data sharing and collaboration. Data is consistent throughout the multiple stakeholders' digital ecosystem. There are metrics on data re-use and value creation.	0	0	1	2

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Technology for data management	3.7.18	Data management environment and network platform	No platform support.	Digital platform only for submission, communications and data exchanges between applicant and building authority. There is no digital process for data management.	Closed or proprietary tools supporting the different steps. There is a digital tool for managing data; however, not 100% of the information is digitally accessible through it. There are different sources of data depending on the step of the process.	Modular platform. The digital tool stores and manages the data through the whole process. Staff members of the organisation have access to the same data, but external stakeholders' data is not integrated.	Open API-based microservices ecosystem. The tool for data management, works for sharing, storing and managing the data. All internal staff of the organisation can collaborate, while external stakeholders can interact with the data according to defined permissions.	Distributed data space based ecosystem. There is simultaneous working collaboration within all stakeholders of the process and automated workflows.	3	3	1	4
Technology for data management	3.7.19	Data storage/ repository	The process is analogue. Information is stored in paper files and documents.	There is a repository for files of archived processes. There are digital document storage but no centralised repository. Multiple disparate drives and shares.	There is a centralised repository for files that stores ongoing and archived processes that serves as a database and can be accessible by internal staff.	Formal data governance for repository. Lifecycle management with archiving and retention policies.	Centralised digital repository integrates all data throughout the process with backups, archiving, and governance. Integrated with data ecosystems and accessible by all stakeholders according to assigned permissions. Automated backups, archiving and governance.	There is possibility of automatising tasks and workflows in the platform within the data ecosystem increasing the effectiveness of the process. Harmonised access and structures within data space between various data hubs.	2	2	1	4
Technology for data management	3.7.20	Submission system and identification (e.g. electronic signature)	There is not a submission platform. Signature is done manually.	Documents are submitted digitally using non machine-readable formats. The signature is not machine recognisable.	Required information is submitted in a digital ecosystem, using machine-readable data. Models are electronic signed; however, other required information is not automatically verified.	Signature application is available combining all the required information but no automatic validation is performed. Internal systems are integrated with the applicant's portal, directly or via API.	Integrated validation of submission packages (required files and data). There is an application integrated in the process ecosystem that allows digitally sign correspondent submitted content.	Documents and models are digitally signed, integrated within submission process and with the ID authorities. There is automated checking of the identification validation embedded in the process.	1	2	1	3
Technology for data management	3.7.21	Communication system	The communication is done in an analogue way.	The communication is done digitally. However, there is a lack of clear channels and procedures for timely and effective communication between stakeholders.	There is a tool that allows communication internally on the organisation. However, external communication is done in a separate digital environment.	An online portal is introduced for external stakeholders to track permit status, submit documents, communicate with staff. Internal systems are integrated with the applicant's portal, directly or via API.	There is an official tool that allows communication between different stakeholders, both internally and externally to the organisation. Standard API enables communication with other external databases.	There is an official integrated tool that allows live communication between different stakeholders, both internally and externally to the organisation. Automation and digital tools are utilised to streamline communication and enhance responsiveness.	2	3	1	3
Technology for data analysis	3.8.22	Verification of procedural data	Manual inspection of physical formats and documents. Analog process.	Data can be obtained in a digital format to be verified. Electronic infrastructure available but usage of software is unmonitored and irregulated.	Digitisation of data with semi-digital verification process. Software usage is unified within organisation.	Procedural data is provided in machine readable formats. Basic analytical functionalities for data verification.	Advanced analytical functionalities for data verification. Possibility of operational and decision-making actions. Standard API enables automatic connection with databases representing different systems' information (e.g. IDs, professionals registrations and certifications, etc.).	Fully digitalised and automated verification process. Information submitted can be automatically verified against the connected databases. Procedural data is integrated in the cloud and supported by high-performance computing for decision making.	1	2	1	3
Technology for data analysis	3.8.23	Data inspection and visualisation	Manual inspection of physical models or drawings of planned objects. No use of software applications.	2D map data can be obtained to produce 2D deliverables. Proprietary Software is used to produce 2D renderings of planned objects. Usage of software is unmonitored and irregulated.	3D city models can be obtained to produce 3D deliverables. Proprietary Software is used to produce and visualize 3D models of planned objects in specified proprietary formats. Software usage is unified within an organisation or team.	Deliverables are provided in open file formats. Web-based viewers enable dynamic and seamless visualisation in 2D and 3D space by all stakeholders as well as basic analysis functionalities.	Advanced analysis functionalities for operational decision-making are introduced. Open interfaces allow for exchange of data between specialised software applications and multidisciplinary applications in a system-of-systems infrastructure.	Powerful numerical simulation through cloud and high-performance computing model the expected impacts of potential change to make evidence-based strategical decisions. Integration with immersive visualisation technologies, such as AR/VR, to support decision making for non-quantifiable phenomena (e.g. perception of safety due to urban density/lighting)	1	1	0	4
Technology for data analysis	3.8.24	Data validation for building data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data.	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	1	1	0	4

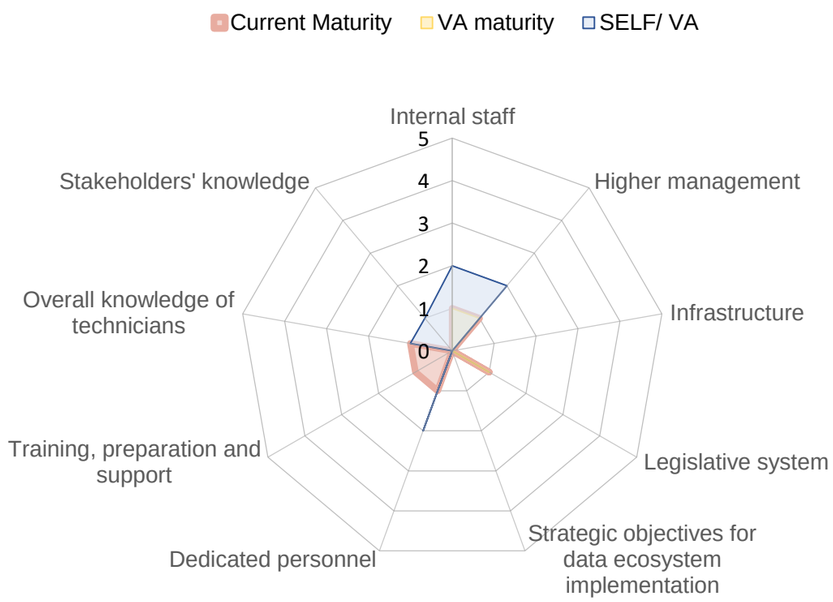
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Technology for data analysis	3.8.25	Data validation for spatial data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data (including consistency and clash-detection).	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	1	1	0	4
Technology for data analysis	3.8.26	Content analyser and Regulations' Checking tool	Manual inspection of rules and regulations.	Manual checking, the content analysis and checking of rules is done in a digital environment; supported by data viewers or inspectors.	Semi-automatic checking of rules and regulations, based on digital building data.	Automatic checking based on digital data. Automated rule-checking is done based on project for a limited number or rules.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including mostly simple analysis.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including all possible regulations and complex analysis.	1	1	1	4
Interoperability and open format	3.9.27	Data format interoperability	No use of digital formats	Use of mainly proprietary formats, reduced capacity to manage and create open format files. Limited support for exchanging data with external systems using standard formats.	Possible use of open formats; however, proprietary formats are still the main practice.	Use of open formats in internal processes is mandatory; however, there are still interoperability related issues when exchanging with external stakeholders.	Support of only open format files, following the standards and best practices for data exchange. Full capability of data exchange within the process and among the different stakeholders.	There are APIs to facilitate interoperability by establishing a common language and protocol for different systems to communicate and exchange data internally and externally.	2	1	1	5
Interoperability and open format	3.9.28	Building data to geospatial data (e.g. BIM to GIS)	No use of building or geospatial data.	Joint visualisation in a geospatial environment, with manual location of building data into geospatial data.	Joint visualisation in a geospatial environment, with correct building data georeferencing.	Conversion of building to geospatial data through semantic mapping and building data georeferencing.	Thorough automatic mapping, generalisation and conversion of building to geospatial data (georeferencing, geometry, semantics, structure).	Automatic communication and real time / on-the-flight thorough mapping, generalisation and conversion of the two models in the respective environments.	2	0	0	4
Interoperability and open format	3.9.29	Geospatial data to building data (e.g. GIS to BIM)	No use of building or geospatial data.	Joint visualisation in a building data environment, with manual location of geospatial data respect building data.	Joint visualisation of geospatial data in a building data environment, with automatic reciprocal registration.	Conversion of geospatial to building data through semantic mapping and automatic reciprocal registration.	Thorough conversion of geospatial to building data (georeferencing, geometry, semantics, structure) via manual enrichment, possibly supported by partially automated routines.	Automatic thorough mapping, enrichment and conversion using Artificial intelligence and Machine Learning methods, implying possible connection to further data sources to achieve reliable resulting building data.	1	0	0	4

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Data standardisation and quality	4.10.30	Data standards and guidelines	There are no guidelines or data requirements specification.	Human readable data requirements specification as basic guidelines, documentation protocols or data standards.	Standard-based data requirements. There are basic guidelines for data standardisation, such as training manual and delivery standards.	Standard-based and Machine-readable data requirements. The organisational standards are aligned with industry standards.	Detailed and comprehensive standard-based and formal data requirements covering geometrical, semantical, structural, syntactical, organisational, and legal aspects enabling easy interoperability and usability.	Organisational modification to Model View Definitions and Information Delivery Manuals are balloted for inclusion in industry standards. Data standards and guidelines are fully integrated into the organisation's policies.	0	0	0	4
Data standardisation and quality	4.10.31	Data quality control	There are no quality control of data.	There are informal quality control plans.	Quality targets and performance benchmarks have been set to maintain high standards.	Proactive processes for monitoring guidelines through audits and spot checks. Metrics track quality trends.	There are comprehensive quality plans to ensure accuracy and consistency. Guidelines are tightly integrated with data validation workflows. Automated reporting on adherence and anomalies.	Quality improvement and adherence to data standards are consistently prioritised and refined. Automated feedback loop from lessons learned.	1	0	0	4
Data and information	4.11.32	Building/intervention design data	The data is analogue. Use only of 2D drawings.	2D drawings, with basic semantic data information.	Building model with geometric data and semantic data. (e.g. BIM)	Building model with standardised data.	Building data is compliant to open standard formats (e.g. IFC) and to specific standard-based data requirements (e.g. MVD, IDS etc.) including metadata.	Integrated dynamic building model. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	0	0	0	4
Data and information	4.11.33	City context data	The data are analogue. Use of only 2D maps	There is a city model; however not all model is populated with the correspondent semantic data. Use of geospatial data, e.g. GIS.	3D city model is more than 80% loaded with semantic data; however the data is not standardised.	3D semantic city model with standardised data.	Open-standard based 3D city model. Specific data requirement compliant. City model with relevant information loaded with metadata however, not linked to other data systems (e.g. BIM).	Integrated dynamic 3D city model, digital twin. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	1	0	1	4
Codes and regulation	4.12.34	Regulations formats	Natural language, needing interpretation and referring to several external laws and definitions.	Unambiguous natural language, containing the needed definitions and related rules, including exceptions. No reference to customs, priorities of different governance levels (municipal, regional, national) are clear.	Regulations are also defined as (semi)formalised language or pseudocode	Regulations are machine-readable	Regulations are machine-readable and refer to standardised information. Fully parameterised rules integrated across platforms.	There is a database used as repository of rules, allowing the creation of new rules according to the updates in the regulation.	0	0	0	2
Codes and regulation	4.12.35	Regulations accessibility	Normative texts can be consulted only in paper and/or pdf format, in the same way by both internal and external stakeholders.	The normative texts can be consulted online according to queries and through a webGIS system associating the regulations to zoning areas	The normative texts can be consulted online according to specific queries in a geographic system. Limited integration and dependencies are managed manually.	Validation rule sets formalised with version control. Central repository established with some real-time updating. Web-based portals for external access, data can be imported into checking software, directly or via APIs.	There is a tool allowing the automatised analysis of data contents and check compliances according to the defined rules. Automated synchronisation and versioning from centralised repository.	The codes are available in a machine-readable format and there are available tools to support the translation of non-translated rules, or to modify parameters in the existing available rules.	0	0	0	2

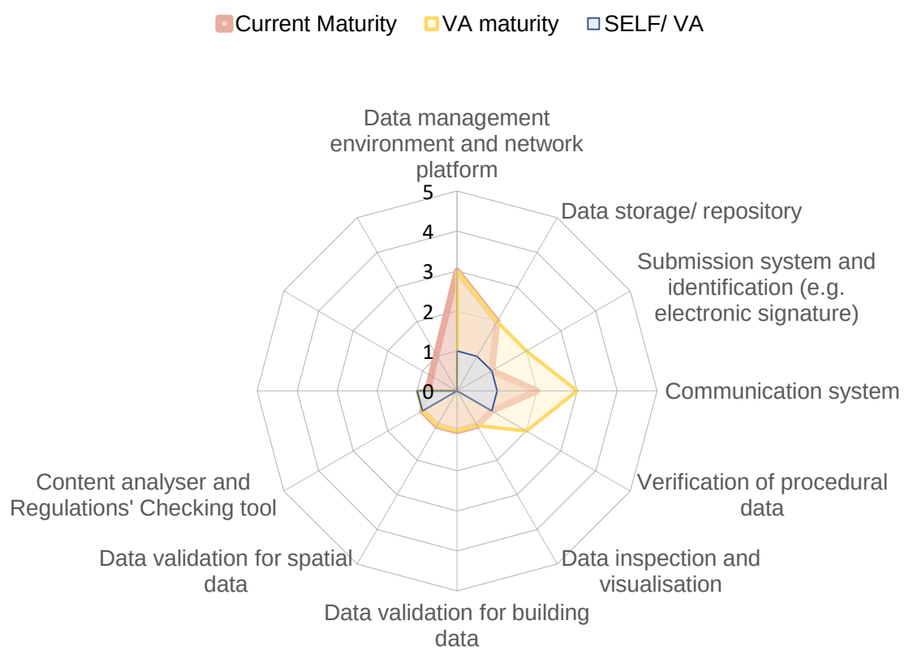
PROCESS MATURITY



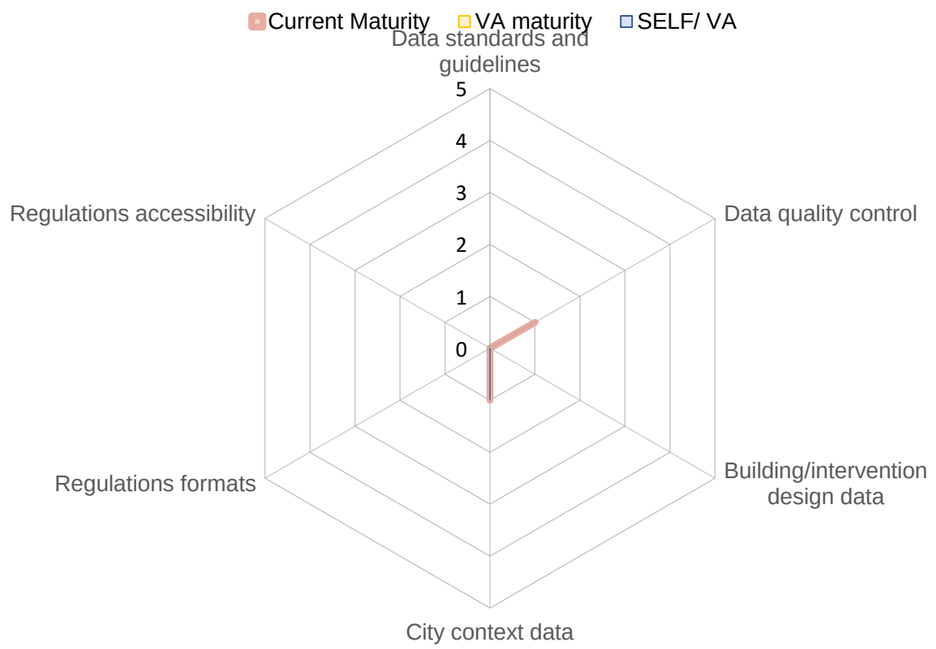
ORGANIZATION MATURITY



TECHNOLOGY MATURITY



INFORMATION MATURITY



PRAGUE

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Process and Methods	1.1.1	Understanding of the process and mapping of steps	There is no clear understanding and the process is not formally mapped.	The process is mapped at a general level and publicly available.	The process steps are identified and documented, providing a clear understanding of the process. The digitalized process is defined and it is on initial steps.	The process is mapped in detail and is integrated into a digital environment for the management of all technical-administrative processes. However, not all steps are fully implemented.	The whole process is mapped and coordinated in central digital environment. All steps are implemented and technical-administrative process can be monitored with the aim of constantly simplifying it.	The whole process is mapped and coordinated in a central digital environment. There is automation throughout the steps in order to increase efficiency, constant monitoring for feedback and lessons learned.	1	1	1	4
Process and Methods	1.1.2	Stakeholders are aware of process steps and required information they must provide	There is no clear understanding and the process is not formally mapped.	Stakeholders have limited understanding of the process steps. Lack of awareness regarding the required information and documentation needed to complete the process. Minimal guidance provided about their roles and responsibilities in the process.	Stakeholders have clear understanding of the process steps. There are guidelines and standards to assist about their roles and responsibilities in the process.	Comprehensive process documentation and checklists enable stakeholders to self-serve. Online resources help stakeholders prepare required information. The digital solution reduces ambiguity.	Stakeholders are fully aware of the steps, the required information and documentation needed to complete the process. Data can be visualised and shared digitally; however, they work in their own digital environment.	Stakeholders are fully aware of their roles the process. There is simultaneous communication and support allowing all different stakeholders to follow the process progression and access the same source of data.	1	1	1	4
Regulatory	1.2.3	Benchmarks and key performance indicators	There is informal or no quality control plans; neither for process, data, or documentation. There are no performance benchmarks for processes or services.	Process, data, and documentation standards are initially defined. Quality targets and performance benchmarks are set; however, there is no official measuring.	Process, data, and documentation standards are defined and established for quality plans. KPIs and benchmarks are clear defined, but not officially measured.	Proactive quality monitoring is conducted through spot checks and structured reviews. Some KPIs are measure, but not all implemented. Metrics provide visibility into performance vs targets.	Performance against benchmarks and KPIs are measured and monitored. KPIs and performance benchmarks are incorporated into quality management and performance improvement systems.	Quality improvement and adherence to regulations and codes are continuously aligned and refined. Benchmarks and KPIs are repetitively revisited to insure highest possible quality in processes and services.	0	0	0	4
Regulatory	1.2.4	Standardised process	There are no guidelines or standards for the processes.	The process is mapped primarily from an administrative perspective. The technical checks within the process are performed by individual knowledge of technicians based on the normative documents. There are informal internal guidelines to help technicians on the steps of process to follow.	In addition to the process map and the normative documents, technicians receive support from a detailed guideline that outlines the specific checks to be performed for each step of the process, with comprehensive instructions and specifying the aspects that need to be examined during each stage.	The supporting guideline for technicians provides a comprehensive list of urban planning and construction aspects that need to be checked for each phase of the building permit process. The guideline serves as a reference tool, ensuring that technicians have clear instructions on the specific aspects they need to assess.	The guideline is continuously refined to reflect lessons learned. Quality improvement and adherence to regulations and codes are continuously aligned and refined. The guideline to support the technicians is updated and monitored based on the KPIs and benchmark measures to simplify the process.	There is a detailed standardised procedure, defined at municipality level for all stakeholders involved in the process whose use is constantly monitored and content updated.	1	1	1	4
Regulatory	1.2.5	Data templates, use of common data formats, and documentation requirements	There are no data templates, use of common data formats, or documentation requirements.	Limited standardisation of data formats, templates, or documentation requirements. Inconsistency in data formats and documentation across different permit processes or projects.	Some steps of the process have standardised data formats, templates and documentation. However, the effort to create single standardised data is ongoing.	There are standardised data formats and templates internally. They are not followed by external stakeholders and there is only an informal quality control verification.	There are standardised data formats and templates. They are easily accessible by all stakeholders and there is a control to maintain the standardisation across the process. Best practices are identified and shared across all the stakeholders.	There are standardised data formats and templates following open data standards. Continuous improvement are implemented to enhance the use of the open formats. Automatised control is done during the process.	1	0	0	5
Procedure	1.3.6	Timelines and response time	There is no clear knowledge of timelines and response time is not pre-defined.	There is an informal understanding of the timelines, but they are not clearly communicated and mostly not followed.	There are defined timelines for each step of the process, they are internally shared, but not clear communicated to all stakeholders.	The timelines are clear defined and communicated. They are followed in more than 80% of the processes; however, there are no official measurement or no efforts to optimise the timelines.	Timelines and response time are clear defined and communicated. They can be monitored by all stakeholders. Measurements are done to allow optimisation of timelines.	Timelines are monitored and measured in all steps of the process. They are continuously open by all stakeholders, they are constantly reviewed and improved based on performance metrics and feedback.	1	0	0	3
Procedure	1.3.7	Accessibility of stakeholders	The information may be accessible through physical documents.	Limited accessibility to the stakeholders involved in the process. The information has a different source and changes workflow for each stakeholder.	Stakeholders can have access to the same source of information and the defined workflows are standardised. However, changes made in the data have to be reloaded by other participants in the process.	Automated workflows push permit status alerts and relevant information to some stakeholders (e.g. applicants).	There is a unique source of data where all stakeholders can retrieve their data. All exchanges happens inside the same digital ecosystem, the data is shared and updated to all stakeholders.	A digital ecosystem enables access to information, include real-time data updates, interactive interfaces, personalised notifications, and collaborative features, allowing stakeholders to actively engage and retrieve the necessary information efficiently from the same source of data.	1	0	0	4
Procedure	1.3.8	Transparency	There is no transparency on the information workflow. Different stakeholders are not able to access or visualise any information not owned by them, other than the final outcome.	There is limited access to information, and stakeholders have difficulty tracking and understanding the flow of information. The documentation and communication processes may be fragmented and limited accessible to stakeholders.	Stakeholders have access to the information that influences their workflow. Information on the process are not clearly communicated or documented. Applicants can check status online throughout process. Basic process metrics reported occasionally.	Real-time permit tracking with notifications to stakeholders(e.g. applicants) and internal staff. Performance trends regularly monitored. Improved transparency.	The information is visible to all stakeholders, with the defined permissions. There is a clear workflow for documentation and communication that can be followed by all stakeholders. External transparency might be through APIs.	Automated workflow tracking and advanced data analytics provide visibility. The information workflow is transparent and collaborative. Reporting tools are utilised to gather insights and monitor the performances while continuous improvement initiatives are implemented to enhance the transparency of the process.	0	0	0	4

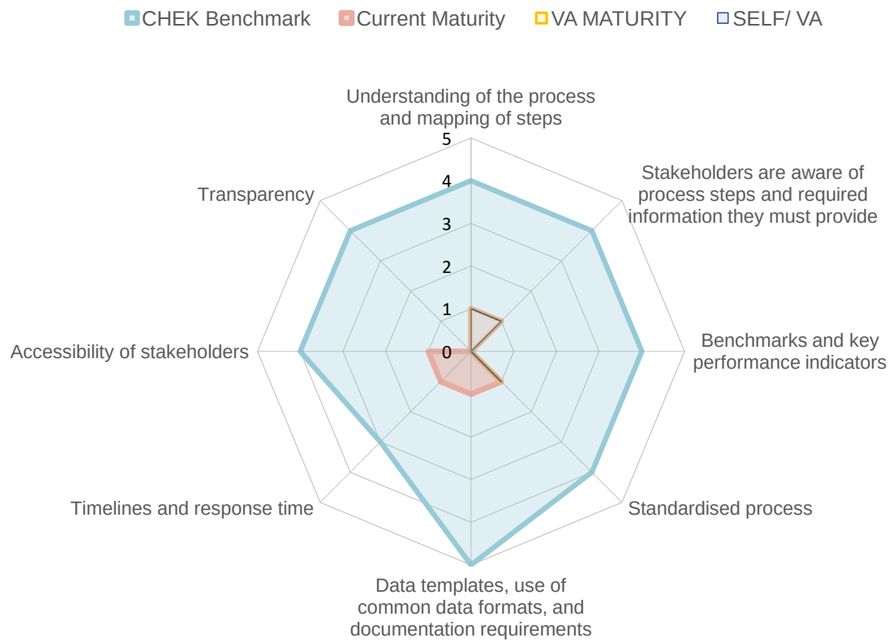
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Readiness for changes	2.4.9	Internal staff	Staff does not express openness to change or digitalisation.	Less than 25% of staff acknowledge the need for digital transformation. There is ad-hoc cooperation between limited individuals on digitalisation.	25-50% of staff participate in cross-functional team to identify digitalisation needs and benefits. Regular meetings are held to discuss digital technology opportunities.	50-75% of staff exhibit proactive mindset about adopting digital innovations. Training incorporates adaptability and readiness for new technologies.	Over 75% of staff are open to digitalisation, some participate in networks to promote digital innovation. Defined processes in place for cooperation on digital best practices.	Staff members are constantly seeking new digital innovations to improve operations. There are knowledge sharing programs across stakeholders to spread digital best practices.	1	2	1	2
Readiness for changes	2.4.10	Higher management	Management does not express openness to organisational changes or digital transformation.	The management supports the vision; however, a strategy is needed to direct the utilisation of digital process including technologies such as BIM and GIS.	There is a movement to kickstart the implementation of digital processes, including BIM, GIS, or other technology. However, the initiative starts from the bottom-up. Management does not have clear plans supporting the implementation.	The management recognises digital innovation and processes advancements including BIM, GIS, or other technology as important strategic plan for the organisation. The efforts for implementation start from a top-down approach.	Digital innovations such as BIM, GIS, and/or other technologies are a part of the IT strategy. An implementation plan of the strategic goals has been promoted at all levels in the organisation.	Digital innovation planning is fully integrated into organisational strategic planning decisions. Visionary awareness of the possibilities of the utilisation of digital technology supports the development of services provided.	1	1	0	3
Readiness for changes	2.4.11	Infrastructure	Hardware/software infrastructure is not capable of supporting required tools for the digital permitting process.	Less than 20% of infrastructure can support required software. There are limited pilot permitting software and test servers, used by less than 20% members of the staff.	20-50% of infrastructure capable of supporting required software. 20-50% of staff have access to software licenses or have it installed. There is an internal network available for file sharing.	Up to 80% of infrastructure is capable of supporting required software. All core permitting software purchased or installed. Redundant permitting servers, cloud backup, common data environment for management of data and files.	100% of hardware can run required software and platforms. All hardware/software for digital permit system fully implemented. Permits database cluster, software integration, online network enables sharing within and outside organisation.	Continuous lifecycle upgrades of hardware/software. Established program for continuous infrastructure upgrades. Regular server refreshes, software updates, new feature additions.	0	0	0	3
Readiness for changes	2.4.12	Legislative system	Not open for changes.	There is no flexibility for creating clear and easy to interpreted rules from the existing regulation. However, there might be current ongoing efforts to simplify the process.	There are a few technical requirements within rule texts that are clearly formulated. However, more than 50% of requirements are subject to human interpretation.	There is an effort at municipal level to ensure that the technical requirements in the normative texts are formulated in a clear and direct way, reducing subjective interpretation.	More than 50% of the regulation under the scope of the municipality have clear and easily interpretable normative text. Facilitating rule interpretation and simplifying the compliance checks.	There is an effort at regional or national level to minimise the subjective interpretability of the texts, facilitating the rule interpretation and simplifying the compliance checks.	1	2	1	2
Organisational structure of units	2.5.13	Strategic objectives for data ecosystem implementation	There is no implementation strategy.	Implementation is conducted without a guiding strategy. There is a lack of awareness and understanding and limited use of tools. Processes are limited integrated into the workflow, and there is a lack of standardised practices.	The implementation strategy has some specific actionable details. There is a general plan of implementation, but processes are not fully integrated and there are no formal standardised guidelines for the implementation.	The implementation strategy is accompanied by comprehensive action plans and a monitoring regime. The organisation recognises that data ecosystem encompasses technological advancements, process improvements, and policy changes.	The vision is shared by staff across the organisation and external stakeholders. The organisations seeks maximum efficiency and effectiveness in data ecosystem implementation. There is integration on process using multiple technologies, e.g. BIM-GIS.	There is a culture of innovation and continuous improvement in data ecosystem practices. The organization seeks for integrating recent innovative tools in their processes (e.g. AI, AR, data spaces).	1	0	0	4
Organisational structure of units	2.5.14	Dedicated personnel	There is no staff fully dedicated to work on BIM, GIS, or other technologies.	Up to 20% staff work part-time on BIM, GIS, or other technologies.	Small team of 3-5 staff dedicated to implementing BIM, GIS, or other technologies within the organisation and internal processes.	Multiple teams working full-time with BIM, GIS, or other technologies. Each team is dedicated to a specific part of the process or data technology. There are high individual and collective knowledge on digital processes and tools.	There is a department dedicated to digital data, such as BIM, GIS or others. With internal teams dedicated to distinct parts of the processes or technologies. There is high individual and collective knowledge, and sharing is stimulated.	There is a team inside the department working with digital process dedicated to maintaining the quality of process, data, standards, and guidelines.	0	1	1	2
Organisational structure of units	2.5.15	Training, preparation and support	There is no type of training or support.	There is a lack of dedicated training or support for technicians to resolve BIM, GIS, or other technologies related issues. There is ad hoc external training as needed. However, less than 8 hours of training per employee per year is stipulated.	There are documented training requirements for digital and data technologies related roles. Annual training is provided to staff members that work directly with BIM, GIS, or other technologies, when needed. 8-16 hours of training per employee per year is stipulated.	Training requirements are managed to meet competency and performance objectives. Regular training is provided to staff members that work directly with BIM, GIS, or other technologies. 16-24 hours of training per employee per year is stipulated.	Training plans based on roles and competencies; training program uses real work examples and lessons learned. There is support inside the organization and fostering collaboration with internal and external partners. 24-40 hours of training per employee per year.	Training is integrated into organizational strategies. On-demand training program are established to cater to the organization's needs and requirements, allowing personnel to access training resources when necessary. More than 40 hours average training per employee per year.	0	0	1	3
Social aspect	2.6.16	Overall knowledge of technicians	No technicians have knowledge or practical experience in data technology (BIM, GIS, or other).	Less than 25% have basic conceptual knowledge, minimal skills. They may have a basic understanding of concepts but lack practical skills and experience in using it.	25-50% have basic knowledge, while less than 20% have practical skills on the tools.	50-75% of staff members regularly use data tools and spatial analysis to enrich permit workflows. There is a tendence to pursue formal certifications to expand capabilities.	Over 75% have good working knowledge and skills on required data technologies with good practical skills. 20% of individuals are experts in BIM, GIS, or other technology.	50% of the technicians are experts in BIM, GIS, or other technology. They possess extensive knowledge and experience and serve as mentors or trainers for other technicians. They are constantly sharing their knowledge and expertise to build a strong digital ecosystem competency for the organisation.	1	1	1	3
Social aspect	2.6.17	Stakeholders' knowledge	None of the stakeholders work with data technologies (BIM, GIS, or other).	Up to 50% of key stakeholders use basic digital data. However, there is no data re-use throughout the process between stakeholders.	50-80% of key stakeholders use digital data such as BIM or GIS. Primarily isolated use, minimal interoperability, collaboration, and little communication or data re-use.	More than 80% of key stakeholders use shared data in a digital ecosystem. Model data is accessible to multiple stakeholders.	100% of key stakeholders use integrated digital ecosystem. All involved parties have access to the same source of information through digital data (e.g. BIM-GIS) in their specific domain.	Data fully integrated across all stakeholders and steps in process with real-time data sharing and collaboration. Data is consistent throughout the multiple stakeholders' digital ecosystem. There are metrics on data re-use and value creation.	1	0	1	2

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Technology for data management	3.7.18	Data management environment and network platform	No platform support.	Digital platform only for submission, communications and data exchanges between applicant and building authority. There is no digital process for data management.	Closed or proprietary tools supporting the different steps. There is a digital tool for managing data; however, not 100% of the information is digitally accessible through it. There are different sources of data depending on the step of the process.	Modular platform. The digital tool stores and manages the data through the whole process. Staff members of the organisation have access to the same data, but external stakeholders' data is not integrated.	Open API-based microservices ecosystem. The tool for data management, works for sharing, storing and managing the data. All internal staff of the organisation can collaborate, while external stakeholders can interact with the data according to defined permissions.	Distributed data space based ecosystem. There is simultaneous working collaboration within all stakeholders of the process and automated workflows.	1	0	0	4
Technology for data management	3.7.19	Data storage/ repository	The process is analogue. Information is stored in paper files and documents.	There is a repository for files of archived processes. There are digital document storage but no centralised repository. Multiple disparate drives and shares.	There is a centralised repository for files that stores ongoing and archived processes that serves as a database and can be accessible by internal staff.	Formal data governance for repository. Lifecycle management with archiving and retention policies.	Centralised digital repository integrates all data throughout the process with backups, archiving, and governance. Integrated with data ecosystems and accessible by all stakeholders according to assigned permissions. Automated backups, archiving and governance.	There is possibility of automatising tasks and workflows in the platform within the data ecosystem increasing the effectiveness of the process. Harmonised access and structures within data space between various data hubs.	0	0	0	4
Technology for data management	3.7.20	Submission system and identification (e.g. electronic signature)	There is not a submission platform. Signature is done manually.	Documents are submitted digitally using non machine-readable formats. The signature is not machine recognisable.	Required information is submitted in a digital ecosystem, using machine-readable data. Models are electronic signed; however, other required information is not automatically verified.	Signature application is available combining all the required information but no automatic validation is performed. Internal systems are integrated with the applicant's portal, directly or via API.	Integrated validation of submission packages (required files and data). There is an application integrated in the process ecosystem that allows digitally sign correspondent submitted content.	Documents and models are digitally signed, integrated within submission process and with the ID authorities. There is automated checking of the identification validation embedded in the process.	0	0	1	3
Technology for data management	3.7.21	Communication system	The communication is done in an analogue way.	The communication is done digitally. However, there is a lack of clear channels and procedures for timely and effective communication between stakeholders.	There is a tool that allows communication internally on the organisation. However, external communication is done in a separate digital environment.	An online portal is introduced for external stakeholders to track permit status, submit documents, communicate with staff. Internal systems are integrated with the applicant's portal, directly or via API.	There is an official tool that allows communication between different stakeholders, both internally and externally to the organisation. Standard API enables communication with other external databases.	There is an official integrated tool that allows live communication between different stakeholders, both internally and externally to the organisation. Automation and digital tools are utilised to streamline communication and enhance responsiveness.	1	1	1	3
Technology for data analysis	3.8.22	Verification of procedural data	Manual inspection of physical formats and documents. Analog process.	Data can be obtained in a digital format to be verified. Electronic infrastructure available but usage of software is unmonitored and irregulated.	Digitisation of data with semi-digital verification process. Software usage is unified within organisation.	Procedural data is provided in machine readable formats. Basic analytical functionalities for data verification.	Advanced analytical functionalities for data verification. Possibility of operational and decision-making actions. Standard API enables automatic connection with databases representing different systems' information (e.g. IDs, professionals registrations and certifications, etc.).	Fully digitalised and automated verification process. Information submitted can be automatically verified against the connected databases. Procedural data is integrated in the cloud and supported by high-performance computing for decision making.	0	0	0	3
Technology for data analysis	3.8.23	Data inspection and visualisation	Manual inspection of physical models or drawings of planned objects. No use of software applications.	2D map data can be obtained to produce 2D deliverables. Proprietary Software is used to produce 2D renderings of planned objects. Usage of software is unmonitored and irregulated.	3D city models can be obtained to produce 3D deliverables. Proprietary Software is used to produce and visualize 3D models of planned objects in specified proprietary formats. Software usage is unified within an organisation or team.	Deliverables are provided in open file formats. Web-based viewers enable dynamic and seamless visualisation in 2D and 3D space by all stakeholders as well as basic analysis functionalities.	Advanced analysis functionalities for operational decision-making are introduced. Open interfaces allow for exchange of data between specialised software applications and multidisciplinary applications in a system-of-systems infrastructure.	Powerful numerical simulation through cloud and high-performance computing model the expected impacts of potential change to make evidence-based strategical decisions. Integration with immersive visualisation technologies, such as AR/VR, to support decision making for non-quantifiable phenomena (e.g. perception of safety due to urban density/lighting)	0	0	0	4
Technology for data analysis	3.8.24	Data validation for building data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data.	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	0	0	0	4

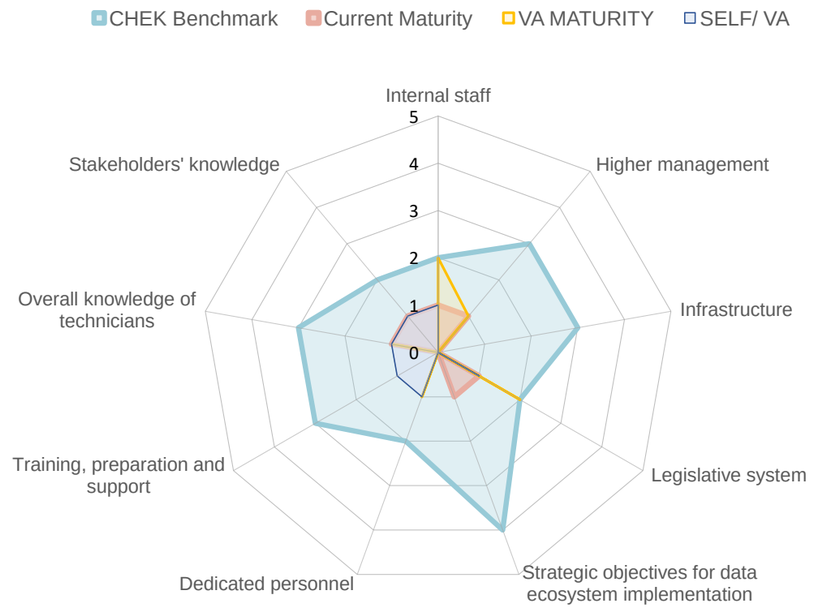
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Technology for data analysis	3.8.25	Data validation for spatial data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data (including consistency and clash-detection).	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	0	0	0	4
Technology for data analysis	3.8.26	Content analyser and Regulations' Checking tool	Manual inspection of rules and regulations.	Manual checking, the content analysis and checking of rules is done in a digital environment; supported by data viewers or inspectors.	Semi-automatic checking of rules and regulations, based on digital building data.	Automatic checking based on digital data. Automated rule-checking is done based on project for a limited number or rules.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including mostly simple analysis.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including all possible regulations and complex analysis.	0	0	0	4
Interoperability and open format	3.9.27	Data format interoperability	No use of digital formats	Use of mainly proprietary formats, reduced capacity to manage and create open format files. Limited support for exchanging data with external systems using standard formats.	Possible use of open formats; however, proprietary formats are still the main practice.	Use of open formats in internal processes is mandatory; however, there are still interoperability related issues when exchanging with external stakeholders.	Support of only open format files, following the standards and best practices for data exchange. Full capability of data exchange within the process and among the different stakeholders.	There are APIs to facilitate interoperability by establishing a common language and protocol for different systems to communicate and exchange data internally and externally.	0	0	0	5
Interoperability and open format	3.9.28	Building data to geospatial data (e.g. BIM to GIS)	No use of building or geospatial data.	Joint visualisation in a geospatial environment, with manual location of building data into geospatial data.	Joint visualisation in a geospatial environment, with correct building data georeferencing.	Conversion of building to geospatial data through semantic mapping and building data georeferencing.	Thorough automatic mapping, generalisation and conversion of building to geospatial data (georeferencing, geometry, semantics, structure).	Automatic communication and real time / on-the-flight thorough mapping, generalisation and conversion of the two models in the respective environments.	0	0	0	4
Interoperability and open format	3.9.29	Geospatial data to building data (e.g. GIS to BIM)	No use of building or geospatial data.	Joint visualisation in a building data environment, with manual location of geospatial data respect building data.	Joint visualisation of geospatial data in a building data environment, with automatic reciprocal registration.	Conversion of geospatial to building data through semantic mapping and automatic reciprocal registration.	Thorough conversion of geospatial to building data (georeferencing, geometry, semantics, structure) via manual enrichment, possibly supported by partially automated routines.	Automatic thorough mapping, enrichment and conversion using Artificial intelligence and Machine Learning methods, implying possible connection to further data sources to achieve reliable resulting building data.	0	0	0	4

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Data standardisation and quality	4.10.30	Data standards and guidelines	There are no guidelines or data requirements specification.	Human readable data requirements specification as basic guidelines, documentation protocols or data standards.	Standard-based data requirements. There are basic guidelines for data standardisation, such as training manual and delivery standards.	Standard-based and Machine-readable data requirements. The organisational standards are aligned with industry standards.	Detailed and comprehensive standard-based and formal data requirements covering geometrical, semantical, structural, syntactical, organisational, and legal aspects enabling easy interoperability and usability.	Organisational modification to Model View Definitions and Information Delivery Manuals are balloted for inclusion in industry standards. Data standards and guidelines are fully integrated into the organisation's policies.	1	0	0	4
Data standardisation and quality	4.10.31	Data quality control	There are no quality control of data.	There are informal quality control plans.	Quality targets and performance benchmarks have been set to maintain high standards.	Proactive processes for monitoring guidelines through audits and spot checks. Metrics track quality trends.	There are comprehensive quality plans to ensure accuracy and consistency. Guidelines are tightly integrated with data validation workflows. Automated reporting on adherence and anomalies.	Quality improvement and adherence to data standards are consistently prioritised and refined. Automated feedback loop from lessons learned.	0	0	0	4
Data and information	4.11.32	Building/intervention design data	The data is analogue. Use only of 2D drawings.	2D drawings, with basic semantic data information.	Building model with geometric data and semantic data. (e.g. BIM)	Building model with standardised data.	Building data is compliant to open standard formats (e.g. IFC) and to specific standard-based data requirements (e.g. MVD, IDS etc.) including metadata.	Integrated dynamic building model. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	0	0	0	4
Data and information	4.11.33	City context data	The data are analogue. Use of only 2D maps	There is a city model; however not all model is populated with the correspondent semantic data. Use of geospatial data, e.g. GIS.	3D city model is more than 80% loaded with semantic data; however the data is not standardised.	3D semantic city model with standardised data.	Open-standard based 3D city model. Specific data requirement compliant. City model with relevant information loaded with metadata however, not linked to other data systems (e.g. BIM).	Integrated dynamic 3D city model, digital twin. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	0	1	1	4
Codes and regulation	4.12.34	Regulations formats	Natural language, needing interpretation and referring to several external laws and definitions.	Unambiguous natural language, containing the needed definitions and related rules, including exceptions. No reference to customs, priorities of different governance levels (municipal, regional, national) are clear.	Regulations are also defined as (semi)formalised language or pseudocode	Regulations are machine-readable	Regulations are machine-readable and refer to standardised information. Fully parameterised rules integrated across platforms.	There is a database used as repository of rules, allowing the creation of new rules according to the updates in the regulation.	0	0	0	2
Codes and regulation	4.12.35	Regulations accessibility	Normative texts can be consulted only in paper and/or pdf format, in the same way by both internal and external stakeholders.	The normative texts can be consulted online according to queries and through a webGIS system associating the regulations to zoning areas	The normative texts can be consulted online according to specific queries in a geographic system. Limited integration and dependencies are managed manually.	Validation rule sets formalised with version control. Central repository established with some real-time updating. Web-based portals for external access, data can be imported into checking software, directly or via APIs.	There is a tool allowing the automatised analysis of data contents and check compliances according to the defined rules. Automated synchronisation and versioning from centralised repository.	The codes are available in a machine-readable format and there are available tools to support the translation of non-translated rules, or to modify parameters in the existing available rules.	0	0	0	2

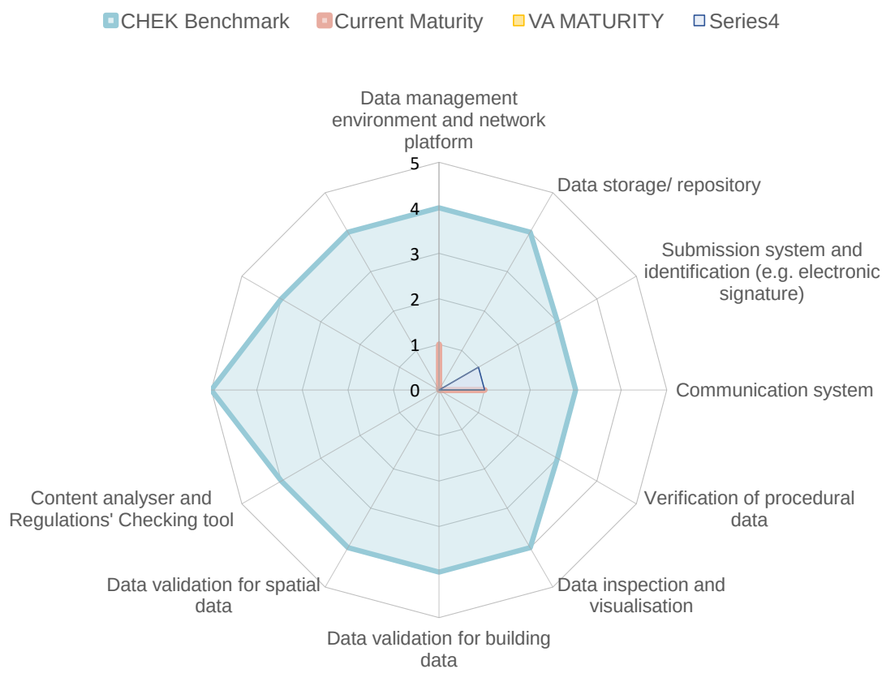
PROCESS MATURITY



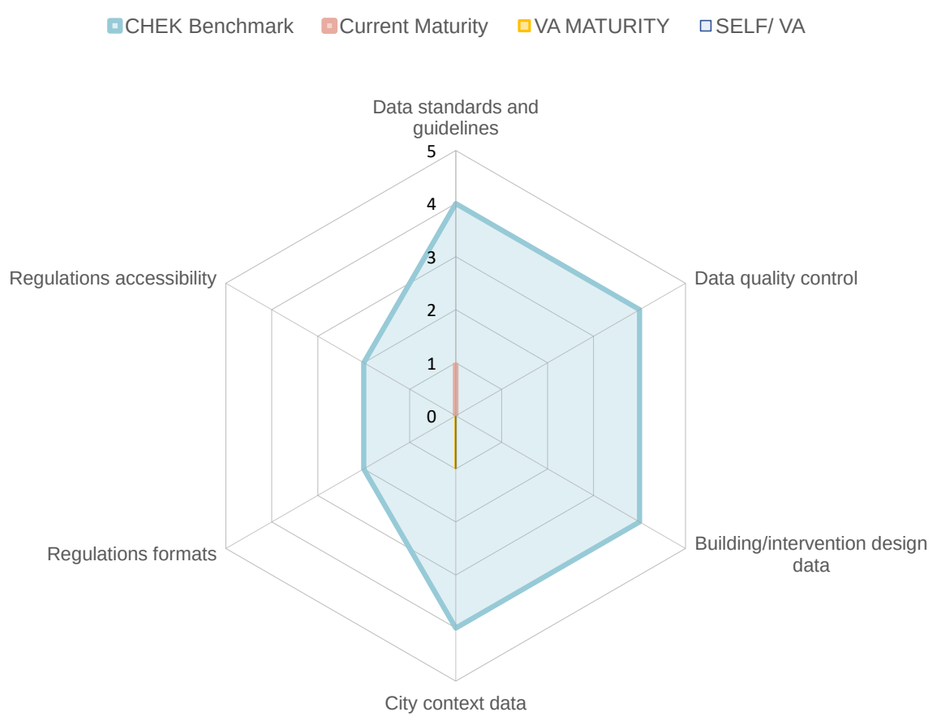
ORGANIZATION MATURITY



TECHNOLOGY MATURITY



INFORMATION MATURITY



VILA NOVA DE GAIA

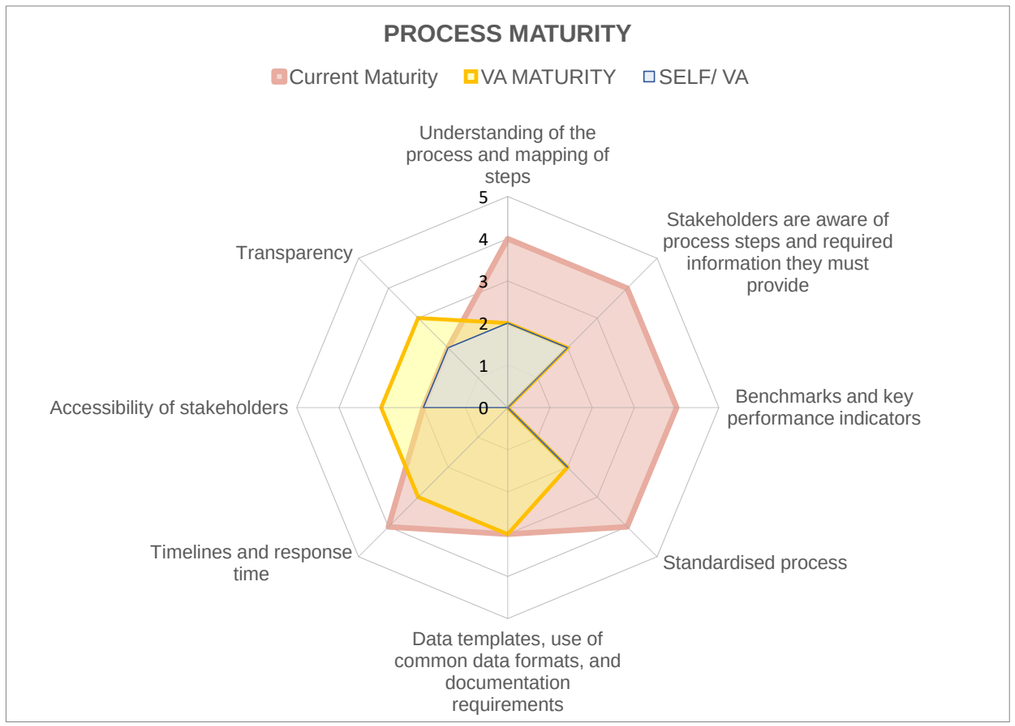
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Process and Methods	1.1.1	Understanding of the process and mapping of steps	There is no clear understanding and the process is not formally mapped.	The process is mapped at a general level and publicly available.	The process steps are identified and documented, providing a clear understanding of the process. The digitalized process is defined and it is on initial steps.	The process is mapped in detail and is integrated into a digital environment for the management of all technical-administrative processes. However, not all steps are fully implemented.	The whole process is mapped and coordinated in central digital environment. All steps are implemented and technical-administrative process can be monitored with the aim of constantly simplifying it.	The whole process is mapped and coordinated in a central digital environment. There is automation throughout the steps in order to increase efficiency, constant monitoring for feedback and lessons learned.	4	2	2	4
Process and Methods	1.1.2	Stakeholders are aware of process steps and required information they must provide	There is no clear understanding and the process is not formally mapped.	Stakeholders have limited understanding of the process steps. Lack of awareness regarding the required information and documentation needed to complete the process. Minimal guidance provided about their roles and responsibilities in the process.	Stakeholders have clear understanding of the process steps. There are guidelines and standards to assist about their roles and responsibilities in the process.	Comprehensive process documentation and checklists enable stakeholders to self-serve. Online resources help stakeholders prepare required information. The digital solution reduces ambiguity.	Stakeholders are fully aware of the steps, the required information and documentation needed to complete the process. Data can be visualised and shared digitally; however, they work in their own digital environment.	Stakeholders are fully aware of their roles the process. There is simultaneous communication and support allowing all different stakeholders to follow the process progression and access the same source of data.	4	2	2	4
Regulatory	1.2.3	Benchmarks and key performance indicators	There is informal or no quality control plans; neither for process, data, or documentation. There are no performance benchmarks for processes or services.	Process, data, and documentation standards are initially defined. Quality targets and performance benchmarks are set; however, there is no official measuring.	Process, data, and documentation standards are defined and established for quality plans. KPIs and benchmarks are clear defined, but not officially measured.	Proactive quality monitoring is conducted through spot checks and structured reviews. Some KPIs are measure, but not all implemented. Metrics provide visibility into performance vs targets.	Performance against benchmarks and KPIs are measured and monitored. KPIs and performance benchmarks are incorporated into quality management and performance improvement systems.	Quality improvement and adherence to regulations and codes are continuously aligned and refined. Benchmarks and KPIs are repetitively revisited to insure highest possible quality in processes and services.	4	0	0	4
Regulatory	1.2.4	Standardised process	There are no guidelines or standards for the processes.	The process is mapped primarily from an administrative perspective. The technical checks within the process are performed by individual knowledge of technicians based on the normative documents. There are informal internal guidelines to help technicians on the steps of process to follow.	In addition to the process map and the normative documents, technicians receive support from a detailed guideline that outlines the specific checks to be performed for each step of the process, with comprehensive instructions and specifying the aspects that need to be examined during each stage.	The supporting guideline for technicians provides a comprehensive list of urban planning and construction aspects that need to be checked for each phase of the building permit process. The guideline serves as a reference tool, ensuring that technicians have clear instructions on the specific aspects they need to assess.	The guideline is continuously refined to reflect lessons learned. Quality improvement and adherence to regulations and codes are continuously aligned and refined. The guideline to support the technicians is updated and monitored based on the KPIs and benchmark measures to simplify the process.	There is a detailed standardised procedure, defined at municipality level for all stakeholders involved in the process whose use is constantly monitored and content updated.	4	2	2	4
Regulatory	1.2.5	Data templates, use of common data formats, and documentation requirements	There are no data templates, use of common data formats, or documentation requirements.	Limited standardisation of data formats, templates, or documentation requirements. Inconsistency in data formats and documentation across different permit processes or projects.	Some steps of the process have standardised data formats, templates and documentation. However, the effort to create single standardised data is ongoing.	There are standardised data formats and templates internally. They are not followed by external stakeholders and there is only an informal quality control verification.	There are standardised data formats and templates. They are easily accessible by all stakeholders and there is a control to maintain the standardisation across the process. Best practices are identified and shared across all the stakeholders.	There are standardised data formats and templates following open data standards. Continuous improvement are implemented to enhance the use of the open formats. Automatised control is done during the process.	3	3	0	5
Procedure	1.3.6	Timelines and response time	There is no clear knowledge of timelines and response time is not pre-defined.	There is an informal understanding of the timelines, but they are not clearly communicated and mostly not followed.	There are defined timelines for each step of the process, they are internally shared, but not clear communicated to all stakeholders.	The timelines are clear defined and communicated. They are followed in more than 80% of the processes; however, there are no official measurement or no efforts to optimise the timelines.	Timelines and response time are clear defined and communicated. They can be monitored by all stakeholders. Measurements are done to allow optimisation of timelines.	Timelines are monitored and measured in all steps of the process. They are continuously open by all stakeholders, they are constantly reviewed and improved based on performance metrics and feedback.	4	3	0	3
Procedure	1.3.7	Accessibility of stakeholders	The information may be accessible through physical documents.	Limited accessibility to the stakeholders involved in the process. The information has a different source and changes workflow for each stakeholder.	Stakeholders can have access to the same source of information and the defined workflows are standardised. However, changes made in the data have to be reloaded by other participants in the process.	Automated workflows push permit status alerts and relevant information to some stakeholders (e.g. applicants).	There is a unique source of data where all stakeholders can retrieve their data. All exchanges happens inside the same digital ecosystem, the data is shared and updated to all stakeholders.	A digital ecosystem enables access to information, include real-time data updates, interactive interfaces, personalised notifications, and collaborative features, allowing stakeholders to actively engage and retrieve the necessary information efficiently from the same source of data.	2	3	2	4
Procedure	1.3.8	Transparency	There is no transparency on the information workflow. Different stakeholders are not able to access or visualise any information not owned by them, other than the final outcome.	There is limited access to information, and stakeholders have difficulty tracking and understanding the flow of information. The documentation and communication processes may be fragmented and limited accessible to stakeholders.	Stakeholders have access to the information that influences their workflow. Information on the process are not clearly communicated or documented. Applicants can check status online throughout process. Basic process metrics reported occasionally.	Real-time permit tracking with notifications to stakeholders(e.g. applicants) and internal staff. Performance trends regularly monitored. Improved transparency.	The information is visible to all stakeholders, with the defined permissions. There is a clear workflow for documentation and communication that can be followed by all stakeholders. External transparency might be through APIs.	Automated workflow tracking and advanced data analytics provide visibility. The information workflow is transparent and collaborative. Reporting tools are utilised to gather insights and monitor the performances while continuous improvement initiatives are implemented to enhance the transparency of the process.	2	3	2	4

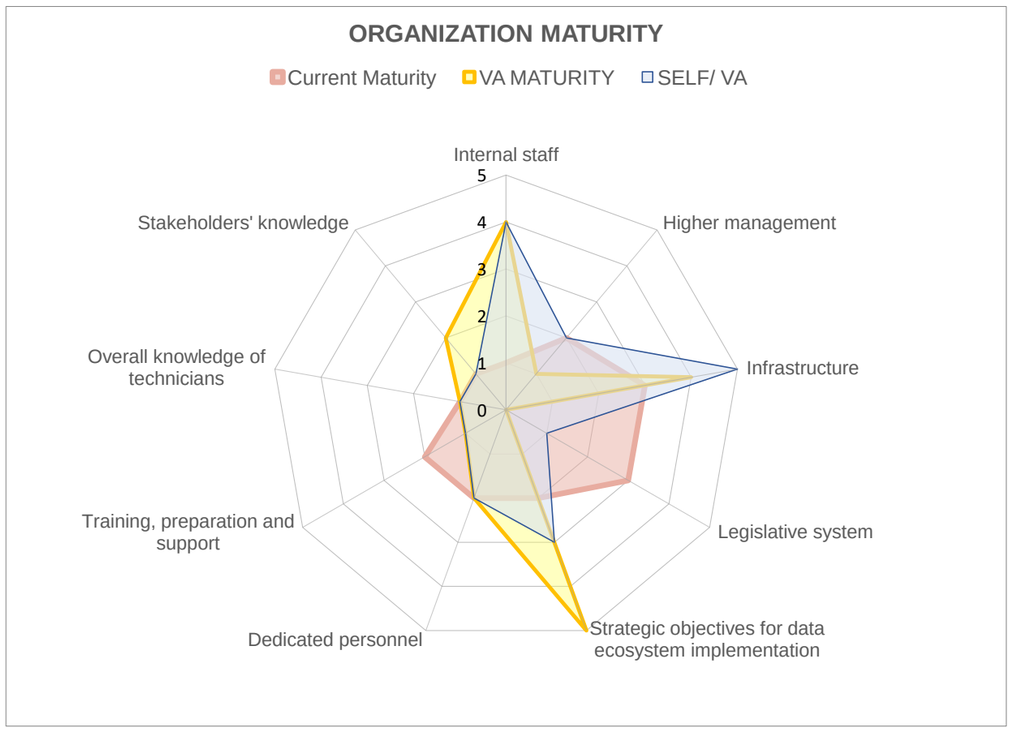
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Readiness for changes	2.4.9	Internal staff	Staff does not express openness to change or digitalisation.	Less than 25% of staff acknowledge the need for digital transformation. There is ad-hoc cooperation between limited individuals on digitalisation.	25-50% of staff participate in cross-functional team to identify digitalisation needs and benefits. Regular meetings are held to discuss digital technology opportunities.	50-75% of staff exhibit proactive mindset about adopting digital innovations. Training incorporates adaptability and readiness for new technologies.	Over 75% of staff are open to digitalisation, some participate in networks to promote digital innovation. Defined processes in place for cooperation on digital best practices.	Staff members are constantly seeking new digital innovations to improve operations. There are knowledge sharing programs across stakeholders to spread digital best practices.	1	4	4	2
Readiness for changes	2.4.10	Higher management	Management does not express openness to organisational changes or digital transformation.	The management supports the vision; however, a strategy is needed to direct the utilisation of digital process including technologies such as BIM and GIS.	There is a movement to kickstart the implementation of digital processes, including BIM, GIS, or other technology. However, the initiative starts from the bottom-up. Management does not have clear plans supporting the implementation.	The management recognises digital innovation and processes advancements including BIM, GIS, or other technology as important strategic plan for the organisation. The efforts for implementation start from a top-down approach.	Digital innovations such as BIM, GIS, and/or other technologies are a part of the IT strategy. An implementation plan of the strategic goals has been promoted at all levels in the organisation.	Digital innovation planning is fully integrated into organisational strategic planning decisions. Visionary awareness of the possibilities of the utilisation of digital technology supports the development of services provided.	2	1	2	3
Readiness for changes	2.4.11	Infrastructure	Hardware/software infrastructure is not capable of supporting required tools for the digital permitting process.	Less than 20% of infrastructure can support required software. There are limited pilot permitting software and test servers, used by less than 20% members of the staff.	20-50% of infrastructure capable of supporting required software. 20-50% of staff have access to software licenses or have it installed. There is an internal network available for file sharing.	Up to 80% of infrastructure is capable of supporting required software. All core permitting software purchased or installed. Redundant permitting servers, cloud backup, common data environment for management of data and files.	100% of hardware can run required software and platforms. All hardware/software for digital permit system fully implemented. Permits database cluster, software integration, online network enables sharing within and outside organisation.	Continuous lifecycle upgrades of hardware/software. Established program for continuous infrastructure upgrades. Regular server refreshes, software updates, new feature additions.	3	4	5	3
Readiness for changes	2.4.12	Legislative system	Not open for changes.	There is no flexibility for creating clear and easy to interpreted rules from the existing regulation. However, there might be current ongoing efforts to simplify the process.	There are a few technical requirements within rule texts that are clearly formulated. However, more than 50% of requirements are subject to human interpretation.	There is an effort at municipal level to ensure that the technical requirements in the normative texts are formulated in a clear and direct way, reducing subjective interpretation.	More than 50% of the regulation under the scope of the municipality have clear and easily interpretable normative text. Facilitating rule interpretation and simplifying the compliance checks.	There is an effort at regional or national level to minimise the subjective interpretability of the texts, facilitating the rule interpretation and simplifying the compliance checks.	3	0	1	2
Organisational structure of units	2.5.13	Strategic objectives for data ecosystem implementation	There is no implementation strategy.	Implementation is conducted without a guiding strategy. There is a lack of awareness and understanding and limited use of tools. Processes are limited integrated into the workflow, and there is a lack of standardised practices.	The implementation strategy has some specific actionable details. There is a general plan of implementation, but processes are not fully integrated and there are no formal standardised guidelines for the implementation.	The implementation strategy is accompanied by comprehensive action plans and a monitoring regime. The organisation recognises that data ecosystem encompasses technological advancements, process improvements, and policy changes.	The vision is shared by staff across the organisation and external stakeholders. The organisations seeks maximum efficiency and effectiveness in data ecosystem implementation. There is integration on process using multiple technologies, e.g. BIM-GIS.	There is a culture of innovation and continuous improvement in data ecosystem practices. The organization seeks for integrating recent innovative tools in their processes (e.g. AI, AR, data spaces).	2	5	3	4
Organisational structure of units	2.5.14	Dedicated personnel	There is no staff fully dedicated to work on BIM, GIS, or other technologies.	Up to 20% staff work part-time on BIM, GIS, or other technologies.	Small team of 3-5 staff dedicated to implementing BIM, GIS, or other technologies within the organisation and internal processes.	Multiple teams working full-time with BIM, GIS, or other technologies. Each team is dedicated to a specific part of the process or data technology. There are high individual and collective knowledge on digital processes and tools.	There is a department dedicated to digital data, such as BIM, GIS or others. With internal teams dedicated to distinct parts of the processes or technologies. There is high individual and collective knowledge, and sharing is stimulated.	There is a team inside the department working with digital process dedicated to maintaining the quality of process, data, standards, and guidelines.	2	2	2	2
Organisational structure of units	2.5.15	Training, preparation and support	There is no type of training or support.	There is a lack of dedicated training or support for technicians to resolve BIM, GIS, or other technologies related issues. There is ad hoc external training as needed. However, less than 8 hours of training per employee per year is stipulated.	There are documented training requirements for digital and data technologies related roles. Annual training is provided to staff members that work directly with BIM, GIS, or other technologies, when needed. 8-16 hours of training per employee per year is stipulated.	Training requirements are managed to meet competency and performance objectives. Regular training is provided to staff members that work directly with BIM, GIS, or other technologies. 16-24 hours of training per employee per year is stipulated.	Training plans based on roles and competencies; training program uses real work examples and lessons learned. There is support inside the organization and fostering collaboration with internal and external partners. 24-40 hours of training per employee per year.	Training is integrated into organizational strategies. On-demand training program are established to cater to the organization's needs and requirements, allowing personnel to access training resources when necessary. More than 40 hours average training per employee per year.	2	1	1	3
Social aspect	2.6.16	Overall knowledge of technicians	No technicians have knowledge or practical experience in data technology (BIM, GIS, or other).	Less than 25% have basic conceptual knowledge, minimal skills. They may have a basic understanding of concepts but lack practical skills and experience in using it.	25-50% have basic knowledge, while less than 20% have practical skills on the tools.	50-75% of staff members regularly use data tools and spatial analysis to enrich permit workflows. There is a tendence to pursue formal certifications to expand capabilities.	Over 75% have good working knowledge and skills on required data technologies with good practical skills. 20% of individuals are experts in BIM, GIS, or other technology.	50% of the technicians are experts in BIM, GIS, or other technology. They possess extensive knowledge and experience and serve as mentors or trainers for other technicians. They are constantly sharing their knowledge and expertise to build a strong digital ecosystem competency for the organisation.	1	1	1	3
Social aspect	2.6.17	Stakeholders' knowledge	None of the stakeholders work with data technologies (BIM, GIS, or other).	Up to 50% of key stakeholders use basic digital data. However, there is no data re-use throughout the process between stakeholders.	50-80% of key stakeholders use digital data such as BIM or GIS. Primarily isolated use, minimal interoperability, collaboration, and little communication or data re-use.	More than 80% of key stakeholders use shared data in a digital ecosystem. Model data is accessible to multiple stakeholders.	100% of key stakeholders use integrated digital ecosystem. All involved parties have access to the same source of information through digital data (e.g. BIM-GIS) in their specific domain.	Data fully integrated across all stakeholders and steps in process with real-time data sharing and collaboration. Data is consistent throughout the multiple stakeholders' digital ecosystem. There are metrics on data re-use and value creation.	1	2	1	2

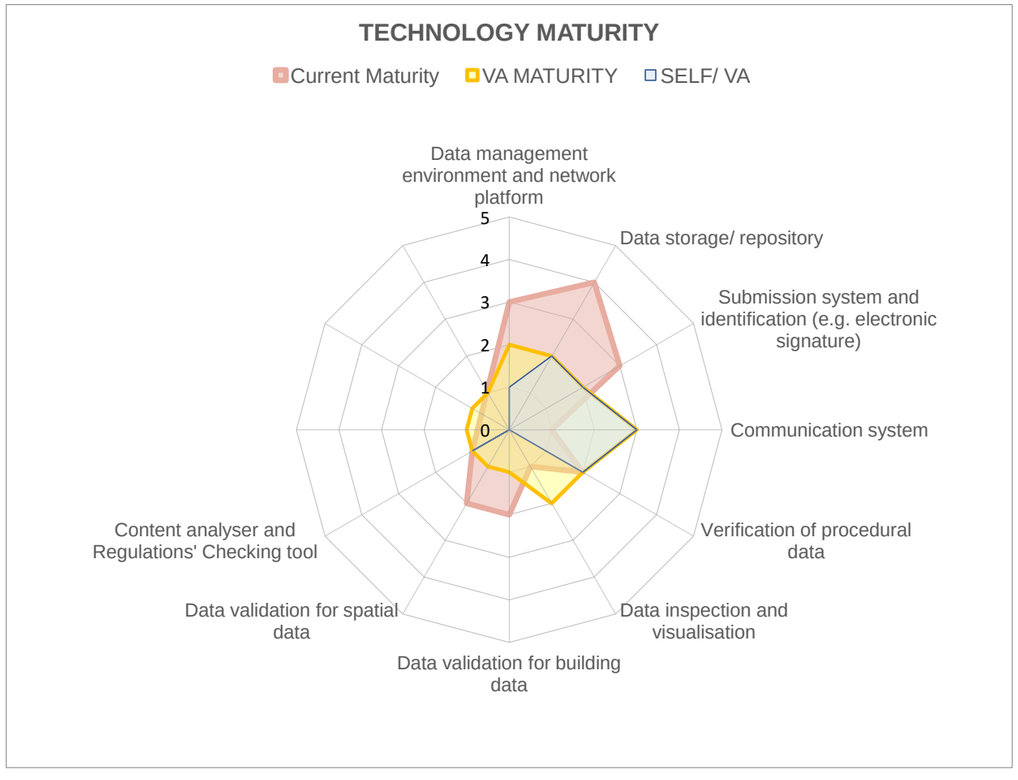
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Technology for data management	3.7.18	Data management environment and network platform	No platform support.	Digital platform only for submission, communications and data exchanges between applicant and building authority. There is no digital process for data management.	Closed or proprietary tools supporting the different steps. There is a digital tool for managing data; however, not 100% of the information is digitally accessible through it. There are different sources of data depending on the step of the process.	Modular platform. The digital tool stores and manages the data through the whole process. Staff members of the organisation have access to the same data, but external stakeholders' data is not integrated.	Open API-based microservices ecosystem. The tool for data management, works for sharing, storing and managing the data. All internal staff of the organisation can collaborate, while external stakeholders can interact with the data according to defined permissions.	Distributed data space based ecosystem. There is simultaneous working collaboration within all stakeholders of the process and automated workflows.	3	2	1	4
Technology for data management	3.7.19	Data storage/ repository	The process is analogue. Information is stored in paper files and documents.	There is a repository for files of archived processes. There are digital document storage but no centralised repository. Multiple disparate drives and shares.	There is a centralised repository for files that stores ongoing and archived processes that serves as a database and can be accessible by internal staff.	Formal data governance for repository. Lifecycle management with archiving and retention policies.	Centralised digital repository integrates all data throughout the process with backups, archiving, and governance. Integrated with data ecosystems and accessible by all stakeholders according to assigned permissions. Automated backups, archiving and governance.	There is possibility of automatising tasks and workflows in the platform within the data ecosystem increasing the effectiveness of the process. Harmonised access and structures within data space between various data hubs.	4	2	2	4
Technology for data management	3.7.20	Submission system and identification (e.g. electronic signature)	There is not a submission platform. Signature is done manually.	Documents are submitted digitally using non machine-readable formats. The signature is not machine recognisable.	Required information is submitted in a digital ecosystem, using machine-readable data. Models are electronic signed; however, other required information is not automatically verified.	Signature application is available combining all the required information but no automatic validation is performed. Internal systems are integrated with the applicant's portal, directly or via API.	Integrated validation of submission packages (required files and data). There is an application integrated in the process ecosystem that allows digitally sign correspondent submitted content.	Documents and models are digitally signed, integrated within submission process and with the ID authorities. There is automated checking of the identification validation embedded in the process.	3	2	2	3
Technology for data management	3.7.21	Communication system	The communication is done in an analogue way.	The communication is done digitally. However, there is a lack of clear channels and procedures for timely and effective communication between stakeholders.	There is a tool that allows communication internally on the organisation. However, external communication is done in a separate digital environment.	An online portal is introduced for external stakeholders to track permit status, submit documents, communicate with staff. Internal systems are integrated with the applicant's portal, directly or via API.	There is an official tool that allows communication between different stakeholders, both internally and externally to the organisation. Standard API enables communication with other external databases.	There is an official integrated tool that allows live communication between different stakeholders, both internally and externally to the organisation. Automation and digital tools are utilised to streamline communication and enhance responsiveness.	1	3	3	3
Technology for data analysis	3.8.22	Verification of procedural data	Manual inspection of physical formats and documents. Analog process.	Data can be obtained in a digital format to be verified. Electronic infrastructure available but usage of software is unmonitored and irregulated.	Digitisation of data with semi-digital verification process. Software usage is unified within organisation.	Procedural data is provided in machine readable formats. Basic analytical functionalities for data verification.	Advanced analytical functionalities for data verification. Possibility of operational and decision-making actions. Standard API enables automatic connection with databases representing different systems' information (e.g. IDs, professionals registrations and certifications, etc.).	Fully digitalised and automated verification process. Information submitted can be automatically verified against the connected databases. Procedural data is integrated in the cloud and supported by high-performance computing for decision making.	2	2	2	3
Technology for data analysis	3.8.23	Data inspection and visualisation	Manual inspection of physical models or drawings of planned objects. No use of software applications.	2D map data can be obtained to produce 2D deliverables. Proprietary Software is used to produce 2D renderings of planned objects. Usage of software is unmonitored and irregulated.	3D city models can be obtained to produce 3D deliverables. Proprietary Software is used to produce and visualize 3D models of planned objects in specified proprietary formats. Software usage is unified within an organisation or team.	Deliverables are provided in open file formats. Web-based viewers enable dynamic and seamless visualisation in 2D and 3D space by all stakeholders as well as basic analysis functionalities.	Advanced analysis functionalities for operational decision-making are introduced. Open interfaces allow for exchange of data between specialised software applications and multidisciplinary applications in a system-of-systems infrastructure.	Powerful numerical simulation through cloud and high-performance computing model the expected impacts of potential change to make evidence-based strategical decisions. Integration with immersive visualisation technologies, such as AR/VR, to support decision making for non-quantifiable phenomena (e.g. perception of safety due to urban density/lighting)	1	2	0	4
Technology for data analysis	3.8.24	Data validation for building data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data.	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	2	1	0	4

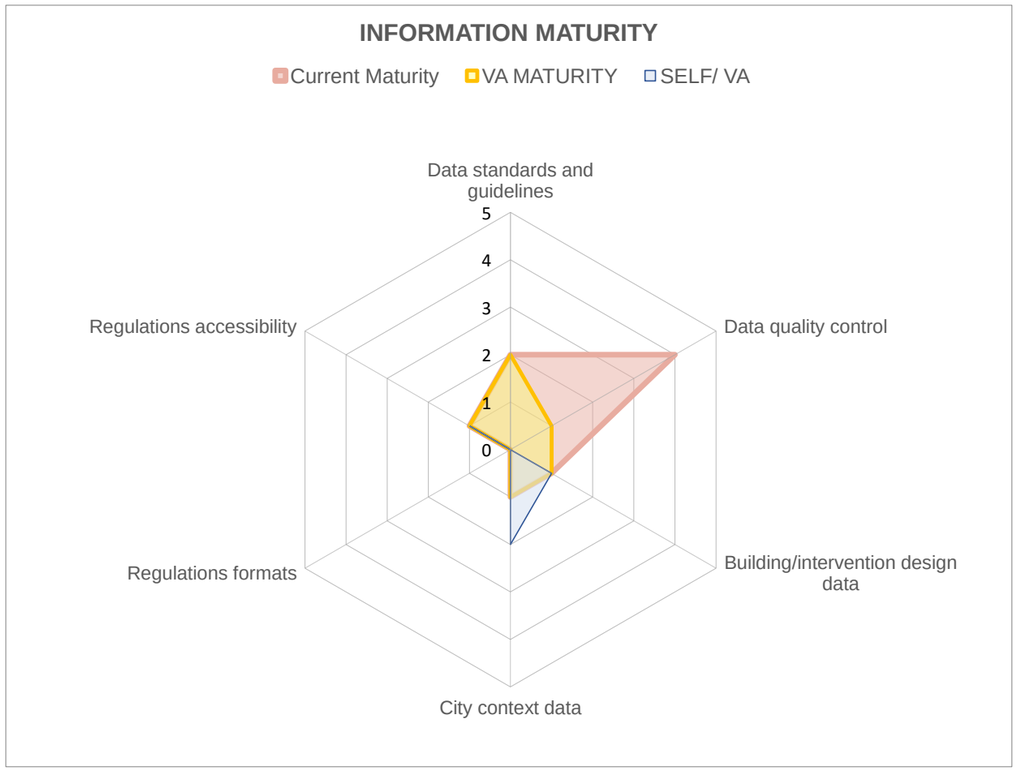
CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Technology for data analysis	3.8.25	Data validation for spatial data	There is only manual validation of the data, based on human input.	Manual validation, based on official data requirements, supported by tools that allow visualisation and manual inspection of the data (including consistency and clash-detection).	(Semi)automatic validation, based on standard-based formal data requirements	Advanced validation rules implemented with complex logic and integration. Automated notifications of issues needing manual review.	Automatic validation against machine-readable standardised data requirements.	Automatic validation against comprehensive machine-readable standardised data requirements. Support for automatic fixing the data.	2	1	0	4
Technology for data analysis	3.8.26	Content analyser and Regulations' Checking tool	Manual inspection of rules and regulations.	Manual checking, the content analysis and checking of rules is done in a digital environment; supported by data viewers or inspectors.	Semi-automatic checking of rules and regulations, based on digital building data.	Automatic checking based on digital data. Automated rule-checking is done based on project for a limited number or rules.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including mostly simple analysis.	Automatic checking based on multiple digital data, e.g. BIM-GIS, depending on the rule. Including all possible regulations and complex analysis.	1	1	1	4
Interoperability and open format	3.9.27	Data format interoperability	No use of digital formats	Use of mainly proprietary formats, reduced capacity to manage and create open format files. Limited support for exchanging data with external systems using standard formats.	Possible use of open formats; however, proprietary formats are still the main practice.	Use of open formats in internal processes is mandatory; however, there are still interoperability related issues when exchanging with external stakeholders.	Support of only open format files, following the standards and best practices for data exchange. Full capability of data exchange within the process and among the different stakeholders.	There are APIs to facilitate interoperability by establishing a common language and protocol for different systems to communicate and exchange data internally and externally.	2	1	0	5
Interoperability and open format	3.9.28	Building data to geospatial data (e.g. BIM to GIS)	No use of building or geospatial data.	Joint visualisation in a geospatial environment, with manual location of building data into geospatial data.	Joint visualisation in a geospatial environment, with correct building data georeferencing.	Conversion of building to geospatial data through semantic mapping and building data georeferencing.	Thorough automatic mapping, generalisation and conversion of building to geospatial data (georeferencing, geometry, semantics, structure).	Automatic communication and real time / on-the-flight thorough mapping, generalisation and conversion of the two models in the respective environments.	1	1	0	4
Interoperability and open format	3.9.29	Geospatial data to building data (e.g. GIS to BIM)	No use of building or geospatial data.	Joint visualisation in a building data environment, with manual location of geospatial data respect building data.	Joint visualisation of geospatial data in a building data environment, with automatic reciprocal registration.	Conversion of geospatial to building data through semantic mapping and automatic reciprocal registration.	Thorough conversion of geospatial to building data (georeferencing, geometry, semantics, structure) via manual enrichment, possibly supported by partially automated routines.	Automatic thorough mapping, enrichment and conversion using Artificial intelligence and Machine Learning methods, implying possible connection to further data sources to achieve reliable resulting building data.	1	1	0	4

CAPABILITY SET	#	KMA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	CURRENT LEVEL OF MATURITY	VA MATURITY	SELF/ VA	DESIRED LEVEL OF MATURITY (CHEK BENCHMARK)
Data standardisation and quality	4.10.30	Data standards and guidelines	There are no guidelines or data requirements specification.	Human readable data requirements specification as basic guidelines, documentation protocols or data standards.	Standard-based data requirements. There are basic guidelines for data standardisation, such as training manual and delivery standards.	Standard-based and Machine-readable data requirements. The organisational standards are aligned with industry standards.	Detailed and comprehensive standard-based and formal data requirements covering geometrical, semantical, structural, syntactical, organisational, and legal aspects enabling easy interoperability and usability.	Organisational modification to Model View Definitions and Information Delivery Manuals are balloted for inclusion in industry standards. Data standards and guidelines are fully integrated into the organisation's policies.	2	2	0	4
Data standardisation and quality	4.10.31	Data quality control	There are no quality control of data.	There are informal quality control plans.	Quality targets and performance benchmarks have been set to maintain high standards.	Proactive processes for monitoring guidelines through audits and spot checks. Metrics track quality trends.	There are comprehensive quality plans to ensure accuracy and consistency. Guidelines are tightly integrated with data validation workflows. Automated reporting on adherence and anomalies.	Quality improvement and adherence to data standards are consistently prioritised and refined. Automated feedback loop from lessons learned.	4	1	0	4
Data and information	4.11.32	Building/intervention design data	The data is analogue. Use only of 2D drawings.	2D drawings, with basic semantic data information.	Building model with geometric data and semantic data. (e.g. BIM)	Building model with standardised data.	Building data is compliant to open standard formats (e.g. IFC) and to specific standard-based data requirements (e.g. MVD, IDS etc.) including metadata.	Integrated dynamic building model. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	1	1	1	4
Data and information	4.11.33	City context data	The data are analogue. Use of only 2D maps	There is a city model; however not all model is populated with the correspondent semantic data. Use of geospatial data, e.g. GIS.	3D city model is more than 80% loaded with semantic data; however the data is not standardised.	3D semantic city model with standardised data.	Open-standard based 3D city model. Specific data requirement compliant. City model with relevant information loaded with metadata however, not linked to other data systems (e.g. BIM).	Integrated dynamic 3D city model, digital twin. Virtually all authoritative information loaded with metadata and linked to fully integration of data ecosystems.	1	1	2	4
Codes and regulation	4.12.34	Regulations formats	Natural language, needing interpretation and referring to several external laws and definitions.	Unambiguous natural language, containing the needed definitions and related rules, including exceptions. No reference to customs, priorities of different governance levels (municipal, regional, national) are clear.	Regulations are also defined as (semi)formalised language or pseudocode	Regulations are machine-readable	Regulations are machine-readable and refer to standardised information. Fully parameterised rules integrated across platforms.	There is a database used as repository of rules, allowing the creation of new rules according to the updates in the regulation.	0	0	0	2
Codes and regulation	4.12.35	Regulations accessibility	Normative texts can be consulted only in paper and/or pdf format, in the same way by both internal and external stakeholders.	The normative texts can be consulted online according to queries and through a webGIS system associating the regulations to zoning areas	The normative texts can be consulted online according to specific queries in a geographic system. Limited integration and dependencies are managed manually.	Validation rule sets formalised with version control. Central repository established with some real-time updating. Web-based portals for external access, data can be imported into checking software, directly or via APIs.	There is a tool allowing the automatised analysis of data contents and check compliances according to the defined rules. Automated synchronisation and versioning from centralised repository.	The codes are available in a machine-readable format and there are available tools to support the translation of non-translated rules, or to modify parameters in the existing available rules.	1	1	1	2


PROCESS MATURITY
Current Maturity
VA MATURITY
SELF/ VA
Understanding of the process and mapping of steps
Stakeholders are aware of process steps and required information they must provide
Benchmarks and key performance indicators
Standardised process
Data templates, use of common data formats, and documentation requirements
Timelines and response time
Accessibility of stakeholders
Transparency
0
1
2
3
4
5


ORGANIZATION MATURITY
Current Maturity
VA MATURITY
SELF/ VA
Internal staff
Higher management
Infrastructure
Legislative system
Strategic objectives for data ecosystem implementation
Dedicated personnel
Training, preparation and support
Overall knowledge of technicians
Stakeholders' knowledge
0
1
2
3
4
5


TECHNOLOGY MATURITY
Current Maturity
VA MATURITY
SELF/ VA
Data management environment and network platform
Data storage/ repository
Submission system and identification (e.g. electronic signature)
Communication system
Verification of procedural data
Data inspection and visualisation
Data validation for building data
Data validation for spatial data
Content analyser and Regulations' Checking tool
0
1
2
3
4
5


INFORMATION MATURITY
Current Maturity
VA MATURITY
SELF/ VA
Data standards and guidelines
Data quality control
Building/intervention design data
City context data
Regulations formats
Regulations accessibility
0
1
2
3
4
5

ANNEX II

ASCOLI RESULTS

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a comprehensive procedure involving multiple stakeholders, including the Applicant, the Building Authority, the Public, and Third Parties. This report provides a detailed examination of the process as it currently stands, highlighting the roles and responsibilities of each participant. The process is designed to ensure that all necessary steps are taken to comply with regulatory requirements and to facilitate the successful issuance of building permits.

Process Overview

Participant	Task/Event	Description
Applicant	Start	The process begins with the applicant initiating the procedure.
	Collect city regulatory information	The applicant gathers information from the SIT, managed by the Municipality of Ascoli Piceno.
	Collect city planning information	Similar to the previous step, the applicant collects planning information from the SIT website.
	Collect building regulatory information	The applicant gathers building regulatory information, which is issued digitally.
	Collect existing building and regulatory information	The applicant collects additional existing building and regulatory information.
	Draft initial design	The applicant drafts an initial design based on the collected information.
	Require pre-application consulting	The applicant requests pre-application consulting.
	Pre-application consulting received	The applicant receives pre-application consulting, conducted via a meeting in person or via videocall.
	Prepare Application Documents	The applicant prepares the necessary application documents.
	Fulfill fiscal obligation (pay taxes)	The applicant fulfills fiscal obligations by paying taxes.
	Pay Application Fees	The applicant pays the application fees.
	Submit application through the SUE platform	The applicant submits the application through the SUE platform.
	Collect Additional Information	If a revision is received, the applicant collects additional information.
	Resubmit application	The applicant resubmits the application if required.
	Implement required	If changes are requested, the applicant

	changes	implements the required changes.	
	Resubmit updated project	The applicant resubmits the updated project after implementing changes.	
	Fulfill final conditions	The applicant fulfills any final conditions required.	
		Pay fees	The applicant pays any additional fees.
	Send final documents	The applicant sends the final documents.	
Building Authority	Application received	The application is received through an online submission at the municipality's web portal.	
	Is the documentation complete?	The building authority checks if the documentation is complete.	
	Return application for revision	If not complete, the application is returned for revision via email or phone call.	
	Pre-application consulting request received	The building authority receives a request for pre-application consulting.	
	Provide pre-application consulting	The building authority provides pre-application consulting through a meeting in person.	
	Is external evaluation needed?	The building authority decides if an external evaluation is needed.	
	Require external evaluation	If needed, an official email is sent to the external evaluator.	
	Receive external evaluation report	The building authority receives the external evaluation report via email.	
	Are changes required?	The building authority checks if changes are required.	
	Require changes	If changes are needed, an email is sent to the applicant.	
	Receive updated project	The building authority receives the updated project uploaded by the applicant.	
	Are all checks compliant?	The building authority checks if all compliance checks are met.	
	Require changes	If not compliant, changes are required.	
	Changes accepted	If changes are accepted, the process continues.	
	All compliance checks approved	All compliance checks are approved by the technician.	
	Send final building permit proposal	The final building permit proposal is sent to the SUE platform manager.	
	Final proposal accepted	The final proposal is reviewed for	

	Final proposal accepted	The final proposal is reviewed for acceptance.	
	Building permit denied	If not accepted, the permit is denied, and the applicant is notified.	
	Approval notification sent	If approved, an approval notification is sent to the applicant.	
		Receive final documents	The building authority receives the final documents uploaded by the applicant.
	Permit Document Preparation	The responsible technician prepares the issuance document of the building permit.	
	Issue building permit	The building permit is issued digitally.	
	Update Building Permit Database	The building permit is published on the official site of the municipality.	
	Public notification	The public is notified via the municipality's public site.	
Public	Public notified	The public is notified about the building permit.	
	Is there public feedback?	The process checks if there is any public feedback.	
	Send public feedback	If there is feedback, it is sent for consideration.	
	Another process starts...	The process ends or transitions to another process based on public feedback.	
Third Parties	Request for external evaluation received	Third parties receive a request for external evaluation.	
	Evaluate project	Third parties evaluate the project.	
	Send external evaluation	The evaluation is sent back to the building authority.	
	Receive update	Third parties receive updates if any changes are made.	

Detailed Process Description

Applicant

The applicant initiates the building permit process by gathering essential regulatory and planning information from the SIT, a public site managed by the Municipality of Ascoli Piceno. This includes city regulatory, planning, and building regulatory information, as well as existing building data. With this information, the applicant drafts an initial design and requests pre-application consulting, which can be conducted in person or via videocall. Following the consultation, the applicant prepares the necessary application documents, fulfills fiscal obligations by paying taxes, and pays the application fees. The application is then submitted through the SUE platform. If revisions are required, the applicant collects additional information, implements necessary changes, and resubmits the application. The applicant ensures all final conditions are met, pays any additional fees, and sends the final documents to complete their part of the process.

Building Authority

Upon receiving the application through the municipality's web portal, the building authority verifies the completeness of the documentation. If incomplete, the application is returned for revision. The authority also handles pre-application consulting requests and determines if an external evaluation is necessary, sending official emails to external evaluators if required. Once the external evaluation report is received, the authority assesses whether changes are needed and communicates these to the applicant. The updated project is reviewed for compliance, and if all checks are approved, the final building permit proposal is sent to the SUE platform manager. The proposal is reviewed, and if accepted, an approval notification is sent to the applicant. The building authority then prepares the permit issuance document, issues the permit digitally, updates the building permit database, and notifies the public via the municipality's public site.

Public

The public is notified about the building permit through the municipality's public site. The process includes a mechanism for public feedback, which is considered if provided. Depending on the feedback, the process may end or transition to another phase.

Third Parties

Third parties are involved when an external evaluation is required. They receive requests for evaluation, assess the project, and send their evaluation back to the building authority. They are also kept informed of any updates or changes made to the project.

Conclusion

The building permit process is a meticulously structured procedure involving multiple stakeholders, each with specific roles and responsibilities. The process ensures that all necessary regulatory and compliance checks are conducted, facilitating the successful issuance of building permits. The involvement of the public and third parties adds an additional layer of scrutiny, ensuring transparency and adherence to regulations. This comprehensive approach not only streamlines the application process but also upholds the integrity of the building permit system.

Final Report: Maturity Assessment by IntelliCHEK

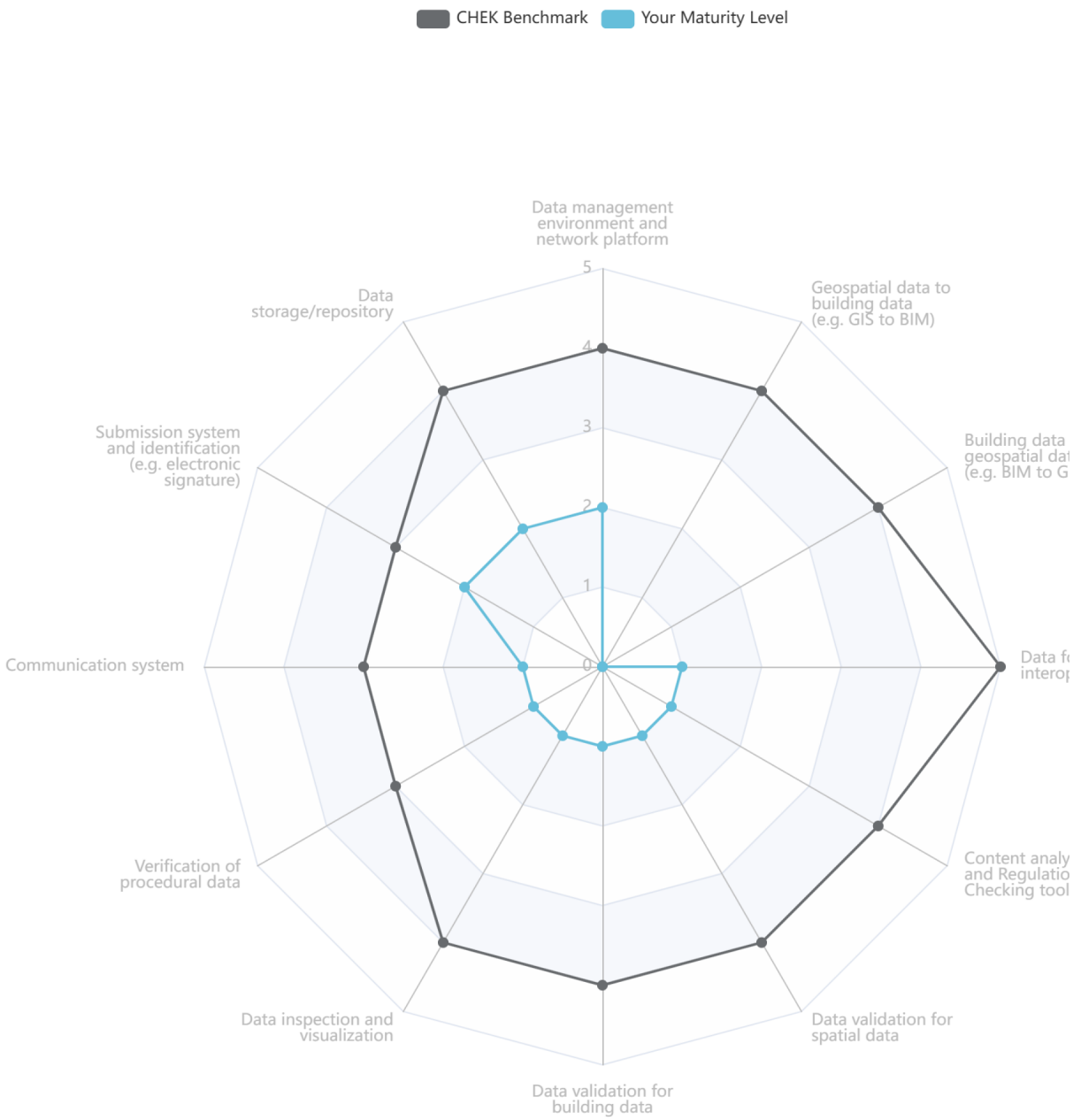
Maturity Models with Average Maturity Level

Technology (1.1)

- **Data Management Environment and Network Platform**: Level 2
  - The SUE platform facilitates submission and communication, but digital accessibility is inconsistent, with data sourced from various points in the process.
- **Data Storage/Repository**: Level 2
  - A centralized repository exists for internal staff, but lacks formal data governance and integration with broader data ecosystems.
- **Submission System and Identification**: Level 2
  - Digital submissions and electronic signatures are in place, yet automated validation of additional information is absent.
- **Communication System**: Level 1
  - Communication is primarily via email, lacking structured channels and procedures for stakeholder interaction.

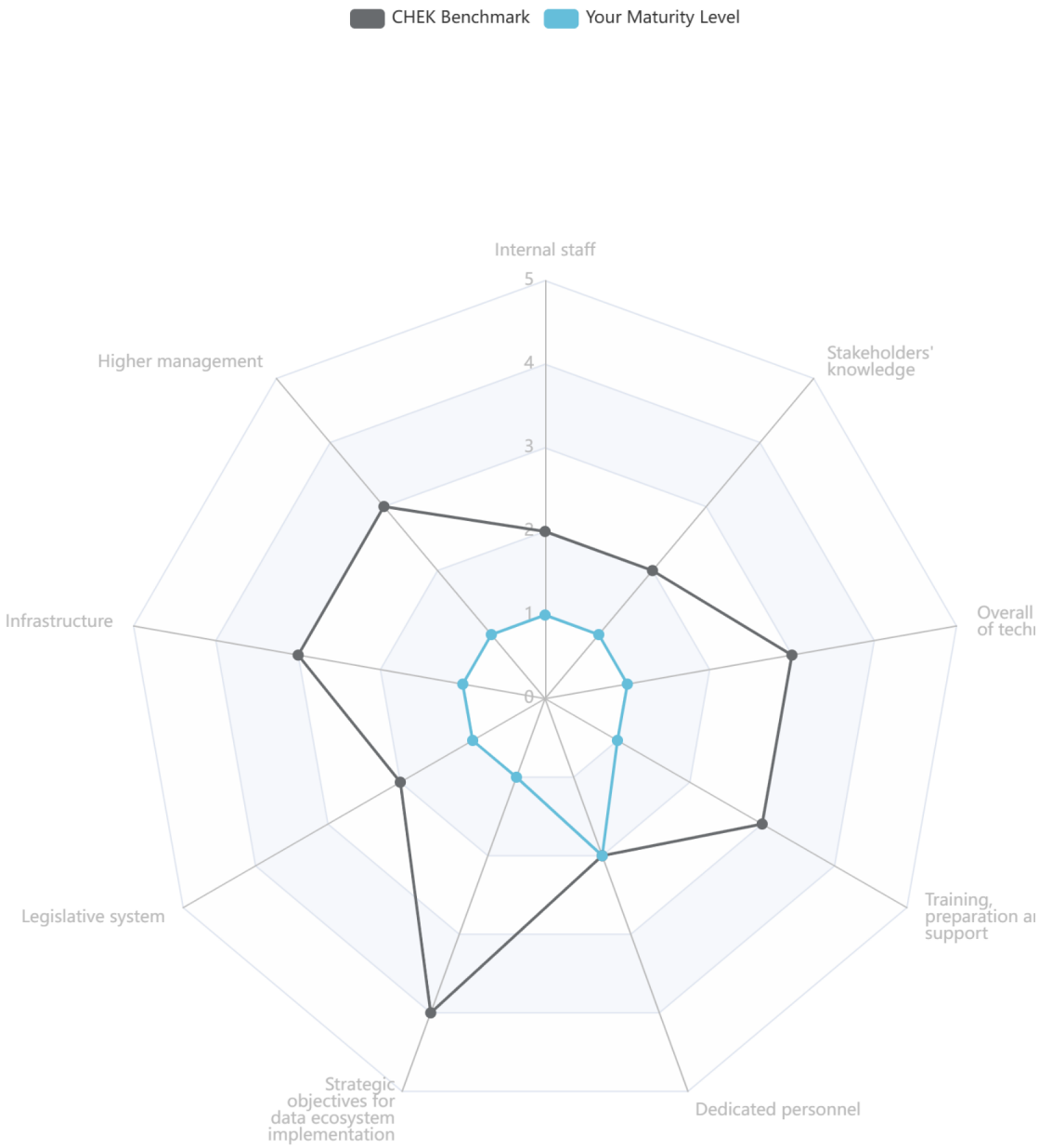
- **Verification of Procedural Data**: Level 1

- **Verification of Procedural Data**: Level 1
  - Digital data is used for verification, but without unified software or advanced analytics.
- **Data Inspection and Visualization**: Level 1
  - Visual checks are limited to 2D PDF documents, with no advanced visualization tools.
- **Data Validation for Building and Spatial Data**: Level 1
  - Both rely on manual validation against official requirements, with basic visualization tools.
- **Content Analyser and Regulations' Checking Tool**: Level 1
  - Manual content analysis and rule checking are supported by digital viewers.
- **Data Format Interoperability**: Level 1
  - Predominantly proprietary formats are used, with limited open format management.
- **Building to Geospatial Data and Vice Versa**: Level 0
  - No integration between building and geospatial data is reported.



Information (0.5)

- **Data Quality Control**: Level 0
    - No structured quality control measures or plans are in place.
- **Building/Intervention Design Data**: Level 0
    - No use of building models or BIM is reported.
- **City Context Data**: Level 1
    - Digital access to city regulatory and planning information exists, but lacks 3D modeling or semantic data.
- **Data Standards and Guidelines**: Level 1
    - Basic human-readable guidelines and documentation protocols are available.
- **Regulations Formats**: Level 0
    - Regulations are in natural language, requiring interpretation and cross-referencing.
- **Regulations Accessibility**: Level 1
    - Normative texts are accessible online, linked to zoning areas via a webGIS system.

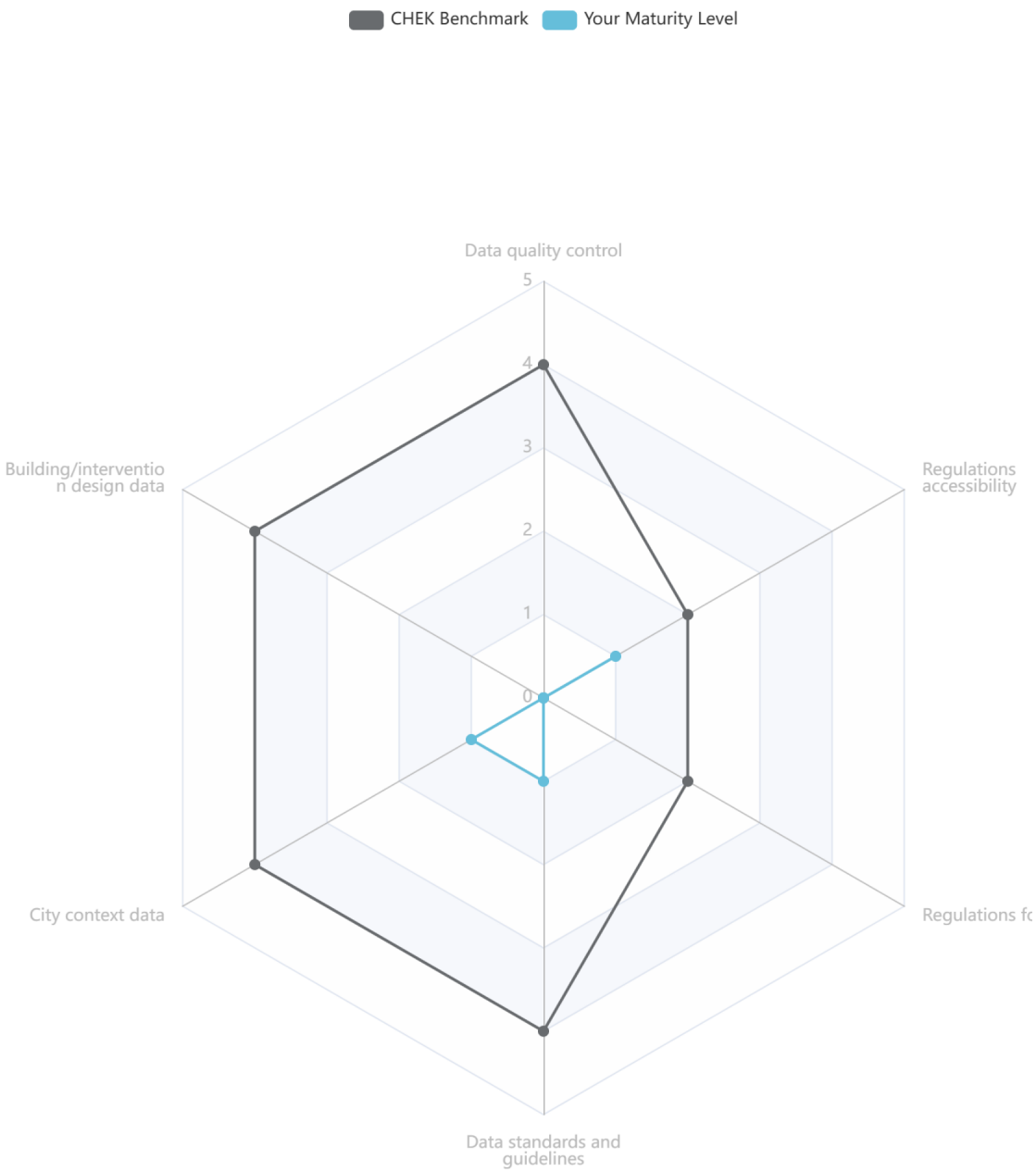


Process (1.4)

- **Understanding of the Process and Mapping of Steps**: Level 2
  - Detailed documentation and initial digital definitions are present, supported by the SUE platform.
- **Stakeholder Awareness**: Level 2
  - Clear guidelines and standards facilitate stakeholder understanding, aided by the SUE platform.
- **Benchmarks and Key Performance Indicators**: Level 0
  - No formal quality control plans or performance benchmarks are provided.
- **Standardised Process**: Level 2
  - Guidelines support technicians with specific checks at each step.
- **Data Templates and Documentation**: Level 3
  - Internal standardization is evident, though external compliance and quality control are not mentioned.
- **Timelines and Response Time**: Level 0
  - No information on timelines or response times is provided.
- **Accessibility of Stakeholders**: Level 3
  - Automated workflows and notifications enhance stakeholder accessibility.

- **Transparency**: Level 3

- **Transparency**: Level 3
    - Real-time tracking and notifications improve transparency.



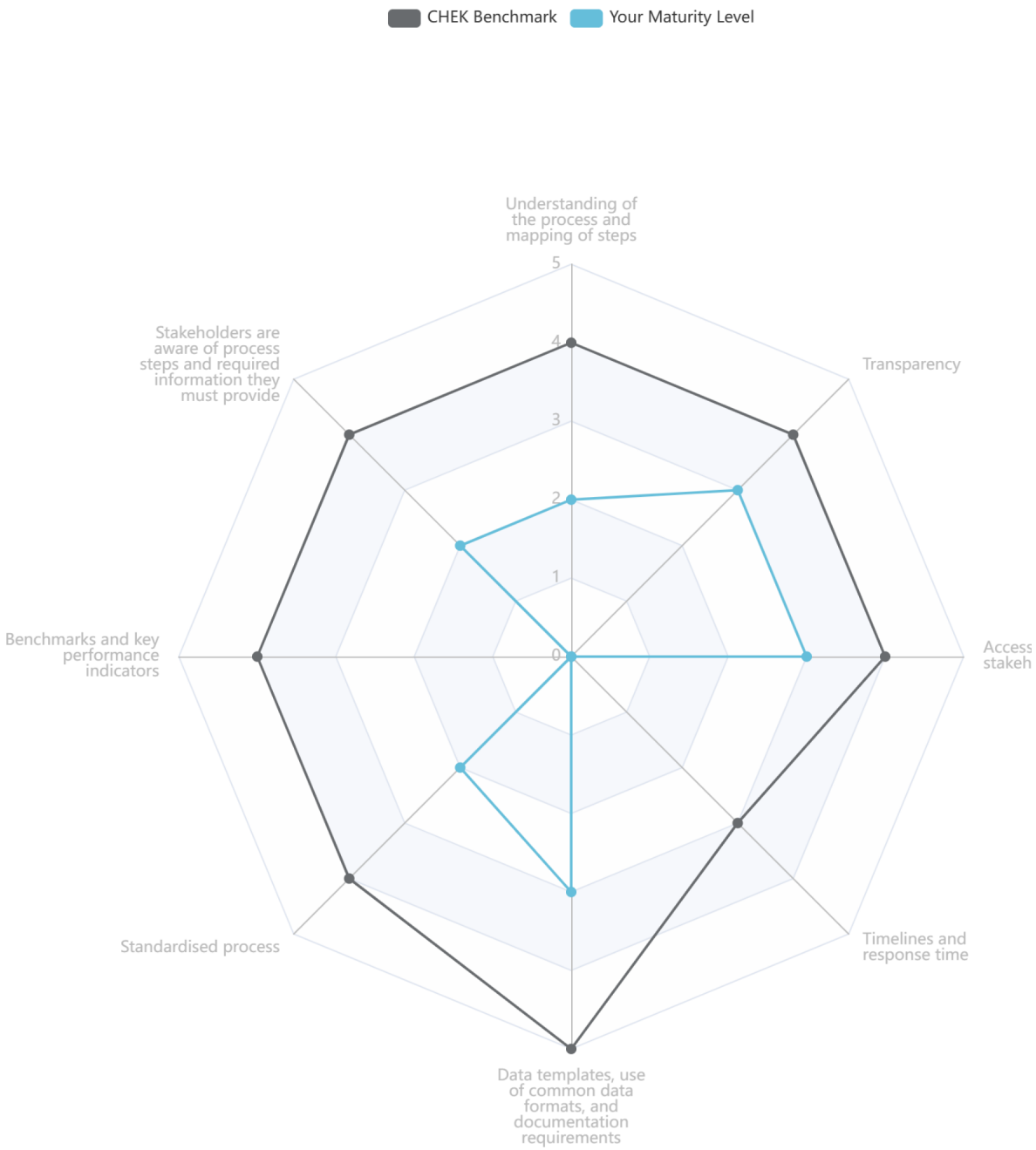
Organization (1.1)

- **Internal Staff**: Level 1
    - Less than 25% acknowledge digital transformation needs, with ad-hoc digitalization efforts.
- **Higher Management**: Level 1
    - Management supports digital vision but lacks strategic implementation for BIM and GIS.
- **Infrastructure**: Level 1
    - Limited infrastructure supports necessary software, with pilot programs used by a minority.
- **Legislative System**: Level 1
    - Efforts to simplify processes exist, but rules remain inflexible and complex.

- **Strategic Objectives for Data Ecosystem**: Level 1

- Implementation lacks strategy, with limited tool integration and standardization.

- **Dedicated Personnel**: Level 2
  - A small team is dedicated to implementing digital technologies.
- **Training and Support**: Level 1
  - Minimal training and support, with less than 8 hours of training per employee annually.
- **Overall Knowledge of Technicians**: Level 1
  - Basic conceptual knowledge is limited to less than 25% of technicians.
- **Stakeholders' Knowledge**: Level 1
  - Up to 50% of stakeholders use basic digital data, with no data re-use.



Conclusion

The maturity assessment of the building permit process indicates a nascent stage of digital transformation, with significant room for improvement across all dimensions. The current system is predominantly analogue with some digital integration, particularly in the Process dimension. To advance the maturity levels, there is a need for enhanced digital integration, standardization, and strategic planning. Focus should be placed on developing a comprehensive digital strategy, improving data governance, and increasing stakeholder engagement and training to support a more robust digital transformation.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Benchmarks and Key Performance Indicators	2026-01-01	2026-12-31	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Internal Staff	2025-01-01	2025-03-31	None	Make online trainings	CHEK training package
Higher Management	2025-01-01	2025-06-30	None	Create strategic plan	Municipality's domain
Infrastructure	2025-04-01	2025-09-30	Have process map	Define current situation of hardware infrastructure	Municipality's domain
Legislative System	2025-01-01	2025-03-31	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2025-12-31	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2025-12-31	2025-12-31	None	Chek benchmark level reached	None
Training, Preparation and Support	2026-01-01	2026-06-30	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2026-07-01	2026-12-31	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2027-01-01	2027-03-31	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2027-04-01	2027-09-30	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2027-10-01	2027-12-31	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2028-01-01	2028-06-30	Use BIMserver.centre for BIM and GIS, Integrate IFC signature	Connect web portal	BIM Server Centre

Verification of Procedural Data	2028-07-01	2028-12-31	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS	
	Data Validation for Building Data	2029-01-01	2029-09-30	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2029-10-01	2030-06-30	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard	
Content Analyser and Regulations' Checking Tool	2030-07-01	2031-03-31	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban	
Data Format Interoperability	2031-04-01	2032-03-31	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS	
Building Data to Geospatial Data (e.g. BIM to GIS)	2032-04-01	2033-03-31	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit	
Geospatial Data to Building Data (e.g. GIS to BIM)	2033-04-01	2034-03-31	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC	
Data Quality Control	2034-04-01	2035-03-31	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material	
Building/Intervention Design Data	2035-04-01	2036-03-31	Use CHEK rules repository	Use CHEK IDS	CHEK IDS	
City Context Data	2036-04-01	2037-03-31	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS	
Data Standards and Guidelines	2037-04-01	2038-03-31	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS	
Regulations Formats	2038-04-01	2038-09-30	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool	
Regulations Accessibility	2038-10-01	2038-12-31	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material	

	Understanding of the Process and Mapping of Steps	2025-01-01	2025-06-30	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-07-01	2025-12-31	Have process map	Implement tracking platform	CHEK Guidelines and support material	
Standardised Process	2027-01-01	2027-06-30	Implement tracking platform	Create guidelines	CHEK Guidelines and support material	
Data Templates, Use of Common Data Formats, and Documentation Requirements	2027-07-01	2027-12-31	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material	
Timelines and Response Time	2028-01-01	2028-09-30	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material	
Accessibility of Stakeholders	2028-10-01	2028-12-31	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre	
Transparency	2029-01-01	2029-03-31	Implement data sharing	Connect stakeholders	BIM Server Centre	

Conclusion

The roadmap outlined above provides a comprehensive plan for achieving the desired benchmark values through a series of strategic actions and dependencies. Each step is designed to build upon the previous one, ensuring a cohesive and integrated approach to reaching the final objectives. The use of CHEK tools and guidelines throughout the process will facilitate the implementation and monitoring of each phase, ensuring that all stakeholders are aligned and informed. This structured approach will ultimately lead to improved data management, interoperability, and quality control, setting a solid foundation for future advancements in building permit processes.

APPLICANT
BUILDING AUTHORITY
THIRD PARTIES
PUBLIC
Start
Collect city regulatory information
Collect city planning information
Collect building regulatory information
Collect existing building and regulatory information
Draft initial design
Require pre-application consulting
Pre-application consulting received
Prepare Application Documents
Fulfill fiscal obligation (pay taxes)
Pay Application Fees
Submit application through the SUE platform
Revision received
Collect Additional Information
Resubmit application
Receive request for changes
Implement required changes
Resubmit updated project
Receive request for changes
Implement required changes
Resubmit updated project
Approval notification received
Fulfill final conditions
Pay fees
Send final documents
Building permit issued
City regulatory information
City planning information
Building regulatory information
Pre-application consulting request received
Provide pre-application consulting
Check documentation completeness
Application received
Issue application number
Assign responsible technician for the process
Check compliance with regulations
Application received
Check administrative requirements
Check compliance with building regulation
Check compliance with urban regulation
Return application for revision
No
Is the documentation complete?
Check compliance with regulations
Check landscape and archeological compliance
Check compliance with fire and safety regulation
Check hidrological and geolological report
Check compliance with regulations
YES
Is the documentation complete?
NO
Is external evaluation needed
Yes
Require external evaluation
Receive external evaluation report
Are changes required?
Yes
No
Require changes
No project changes required
Receive updated project
Changes sent to the external evaluators
Receive external evaluation report
YES
NO
Changes accepted
Building permit denied
Are all checks compliant?
No
Require changes
Receive updated project
No
Are changes accepted?
Yes
Changes accepted
all compliant
IS all compliant?
YES
NO
All compliance checks approved
Building permit denied
Send final building permit proposal
Final proposal accepted
Building permit denied
Building permit approved
Approval notification sent
Receive final documents
Permit Document Preparation
Issue building permit
Update Building Permit Database
Public notification
End
Request for external evaluation received
Evaluate project
Send external evaluation
Receive update
Evaluate project
Send external evaluation
Public notified
Is there public feedback?
Send public feedback
Another process starts...

LISBON RESULTS

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a comprehensive and intricate procedure involving multiple stakeholders, including the Applicant, Building Authority, Public, and Third Parties. This report provides a detailed examination of the process, highlighting the tasks and events for each participant. The process ensures that building permit applications are meticulously reviewed, evaluated, and either approved or denied based on compliance with regulations and the completeness of documentation.

Process Overview

Participant	Task/Event	Description
Applicant	Start	The process begins for the applicant.
	Collect city regulatory information	The applicant gathers information about city regulations.
	Collect building regulatory information	The applicant collects information about building regulations.
	Collect existing building and regulatory information	The applicant gathers information on existing buildings and regulations.
	Draft initial design	The applicant drafts an initial design for the project.
	Require pre-application consulting	The applicant requests pre-application consulting.
	Pre-application consulting received	The applicant receives pre-application consulting.
	Prepare Application Documents	The applicant prepares the necessary application documents.
	Fulfill fiscal obligation (pay taxes)	The applicant pays the required taxes.
	Pay Application Fees	The applicant pays the application fees.
	Geolocate the plot	The applicant geolocates the plot for the project.
	Submit application	The applicant submits the application.
	Revision received	The applicant receives a revision request.
	Collect Additional Information	The applicant collects additional information as required.

	Resubmit application	The applicant resubmits the application.	
	Receive request for changes	The applicant receives a request for changes.	
	Implement required changes	The applicant implements the required changes.	
	Resubmit updated project	The applicant resubmits the updated project.	
	Approval notification received	The applicant receives the approval notification.	
Building Authority	Application received	The building authority receives the application.	
	Preliminary assessment of documentation	A technician checks the administrative and architectural documents.	
		Is the documentation complete?	The building authority checks if the documentation is complete.
	Request for information	The building authority requests more information from the applicant.	
	Provide pre-application consulting	The building authority provides pre-application consulting via email.	
	Require external evaluation	The building authority requires an external evaluation using the E-URBAN platform.	
	Are changes accepted?	The building authority checks if the changes are accepted.	
	Check compliance with specialities	The building authority checks compliance with specialities.	
	Receive updated project	The building authority receives the updated project.	
	Require missing document	The building authority requests missing documents from the applicant.	
	Receive additional documents	The building authority receives additional documents.	
	Acceptance of the project	The building authority accepts the project.	
	All checks approved	The building authority approves all checks.	
	Approval notification sent	The building authority sends the approval notification.	
	Building permit approved	The building authority approves the building permit.	

	Permit Document Preparation	The building authority prepares the permit document.			
	Issue building permit	The building authority issues the building permit.			
Third Parties	Request for external evaluation received	Third parties receive a request for external evaluation.			
			Evaluate project	Third parties evaluate the project.	
	Send external evaluation	Third parties send the external evaluation report.			

Detailed Process Description

Applicant

The applicant initiates the building permit process by gathering essential regulatory information, including city and building regulations, as well as data on existing structures. This foundational knowledge is crucial for drafting an initial design that aligns with local requirements. Recognizing the complexity of the process, the applicant seeks pre-application consulting to ensure compliance and address potential issues early on.

Upon receiving guidance, the applicant meticulously prepares the application documents, fulfilling fiscal obligations such as paying taxes and application fees. The geolocation of the project plot is a critical step, ensuring accurate representation in the application. Once the application is submitted, the applicant remains engaged, responding promptly to revision requests and implementing necessary changes. This iterative process of resubmission and revision underscores the applicant's commitment to meeting regulatory standards. Ultimately, the applicant receives the coveted approval notification, signifying the successful navigation of the permit process.

Building Authority

The building authority plays a pivotal role in the permit process, commencing with the receipt and preliminary assessment of the application. A thorough review of administrative and architectural documents ensures completeness and compliance. Should any deficiencies be identified, the authority promptly requests additional information or documents from the applicant.

Pre-application consulting is provided to guide applicants through the regulatory landscape, while external evaluations via the E-URBAN platform offer an objective assessment of the project. The authority meticulously checks compliance with specialized requirements, ensuring that all aspects of the project adhere to established standards.

Upon receiving updated submissions, the authority conducts a final review, culminating in the acceptance of the project. The approval process is comprehensive, involving multiple checks and balances to safeguard public interest and regulatory compliance. Once all criteria are met, the authority prepares and issues the building permit, formally authorizing the commencement of construction.

Third Parties

Third parties are integral to the evaluation process, providing an external perspective on the project's feasibility and compliance. Upon receiving a request for evaluation, these entities conduct a thorough assessment, leveraging their expertise to identify potential issues or areas for improvement. The external evaluation report is a critical component of the decision-making process, informing the building authority's final determination.

Conclusion

The building permit process is a multifaceted procedure that demands collaboration and diligence from all participants. The applicant's proactive engagement, coupled with the building authority's rigorous oversight and the third parties' expert evaluations, ensures that projects meet the highest standards of safety and compliance. This comprehensive approach not only facilitates the approval of building permits but also upholds the integrity of the built environment, fostering sustainable and responsible development.

Final Report: Maturity Assessment by IntelliCHEK

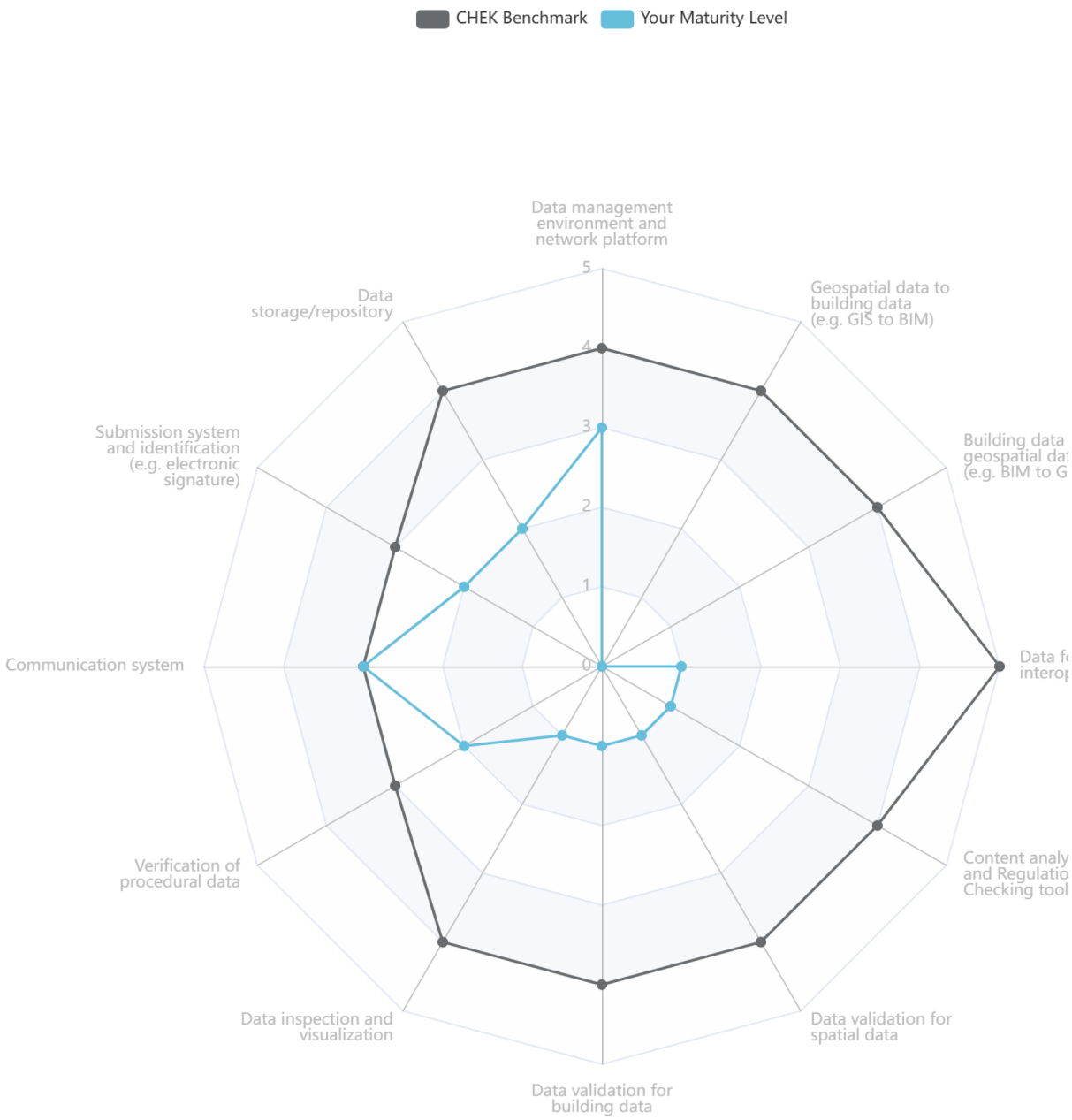
Maturity Models with Average Maturity Level

Technology (1.36)

- **Data Management Environment and Network Platform**: Level 3
  - The use of a centralized document management system and an online portal indicates a modular platform with data accessibility for staff, though not fully integrated with external stakeholders.
- **Data Storage/Repository**: Level 2
  - A centralized system exists, but lacks formal data governance and integration with broader data ecosystems.
- **Submission System and Identification**: Level 2
  - Online submission and digital document handling are present, but electronic signatures and automated validation are absent.
- **Communication System**: Level 3
  - A mature system with an online portal for external communication and integrated internal systems.
- **Verification of Procedural Data**: Level 2
  - Semi-digital verification without advanced analytics or automatic database connections.
- **Data Inspection and Visualization**: Level 1
  - Basic digital inspection with PDF document checks, lacking advanced visualization tools.
- **Data Validation for Building and Spatial Data**: Level 1
  - Manual validation based on official requirements, with no automated support.
- **Content Analyser and Regulations' Checking Tool**: Level 1
  - Manual analysis and rule checking in a digital environment, lacking automation.
- **Data Format Interoperability**: Level 1
  - Limited to PDF format, indicating restricted interoperability.
- **Building to Geospatial Data Integration**: Level 0
  - No integration between building and geospatial data.

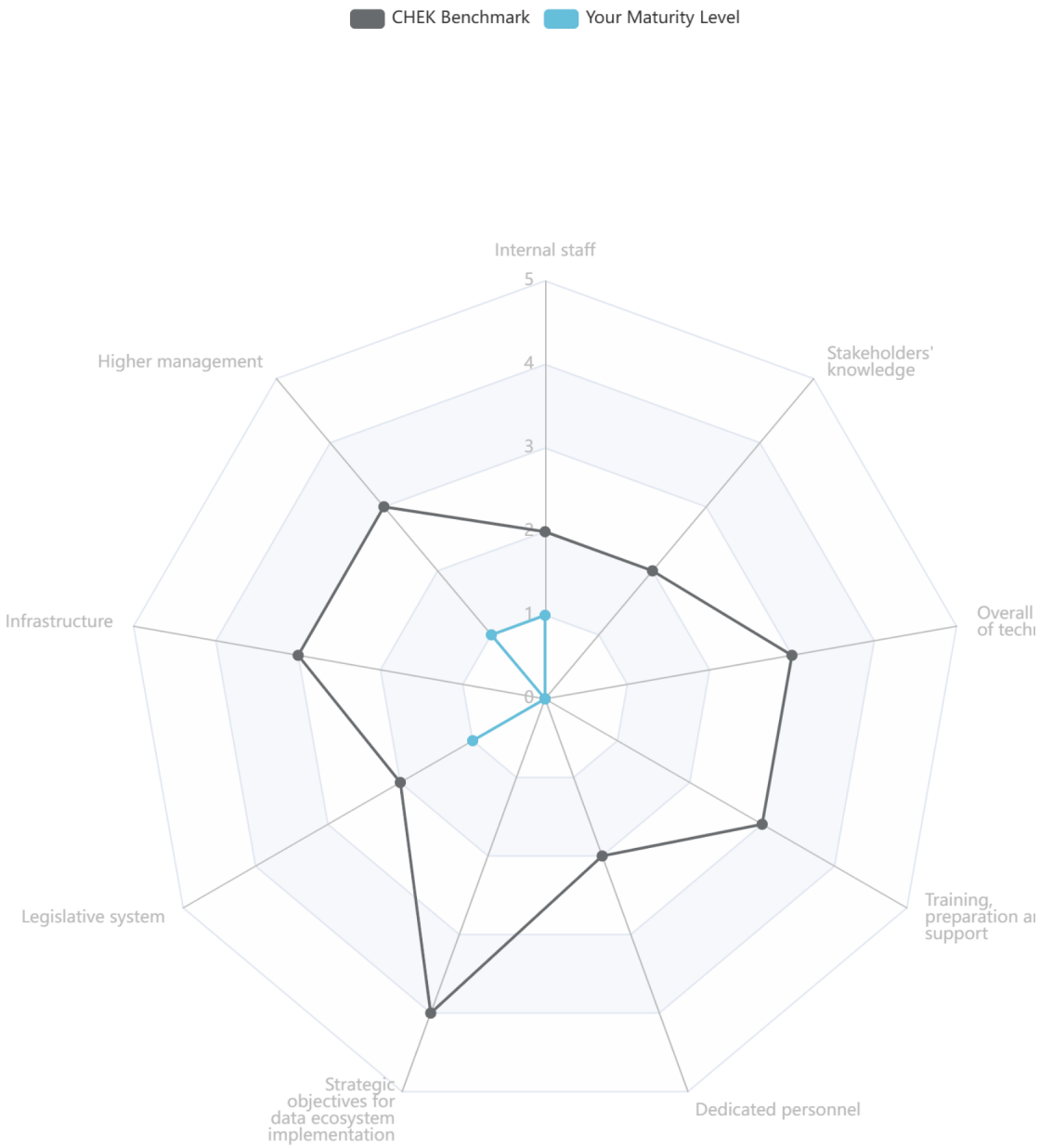
- **Geospatial to Building Data Integration**: Level 0

- **Geospatial to Building Data Integration**: Level 0
  - No integration between geospatial and building data.



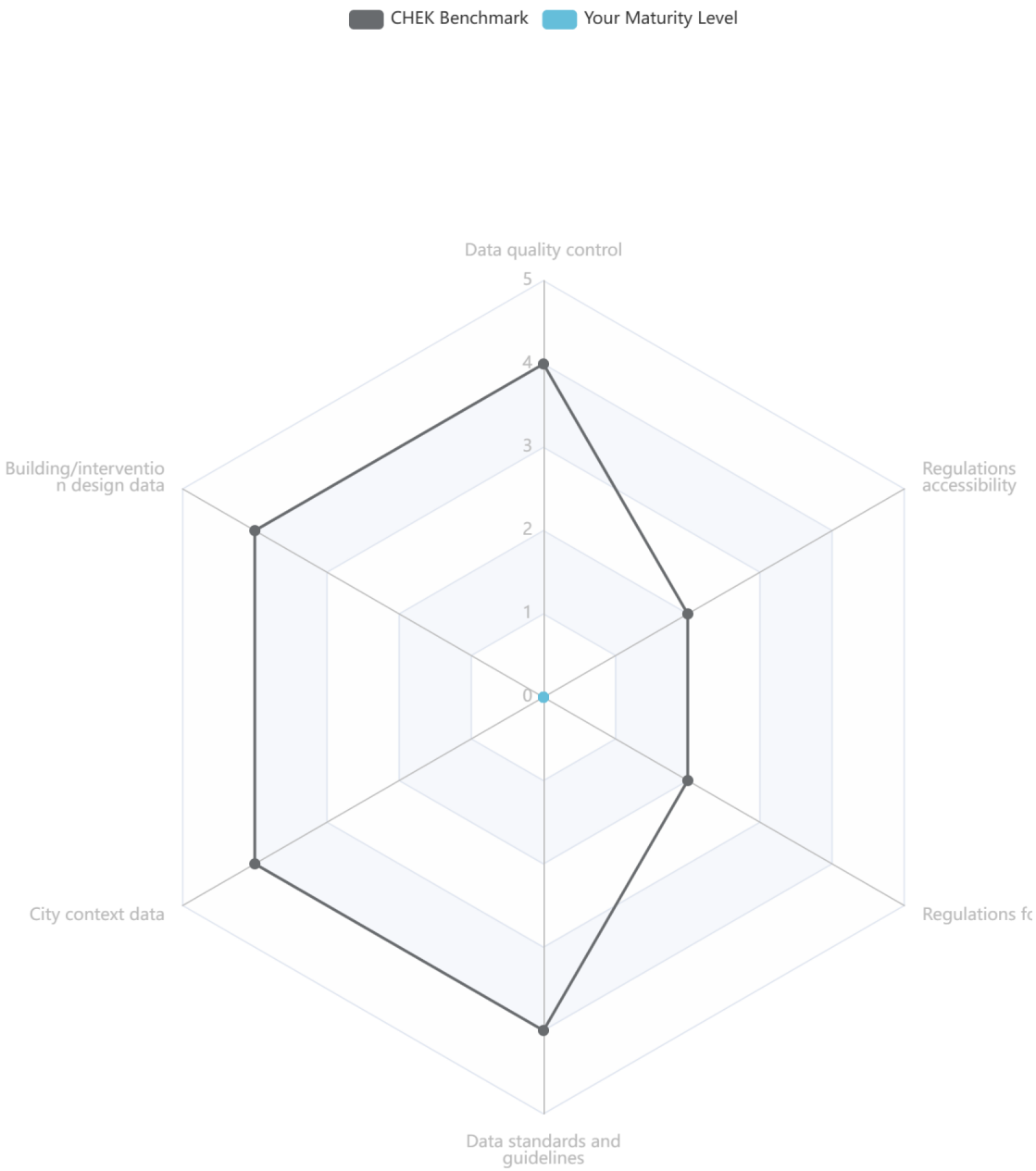
Information (0.0)

- **Data Quality Control**: Level 0
  - No structured quality control measures or performance benchmarks.
- **Building/Intervention Design Data**: Level 0
  - Initial design drafts are mentioned, but no use of standardized formats like 2D drawings or BIM.
- **City Context Data**: Level 0
  - Geolocation of plots is mentioned, but no use of GIS or 3D city models.
- **Data Standards and Guidelines**: Level 0
  - Absence of guidelines or data requirements.
- **Regulations Formats and Accessibility**: Level 0
  - Regulations are in natural language, requiring interpretation, and accessible only in paper/PDF format.



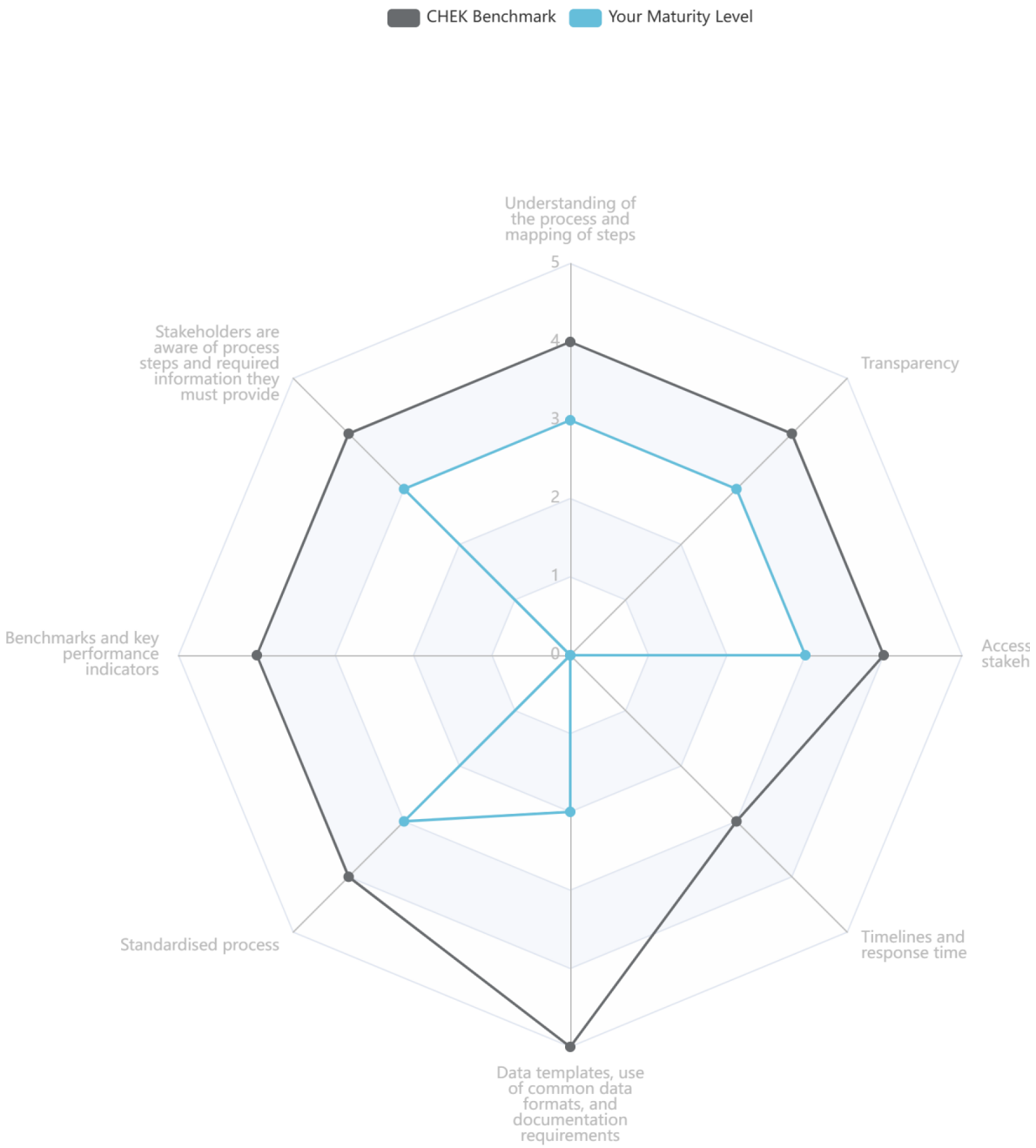
Process (2.0)

- **Understanding and Mapping of Steps**: Level 3
  - Detailed mapping of tasks and events in a digital environment, though not fully implemented.
- **Stakeholder Awareness**: Level 3
  - Comprehensive documentation and checklists support stakeholder self-service.
- **Benchmarks and KPIs**: Level 0
  - No information on quality control plans or KPIs.
- **Standardized Process**: Level 3
  - Comprehensive guidance through urban planning and construction phases.
- **Data Templates and Documentation**: Level 2
  - Some standardization efforts, but a single standard is not yet achieved.
- **Timelines and Response Time**: Level 0
  - No information on timelines or response times.
- **Accessibility and Transparency**: Level 3
  - Automated workflows and real-time tracking improve accessibility and transparency.



Organization (0.4)

- **Internal Staff and Higher Management**: Level 1
    - Limited acknowledgment of digital transformation needs and lack of strategic utilization of digital processes.
- **Infrastructure**: Level 0
    - Inadequate hardware/software infrastructure.
- **Legislative System**: Level 1
    - Efforts to simplify processes, but rules remain inflexible.
- **Strategic Objectives and Dedicated Personnel**: Level 0
    - No strategy or dedicated staff for data ecosystem implementation.
- **Training and Knowledge**: Level 0
    - No training or support, and lack of knowledge in data technology among technicians and stakeholders.



Conclusion

The maturity assessment of the building permit process reveals a moderate level of digitization in the technology and process dimensions, with significant gaps in information management and organizational readiness. The findings suggest that while there are some advancements in digital platforms and process standardization, there is a critical need for strategic planning, infrastructure enhancement, and capacity building. To advance the digitization of building permit processes, it is essential to address the deficiencies in information management and organizational support, ensuring a comprehensive approach to digital transformation.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-03-31	None	Make online trainings	CHEK training package
Higher Management	2025-01-01	2025-06-30	None	Create strategic plan	Municipality's domain
Infrastructure	2025-04-01	2025-09-30	Have process map	Define current situation of hardware infrastructure	Municipality's domain
Legislative System	2025-01-01	2025-03-31	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2026-06-30	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2026-07-01	2026-12-31	Share strategic vision	Create BIM/GIS groups	Municipality's domain
Training, Preparation and Support	2027-01-01	2027-06-30	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2027-07-01	2027-12-31	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2027-07-01	2027-12-31	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2028-01-01	2028-03-31	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2028-04-01	2028-06-30	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2028-07-01	2028-07-01	None	Chek benchmark level reached	Chek benchmark level reached
Verification of Procedural Data	2028-04-01	2028-06-30	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for	2028-07-	2028-	Implement	Implement	BIM Server

Building Data	01	12-31	visualisation tool, Use CHEK IDS	validation tool for BIM	Centre Validation, Verify 3D
Data Validation for Spatial Data	2028-07-01	2028-12-31	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and Regulations' Checking Tool	2029-01-01	2029-06-30	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2029-07-01	2030-06-30	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g. BIM to GIS)	2030-07-01	2031-06-30	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g. GIS to BIM)	2030-07-01	2031-06-30	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2028-07-01	2029-06-30	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2029-07-01	2030-06-30	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2029-07-01	2030-06-30	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2026-07-01	2027-06-30	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2025-04-01	2025-09-30	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2025-10-01	2026-03-31	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-03-31	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-04-01	2025-06-30	Have process map	Implement tracking platform	CHEK Guidelines and support material

Benchmarks and Key Performance Indicators	2025-07-01	2026-06-30	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material	
Standardised Process	2025-07-01	2025-09-30	Implement tracking platform	Create guidelines	CHEK Guidelines and support material	
Data Templates, Use of Common Data Formats, and Documentation Requirements	2025-10-01	2026-03-31	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material	
	Timelines and Response Time	2026-04-01	2026-09-30	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material
Accessibility of Stakeholders	2026-10-01	2026-12-31	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre	
Transparency	2027-01-01	2027-03-31	Implement data sharing	Connect stakeholders	BIM Server Centre	

Conclusion

The roadmap outlined above provides a comprehensive plan to achieve the benchmark value through a series of strategic actions and the use of specific CHEK tools. Each step is designed to build upon the previous one, ensuring a structured and efficient approach to reaching the desired outcomes. The integration of technology, training, and strategic planning is crucial in this process, and the use of CHEK tools will facilitate the implementation and monitoring of each phase. By following this roadmap, the organization can ensure a successful transition to a more efficient and effective data management and building permit process.


APPLICANT
Start
Collect city regulatory information
Collect building regulatory information
Collect existing building and regulatory information
Draft initial design
Require pre-application consulting
Pre-application consulting received
Prepare Application Documents
Fulfill fiscal obligation (pay taxes)
Pay Application Fees
Geolcate the plot
Submit application
Revision received
Collect Additional Information
Resubmit application
Receive request for changes
Implement required changes
Resubmit updated project
Receive request for changes
Implement required changes
Resubmit updated project
Approval notification received
BUILDING AUTHORITY
Municipality regulatory information
Building regulatory information
Request for information
Provide pre-application consulting
Issue process number
Application received
Assign responsible technician for the process
Application received
Preliminary assessment of documentation
Return application for revision
No
Is the documentation complete?
NO
Building permit denied
Yes
Accept application
Application Status updated in the platform
Further evaluation needed?
No
Yes
Require external evaluation
Receive external evaluation report
Internal evaluations
Check compliance with regulations
Check compliance with building regulation
Check compliance with urban regulation
Check compliance with regulations
Are all checks compliant?
No
Require changes
Receive updated project
Are changes accepted?
No
Yes
Changes accepted
Yes
Check compliance with specialities
Check documentation of specialities
Is all the documentation of the specialities submitted?
No
Rrequire missing document
Receive additional documents
Are changes accepted?
No
Yes
Changes accepted
Yes
Acceptance of the project
All checks approved
Building permit approved
Approval notification sent
Permit Document Preparation
Issue building permit
End
THIRD PARTIES
Request for external evaluation received
Evaluate project
Send external evaluation
PUBLIC

PRAGUE RESULTS

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a multifaceted procedure involving several key participants: the Applicant, the Building Authority, the Public, and Third Parties. Each participant plays a crucial role in ensuring that the building permit is processed efficiently and in compliance with all relevant regulations. This report provides a comprehensive overview of the current process, detailing the specific tasks and interactions required from each participant. The process is characterized by a series of document submissions, reviews, and consultations, both in-person and through physical documentation. The following sections outline the detailed steps involved for each participant, culminating in a final assessment and decision regarding the building permit.

Table of Tasks and Descriptions

Participant	Task	Description
Applicant	Start	Collect city regulatory information by visiting the municipality for project details.
Applicant	Collect City Planning Information	Gather city planning information through physical documents and in-person meetings.
Applicant	Collect Building Regulatory Information	Obtain building regulatory information online and through specific inquiries at the municipality.
Applicant	Collect Existing Building and Regulatory Information	Gather existing building and regulatory information.
Applicant	Draft Initial Design	Create an initial design based on collected information.
Applicant	Require Pre-application Consulting	Request pre-application consulting through in-person meetings at the authority's office.
Applicant	Pre-application Consulting Received	Receive feedback from pre-application consulting.
Applicant	Prepare Planning Application Documents	Prepare necessary documents for the planning application.
Applicant	Submit Application	Submit the application via physical delivery of documents to the municipality.
Applicant	Receive Request for Changes	Receive and implement requests for changes if required.
Applicant	Resubmit Updated Project	Resubmit the updated project after implementing required changes.
Applicant	Receive Notification for Application Acceptance	Receive notification regarding the acceptance of the application.
Applicant	Prepare Building Application Documents	Prepare documents for the building application.
Applicant	Submit Building Application	Submit the building application through physical document delivery.
Applicant	Receive Updated Project	Update and resubmit the project based on feedback.

Applicant	Notification Received	Receive notifications throughout the process, including approval or denial of the building permit.
Building Authority	Application Received	Receive the application through physical document submission.
Building Authority	Initiate Application Review	Initiate the review process by directing documents to the appropriate department.
Building Authority	Issue Application Number	Manually assign an application number to the documents.
Building Authority	Check Third Parties Approvals	Verify approvals from third parties.
Building Authority	Analyse Planning Permit	Analyze the planning permit by manually checking documents and rules.
Building Authority	Check Documentation Completeness	Verify the completeness of submitted documentation.
Building Authority	Evaluate Statements from Third Parties	Evaluate statements from third parties to ensure inclusion and positivity.
Building Authority	Is the Documentation Complete?	Decide if documentation is complete; return for revision if not.
Building Authority	Accept Application	Accept the application and send notification to the applicant.
Building Authority	Notify Acceptance	Record acceptance notifications manually.
Building Authority	Assign Responsible Technician for the Process	Assign a technician to handle the application.
Building Authority	Check Compliance with Regulations	Verify compliance with building, structural, and fire safety regulations.
Building Authority	Are All Checks Compliant?	Determine if all compliance checks are met; require changes if not.
Building Authority	Require Changes	Require changes to be made by the applicant.
Building Authority	Approve Compliance Checks	Approve compliance checks internally.
Building Authority	All Compliance Checks Approved	Approve all compliance checks, leading to public notification.
Building Authority	Public Notification	Send a letter to neighbors for public notification.
Building Authority	Receive Public Feedback	Receive feedback from the public.
Building Authority	Evaluate Public Feedback	Evaluate public feedback against the law.
Building Authority	Are Changes Required According to the Law?	Decide if changes are required based on public feedback.
Building Authority	Final Assessment	Conduct a final assessment by the same technician, with decision signed by the head of the building authority.

Building Authority	Is the Building Permit Approved?	Decide if the building permit is approved.
Building Authority	Building Permit Approved	Issue a building permit if approved.
Building Authority	Building Permit Denied Notification	Send notification to the applicant if denied.
Public	Public Notified	Notify the public about the application and their right to provide feedback.
Public	Is There Public Feedback?	Check if there is any feedback from the public.
Public	Send Public Feedback	Send feedback to the relevant parties if received.
Public	Changes Accepted	Inform the public if changes are accepted.
Public	Approval Notification Sent	Notify the public if the application is approved.
Third Parties	Request for External Evaluation Received	Receive requests for external evaluation.
Third Parties	Send External Evaluation	Send evaluation back to the applicant or authority.
Third Parties	Positive Statement	Provide a positive statement if applicable.

In Detail: The Different Applicants

Applicant

The applicant initiates the building permit process by gathering essential regulatory and planning information from the municipality. This involves both online research and in-person visits to collect city planning and building regulatory information. The applicant then drafts an initial design, which serves as the foundation for further consultations and applications. Pre-application consulting is a critical step, requiring the applicant to engage with the building authority to receive feedback and guidance. Following this, the applicant prepares and submits the planning application documents, often necessitating physical delivery to the municipality. Throughout the process, the applicant must be responsive to requests for changes, resubmitting updated projects as needed. Notifications from the building authority guide the applicant through the acceptance of applications and the preparation of building application documents. The applicant remains engaged, updating and resubmitting projects based on feedback until the final notification of approval or denial is received.

Building Authority

The building authority plays a pivotal role in reviewing and processing the building permit application. Upon receiving the application, the authority initiates a thorough review process, directing documents to the appropriate departments and assigning an application number. The authority is responsible for verifying third-party approvals and analyzing the planning permit against established rules. A meticulous check of documentation completeness is conducted, with incomplete applications returned for revision. Once accepted, the application is assigned to a responsible technician who ensures compliance with all relevant regulations, including building, structural, and fire safety standards. The authority requires changes if compliance checks are not met, and upon approval, public notification is issued. Public feedback is evaluated against legal standards, influencing the final assessment conducted by the technician. The building authority's decision on the building permit is communicated to the applicant, with a permit issued if approved or a denial notification sent if not.

Public

The public is an integral part of the building permit process, with the right to be notified and provide feedback on applications. Public notification is a formal process, ensuring that neighbors and other stakeholders are informed of potential developments. The public's feedback is collected and sent to the relevant parties for consideration. If changes are accepted based on public input, the public is informed accordingly. Approval notifications are also communicated to the public, ensuring transparency and community involvement in the decision-making process.

Third Parties

Third parties, often external evaluators or consultants, are engaged to provide independent assessments of the building permit application. Upon receiving requests for external evaluation, third parties conduct their analysis and send their findings back to the applicant or building authority. Their evaluations are crucial in ensuring that all aspects of the application meet the necessary standards. Positive statements from third parties can significantly influence the building authority's decision, providing an additional layer of assurance and compliance.

Conclusion

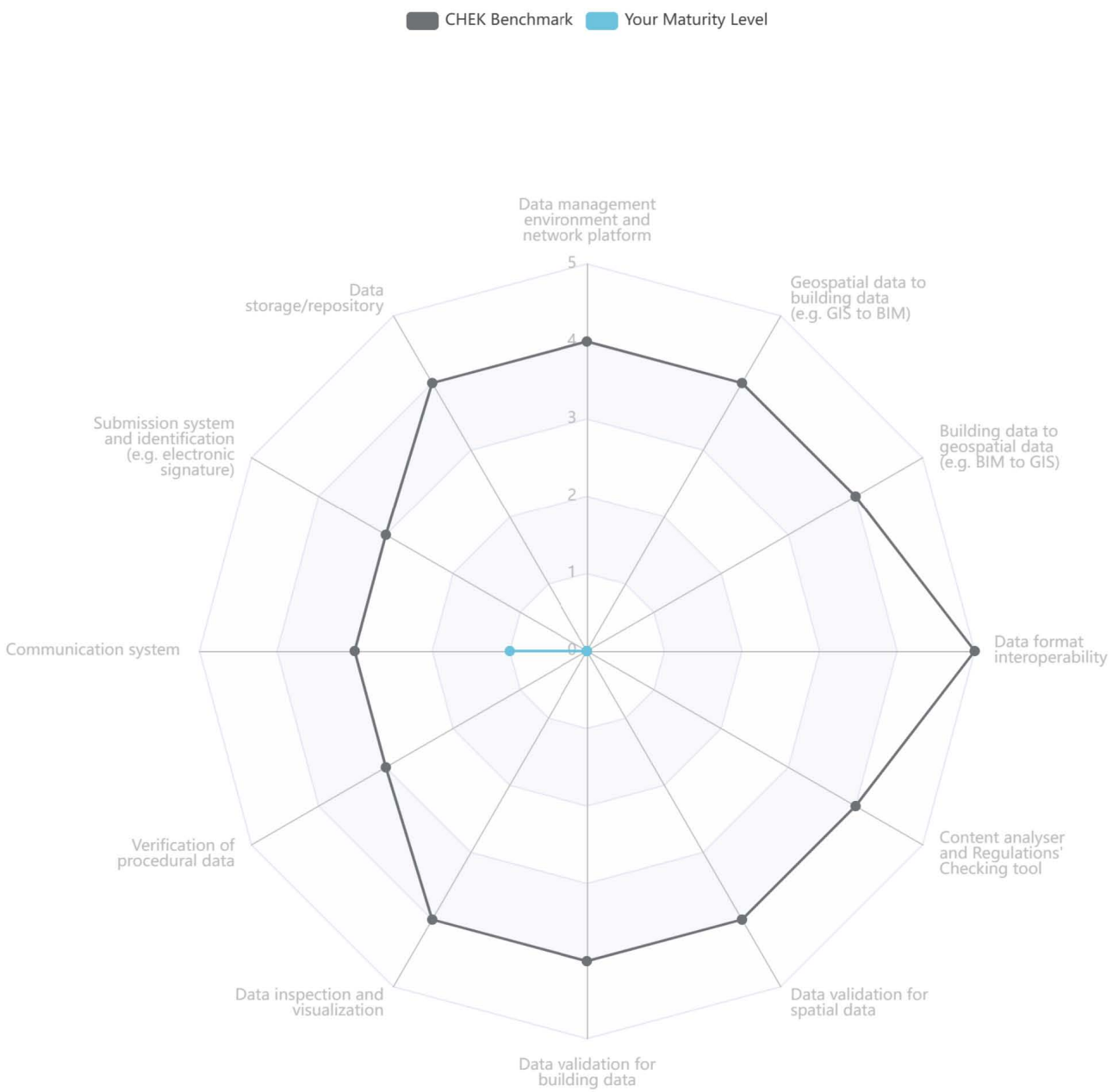
The building permit process, as outlined in this report, is a complex and collaborative effort involving multiple stakeholders. Each participant, from the applicant to the building authority, public, and third parties, plays a vital role in ensuring that the process is thorough, compliant, and transparent. The reliance on physical document submissions and in-person consultations underscores the importance of clear communication and meticulous documentation. As the process progresses from initial application to final decision, each step is carefully managed to uphold regulatory standards and address community concerns. This comprehensive approach ensures that building permits are granted in a manner that balances development needs with public interest and safety.

Final Report: Maturity Assessment by IntelliCHEK

Maturity Models with Average Maturity Level

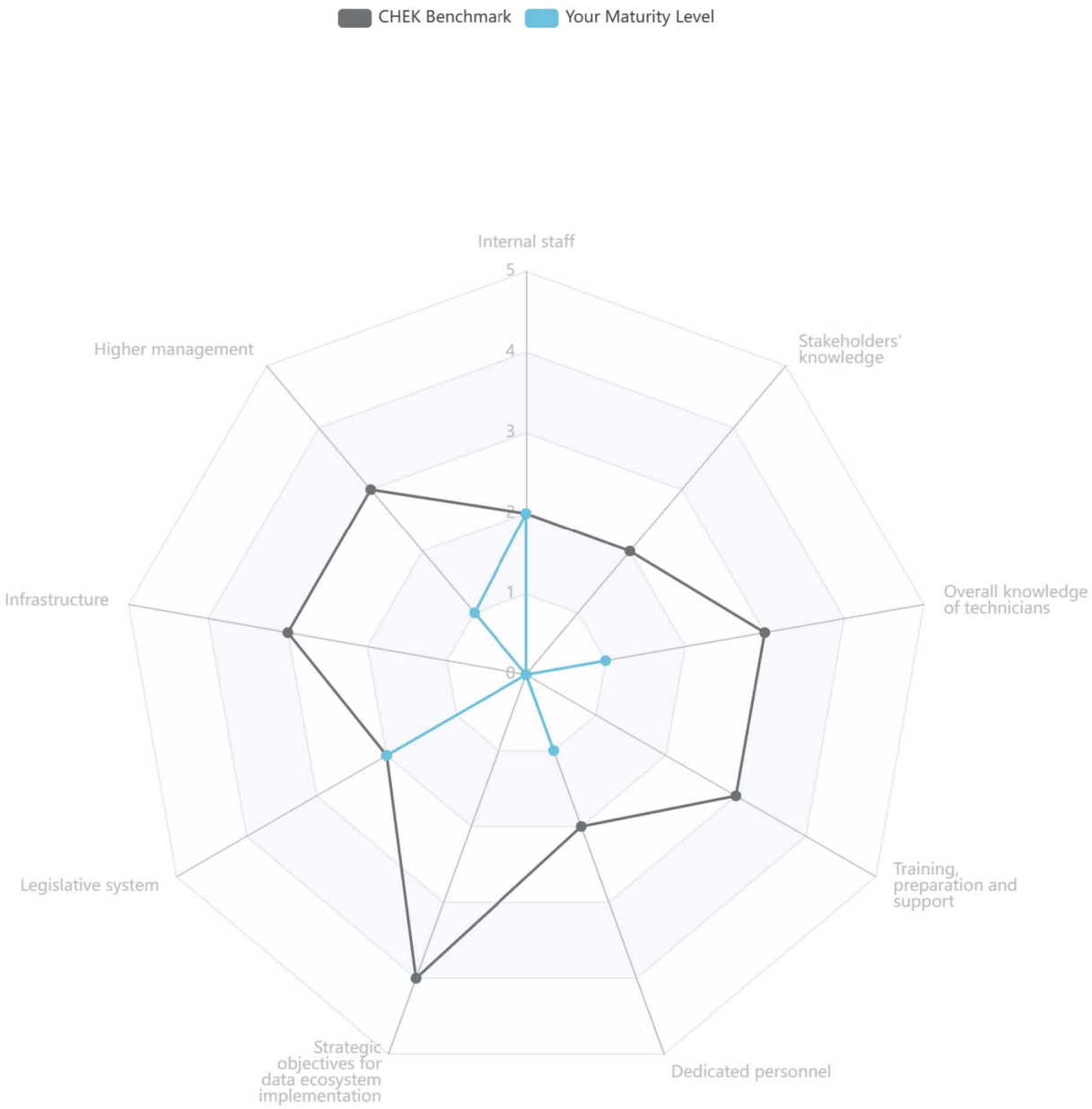
Technology (0.2)

- **Data Management Environment and Network Platform**: Level 0
    - Reliance on physical documents and manual processes with no digital platform.
- **Data Storage/Repository**: Level 0
    - No digital storage or submission system.
- **Communication**: Level 1
    - Utilizes emails and phone calls but lacks structured digital channels.
- **Verification, Inspection, Validation, and Content Analysis**: Level 0
    - All processes are manual with no digital tools or integration.



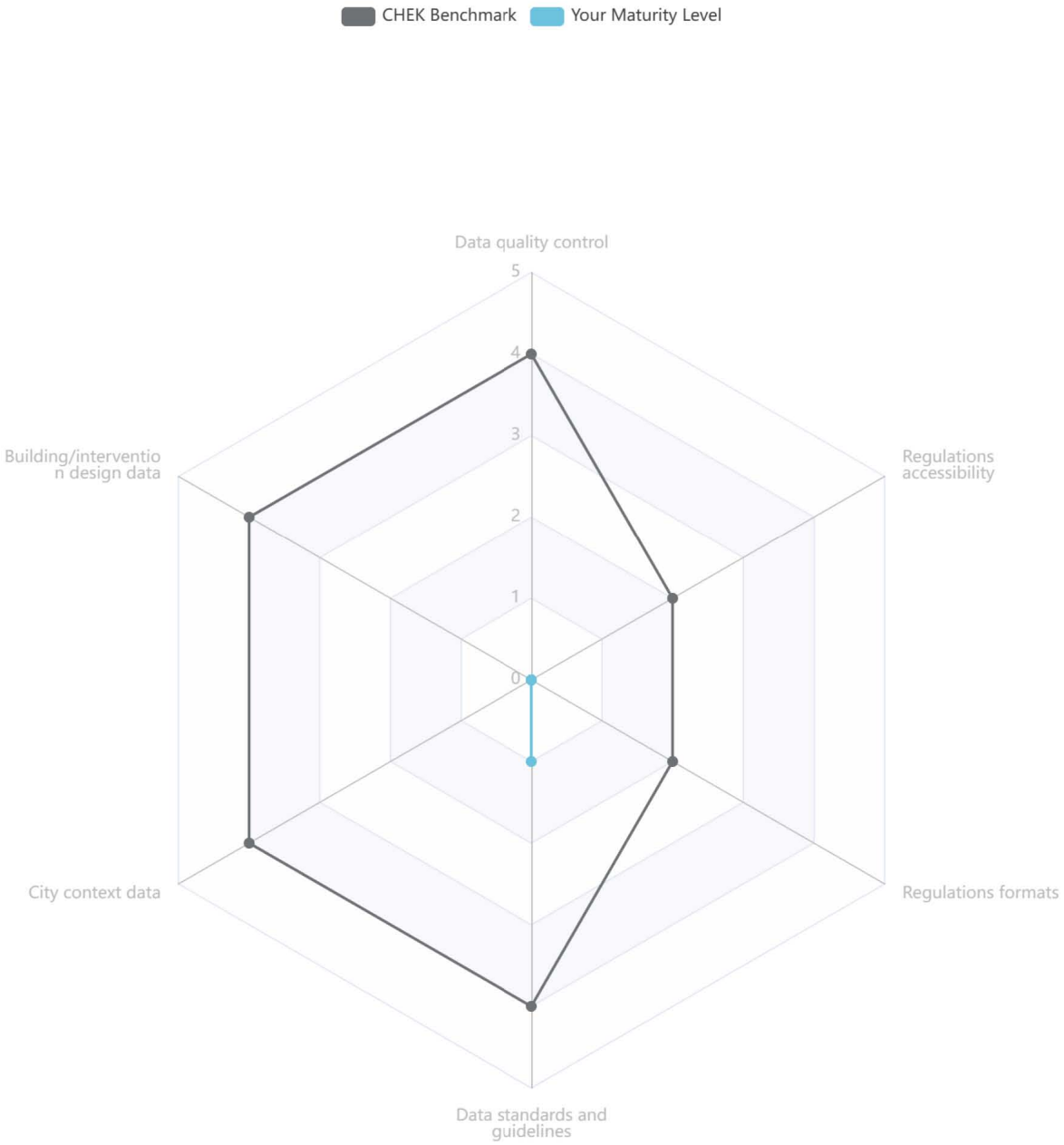
Information (0.2)

- **Data Quality Control**: Level 0
  - Managed through physical documents.
- **Building/Intervention Design Data**: Level 0
  - Managed through physical documents.
- **City Context Data**: Level 0
  - Managed through physical documents.
- **Data Standards and Guidelines**: Level 1
  - Basic human-readable protocols exist.



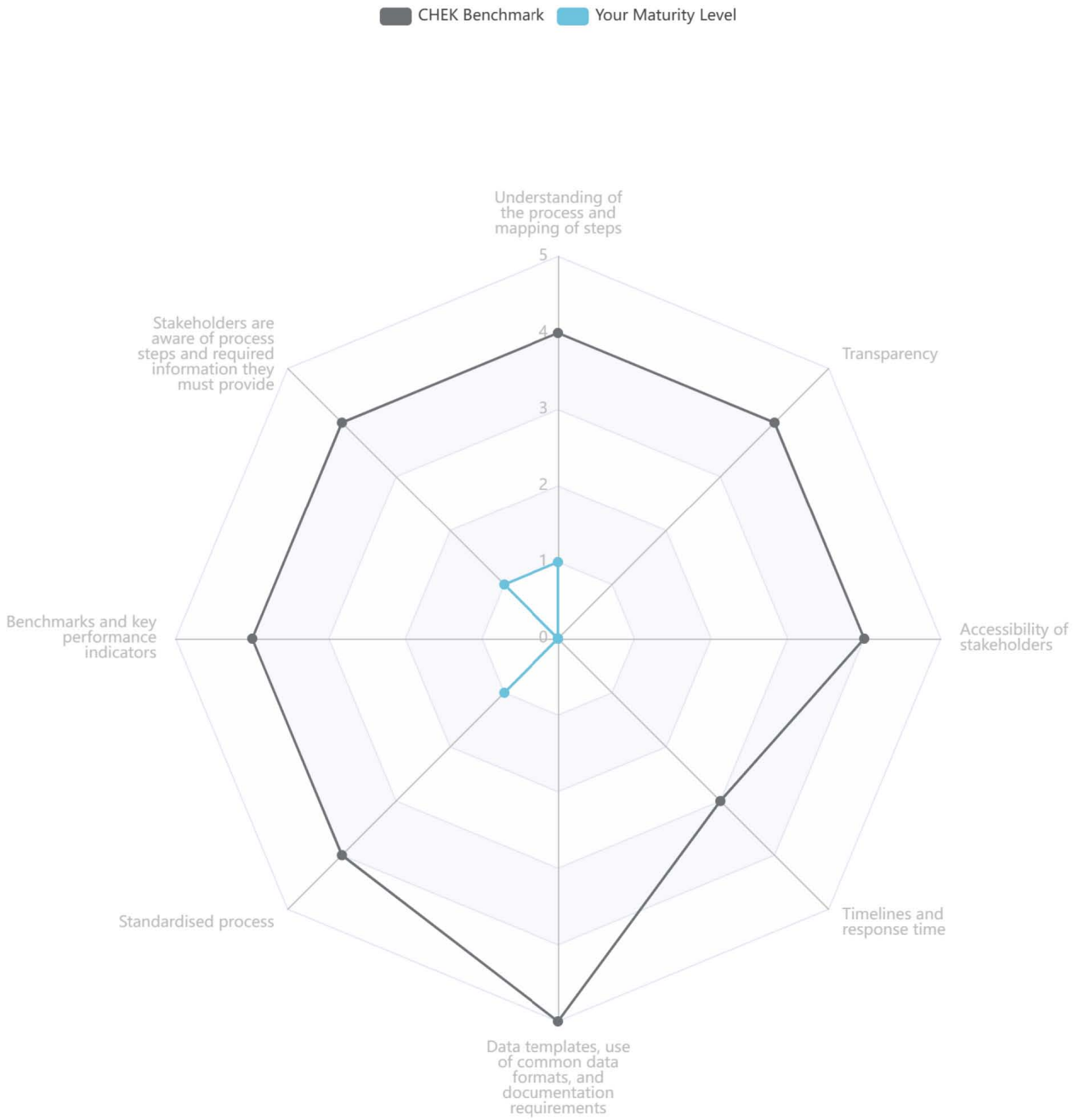
Process (0.2)

- **Process Understanding and Mapping**: Level 1
  - Basic understanding and mapping of process steps.
- **Documentation and Digital Integration**: Level 0
  - No detailed documentation or digital integration.
- **Stakeholder Awareness**: Level 1
  - Basic awareness of process steps.
- **Quality Control and Benchmarks**: Level 0
  - Lacks formal quality control, benchmarks, or transparency.



Organization (0.8)

- **Internal Staff**: Level 2
  - Participation in cross-functional teams and discussions on digital technology.
- **Higher Management Support**: Level 1
  - Supports digitalization but lacks a strategic approach.
- **Infrastructure**: Level 0
  - Inadequate infrastructure with no strategic implementation plan.
- **Training and Stakeholder Knowledge**: Level 0
  - Minimal dedicated personnel working on digital technologies.



Conclusion

The maturity assessment of the building permit process reveals a significant reliance on analog methods across all dimensions, with an overall low maturity level. The Technology, Information, and Process dimensions are predominantly at level 0, indicating a need for substantial digital transformation. The Organization dimension shows some progress, particularly in staff participation and management support, but still lacks strategic planning and infrastructure. To improve efficiency, accessibility, and integration, a comprehensive digital transformation strategy is essential. This should include the development of digital platforms, enhanced data management systems, and increased training and support for staff and stakeholders.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Higher Management	2025-01-01	2025-07-01	None	Create strategic plan	Municipality's domain
Infrastructure	2025-04-01	2025-10-01	Have process map	Define current situation of hardware infrastructure	Municipality's domain
Legislative System	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2026-01-01	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2026-01-01	2026-04-01	Share strategic vision	Create BIM/GIS groups	Municipality's domain
Training, Preparation and Support	2026-04-01	2026-10-01	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2026-10-01	2027-04-01	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2026-10-01	2027-04-01	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2027-04-01	2027-10-01	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2027-10-01	2028-04-01	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2028-04-01	2028-10-01	Use BIMserver.centre for BIM and GIS, Integrate IFC signature	Connect web portal	BIM Server Centre
Verification of Procedural Data	2027-04-01	2027-10-01	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2028-10-01	2029-04-01	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2028-10-01	2029-04-01	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and	2029-	2029-	Implement validation tool	Implement checking	CYPE Urban

Regulations' Checking Tool	04-01	10-01	for BIM, Implement validation tool for GIS, Use CHEK rules repository	tool	
Data Format Interoperability	2029-10-01	2030-07-01	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g. BIM to GIS)	2030-07-01	2031-01-01	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g. GIS to BIM)	2030-07-01	2031-01-01	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2029-04-01	2029-10-01	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2029-10-01	2030-04-01	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2029-10-01	2030-04-01	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2026-01-01	2026-07-01	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2025-01-01	2025-07-01	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2025-07-01	2026-01-01	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-07-01	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-07-01	2026-01-01	Have process map	Implement tracking platform	CHEK Guidelines and support material
Benchmarks and Key Performance Indicators	2025-07-01	2026-01-01	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Standardised Process	2026-01-01	2026-07-01	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2025-07-01	2026-10-01	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response	2026-	2027-	Connect stakeholders	Communicate timelines	CHEK Guidelines

Time	07-01	01-01			and support material
Accessibility of Stakeholders	2027-01-01	2027-07-01	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre
Transparency	2027-07-01	2028-01-01	Implement data sharing	Connect stakeholders	BIM Server Centre

Conclusion

The roadmap outlined above provides a comprehensive plan for achieving a benchmark value in the future through a series of strategic actions and dependencies. Each step is designed to build upon the previous one, ensuring a cohesive and integrated approach to data management, infrastructure development, and stakeholder engagement. By following this roadmap, the organization can effectively implement the necessary tools and processes to enhance data interoperability, quality control, and transparency, ultimately leading to improved efficiency and effectiveness in building permit management.

APPLICANT
BUILDING AUTHORITY
THIRD PARTIES
PUBLIC
Start
Collect city regulatory information
Collect city planning information
Collect building regulatory information
ollect existing building and regulatory information
Draft initial design
Require pre-application consulting
Pre-application consulting received
Prepare Planning Application Documents
Submit application
City regulatory information
City planning information
Building regulatory information
Pre-application consulting request received
Provide pre-application consulting
Application received
Initiate Application Review
Issue application number
Check third parties approvals
Analyse Planning permit
Request for external evaluation received
Send external evaluation
Positive statement
Notification received
Approval notification sent
Is Planning Permit Approved?
Prepare building Application Documents
Submit building application
Request for external evaluation received
Send external evaluation
Positive statement
Application received
Check documentation completeness
Evaluate statements from third parties
Is the documentation complete?
No
Return application for revision
Revision received
Collect Additional Information
Resubmit application
Yes
Accept application
Notify acceptance
Receive notification for application acceptance
Application Status update
Normally the same technician that done the step before, there is not a defined way to assign a technician.
Assign responsible technician for the process
Check compliance with regulations
Check compliance with fire and safety regulation
Check structural project compliance
Check compliance with building regulation
Check compliance with regulations
Are all checks compliant?
No
Require changes
Receive request for changes
Implement required changes
Resubmit updated project
Receive updated project
Are changes accepted?
No
Yes
Changes accepted
Approve compliance checks
Yes
All compliance checks approved
Public notification
Public notified
Is there public feedback?
Send public feedback
Public feedback received
Share public feedback
Receive public feedback
Evaluate public feedback
Are changes required according to the law?
Yes
No
Require changes
Receive request for changes
Implement required changes
Resubmit updated project
Receive updated project
Are changes accepted?
No
Yes
Changes accepted
Changes accepted
Final Assessment
Is the building permit approved?
No
Building permit denied notification
Yes
Building permit approved
Issue building permit
Building permit issued
Approval notification sent
Approval notification sent
End

VILA NOVA DE GAIA RESULTS

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a comprehensive procedure involving multiple stakeholders, including the Applicant, Building Authority, Public, and Third Parties. This report provides a detailed examination of the process, highlighting the roles and responsibilities of each participant. The process is designed to ensure compliance with city regulations and standards, facilitating the orderly development of urban spaces. The following sections provide an in-depth analysis of the tasks and events involved in the building permit process.

Table of Tasks and Descriptions

Participant	Task/Event	Description
Applicant	Start	Initiates the building permit process.
	Collect city regulatory information	Gathers information about city regulations from the municipality's website.
	Collect city planning information	Uses a tool on the website to select the plot and receive relevant information via email.
	Collect building regulatory information	Gathers building regulatory information from the municipality's website.
	Collect existing building and regulatory information	Collects information about existing buildings and regulations.
	Draft initial design	Drafts an initial design for the building project.
	Require pre-application consulting	Requests pre-application consulting through email exchanges and meetings.
	Pre-application consulting received	Receives pre-application consulting.
	Prepare Application Documents	Prepares necessary application documents.
	Submit application	Submits the application through an online portal.
	Pay Application Fees	Pays the required application fees.
	Collect Additional Information	Collects additional information if revisions are needed.
	Resubmit application	Resubmits the application if required.
	Approval notification received	Receives a notification of approval.
	Applicant sends other compliance documentation	Sends additional compliance documentation as needed.

	Receive request for changes	Receives a request for changes.	
	Implement required changes	Implements the required changes.	
	Resubmit updated project	Resubmits the updated project.	
	Project accepted	Notified that the project is accepted.	
	Public notification	Sends a public notification.	
	Fulfill final conditions	Fulfills any final conditions required for the permit.	
		Pay fees	Pays any additional fees.
	Send final documents	Sends the final documents.	
	Building permit issued	Receives the building permit.	
Building Authority	Pre-application consulting request received	Receives a request for pre-application consulting.	
	Provide pre-application consulting	Provides pre-application consulting through email and meetings.	
	Application received	Receives the application through an online portal.	
	Initiate Application Review	Initiates the application review automatically.	
	Issue application number	Assigns an application number.	
	Check administrative requirements	Checks the administrative requirements of the application.	
	Geolocate the plot	Inserts the plot's geometry into specific software for verification.	
	Check documentation completeness	Verifies the completeness of the documentation.	
	Is the documentation complete?	Decides if the documentation is complete.	
	Return application for revision	Returns the application for revision if incomplete.	
	Accept application	Accepts the application if complete.	
	Application Status update	Updates the status of the application.	
	Require external evaluation	Requires an external evaluation if needed.	
	Receive external evaluation report	Receives the external evaluation report.	
	Assign responsible technician for the process	Assigns a responsible technician.	
	Assign internal evaluators	Assigns internal evaluators.	
	Check compliance with	Checks compliance with urban and	

	regulations	building regulations.		
	Require changes	Contacts the applicant if changes are required.		
	Receive updated project	Receives the updated project.		
	Are changes accepted?	Decides if the changes are accepted.		
	Notify applicant that the architectural project is approved	Notifies the applicant of the approval.		
	Receive other compliance documentation	Receives other compliance documentation.		
	Accept compliance checks	Accepts compliance checks.		
			All compliance checks accepted	Updates the project status.
	Receive public feedback	Receives public feedback.		
	Evaluate public feedback	Evaluates public feedback.		
	Require changes	Contacts the applicant if changes are required.		
	Receive updated project	Receives the updated project.		
	Changes accepted	Updates the project status.		
	Final Approval	Makes the final approval through a digital report.		
	Is the building permit approved?	Decides if the building permit is approved.		
	Building permit approved	Approves the building permit through a digitally signed document.		
	Approval notification sent and permit available on the platform	Notifies the applicant of the approval.		
	Receive final documents	Receives the final documents.		
	Issue building permit	Issues the building permit.		
	Update Building Permit Database	Updates the status of the building permit.		
Public	Public notified	Notified of the project.		
	Send public feedback	Sends feedback.		
	Changes accepted	Changes are accepted.		
Third Parties	Request for external evaluation received	Receives a request for external evaluation.		
	Evaluate project	Evaluates the project.		
	Send external evaluation	Sends the external evaluation to the building authority.		

In Detail: The Different Applicants

Applicant

The applicant plays a pivotal role in the building permit process, initiating the procedure by gathering essential regulatory and planning information from the municipality's website. This information is crucial for drafting an initial design and preparing the necessary application documents. The applicant is responsible for requesting and receiving pre-application consulting, which can be conducted through various communication channels, including email and meetings. Once the application is prepared, it is submitted through an online portal, accompanied by the payment of application fees. The applicant must be prepared to collect additional information and resubmit the application if revisions are required. Upon receiving approval notifications, the applicant sends additional compliance documentation and implements any requested changes. The process culminates with the applicant fulfilling final conditions, paying any additional fees, and sending final documents to receive the building permit.

Building Authority

The building authority is responsible for receiving and processing the application. The process begins with the receipt of a pre-application consulting request, followed by the provision of consulting services. The authority initiates the application review automatically and assigns an application number. A thorough check of administrative requirements and documentation completeness is conducted, with incomplete applications returned for revision. The authority may require external evaluations and assigns responsible technicians and internal evaluators to ensure compliance with regulations. Public feedback is evaluated, and changes may be required from the applicant. The final approval is made through a digital report, and the building permit is issued through a digitally signed document. The status of the building permit is updated on the platform.

Public

The public is notified of the project and has the opportunity to provide feedback. This feedback is evaluated by the building authority, and any necessary changes are communicated to the applicant. The public's role is crucial in ensuring that the project aligns with community standards and expectations.

Third Parties

Third parties are involved in the external evaluation of the project. Upon receiving a request for evaluation, they assess the project and send their findings to the building authority. This external evaluation is an integral part of the process, providing an additional layer of scrutiny to ensure compliance with regulations.

Conclusion

The building permit process is a multifaceted procedure involving various stakeholders, each with distinct roles and responsibilities. The process is designed to ensure that building projects comply with city regulations and standards, facilitating the orderly development of urban spaces. Through a combination of digital platforms, communication channels, and rigorous evaluation procedures, the process aims to streamline the issuance of building permits while maintaining transparency and accountability. The collaboration between the applicant, building authority, public, and third parties is essential in achieving a successful outcome, ensuring that projects meet the necessary regulatory requirements and community expectations.

Final Report: Maturity Assessment by IntelliCHEK

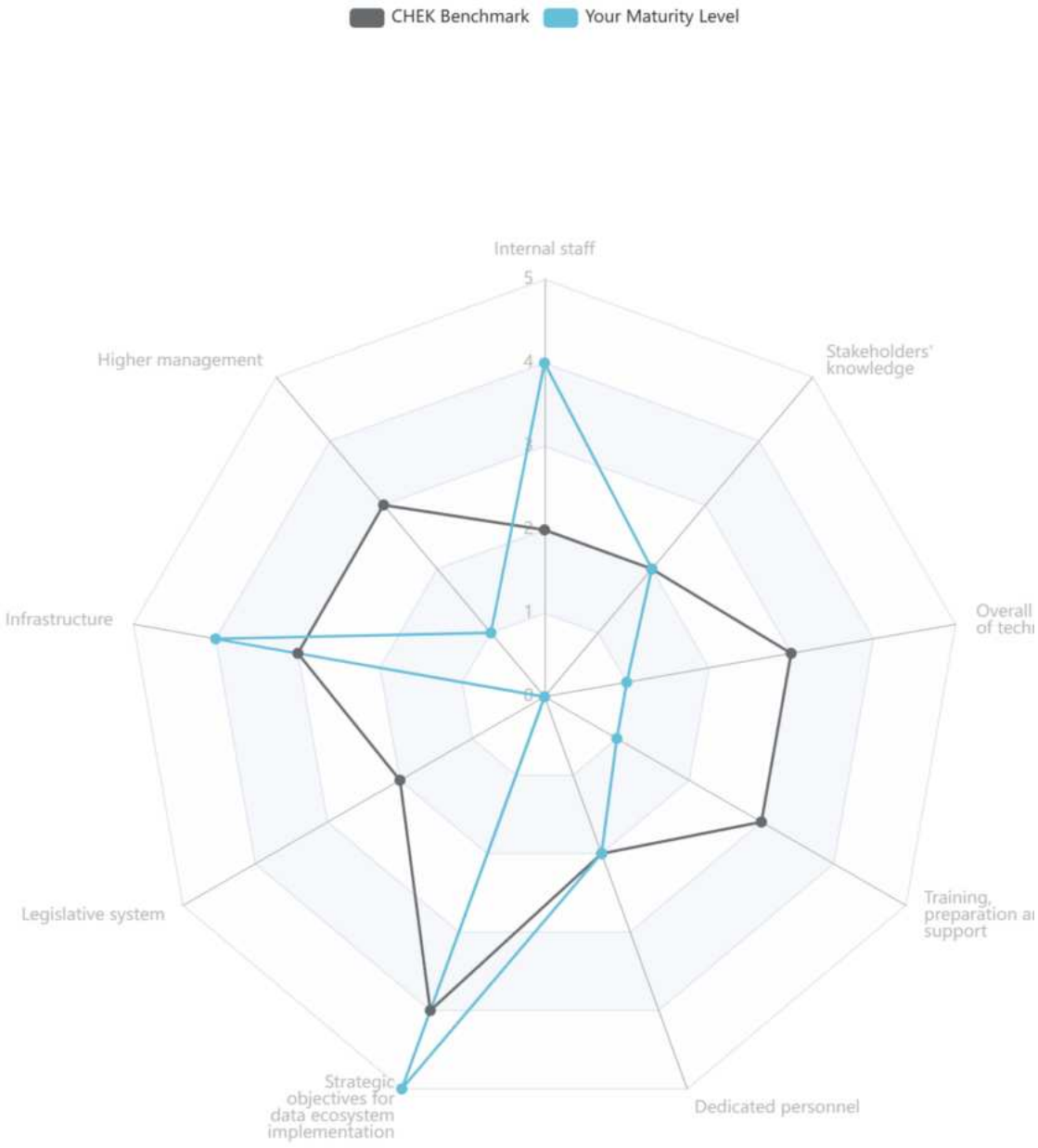
Maturity Models with Average Maturity Level

Technology (2.0)

- **Digital Platforms for Submission and Internal Management**: Level 3
  - Digital submission and communication exist, but no digital data management process.
- **Data Accessibility and Interoperability**: Level 1
  - Centralized repository and digital submission system exist, but lack of automated validation and reliance on proprietary formats limit full digital integration.
- **Communication System**: Level 3
  - Online portal for stakeholders is advanced, but data validation and content analysis remain largely manual.
- **Data Validation and Content Analysis**: Level 1
  - Manual processes highlight areas for improvement.

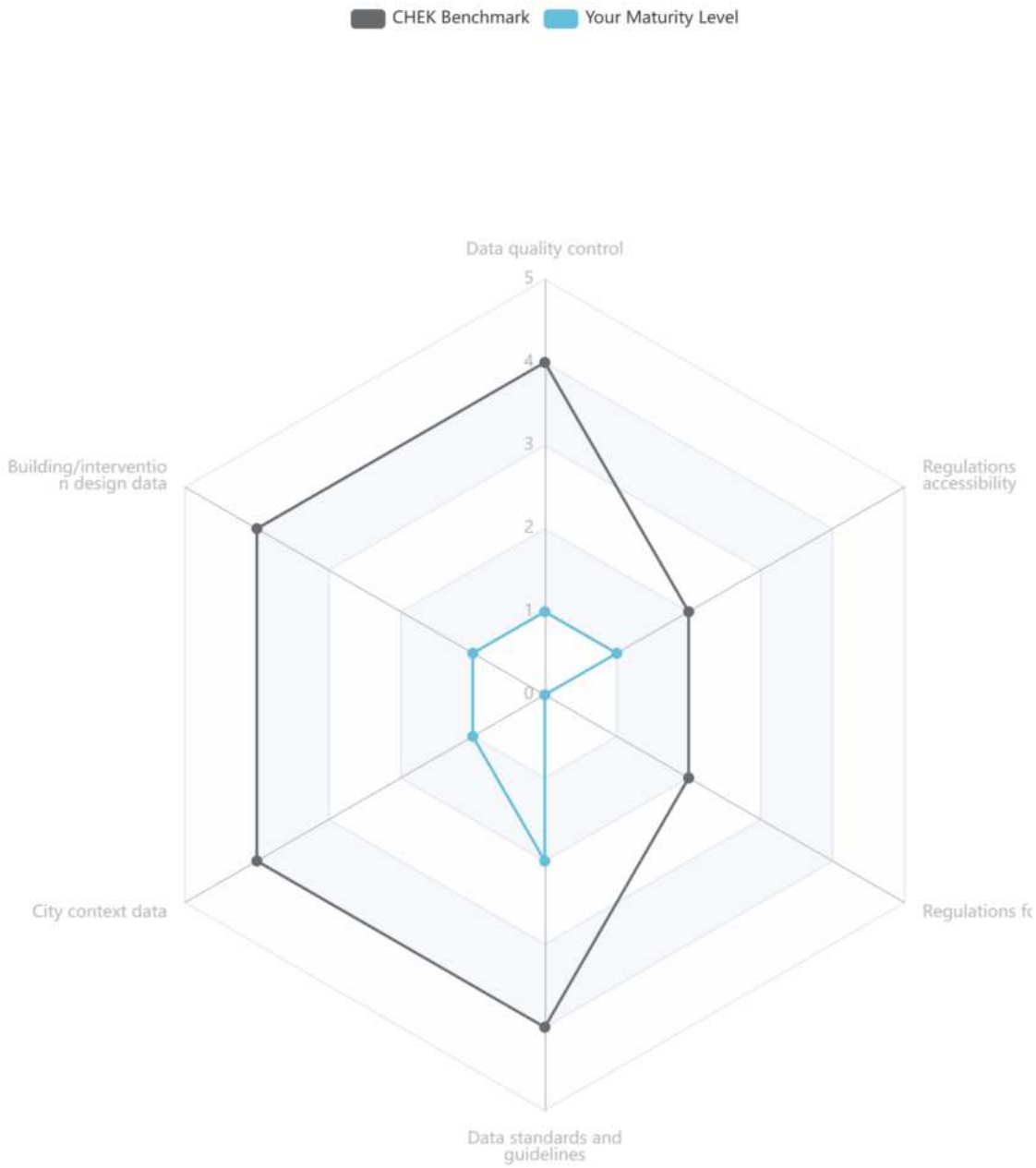
Information (1.0)

- **Use of GIS for Geolocating Plots**: Level 1
  - Some digital elements exist, but overall data quality control and standardization are lacking.
- **Data Quality Control Plans**: Level 1
  - Absence of structured quality control plans.
- **Standardization Practices**: Level 1
  - Reliance on natural language for regulations indicates a need for more robust data management.
- **Data Management and Standardization**: Level 1
  - Need for improvement in data management and standardization practices.



Process (2.0)

- **Timelines and Transparency**: Level 3
    - Structured approach to process management.
- **Benchmarks and Key Performance Indicators**: Level 1
    - Lack of benchmarks and key performance indicators.
- **Standardized Processes**: Level 2
    - Foundation for digital processes exists, but further refinement is necessary.
- **Process Management**: Level 2
    - Need for more standardized processes to achieve higher maturity levels.



Organization (2.5)

- **Internal Staff and Infrastructure**: Level 4
    - High maturity levels reflect a strong foundation for digital transformation.
- **Higher Management and Legislative Systems**: Level 1
    - Lack of strategic direction and openness to change.
- **Training and Knowledge among Technicians and Stakeholders**: Level 1
    - Limited training and knowledge highlight the need for investment in capacity building.
- **Strategic Planning**: Level 4
    - Need for strategic planning to fully leverage digital tools and processes.

Conclusion

Overall, the assessment underscores the need for a more integrated approach to digitization, with a focus on enhancing data interoperability, standardization, and strategic management to elevate the maturity levels across all dimensions. While there are areas of strength, particularly in the organization dimension with internal staff and infrastructure, significant gaps remain in technology, information, and process dimensions. Addressing these gaps through strategic planning, capacity building, and process refinement will be crucial in achieving a comprehensive digital transformation in the building permit process.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Higher Management	2025-01-01	2025-07-01	None	Create strategic plan	Municipality's domain
Infrastructure	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Legislative System	2025-01-01	2025-07-01	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-07-01	2025-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Dedicated Personnel	2025-07-01	2025-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Training, Preparation, and Support	2025-07-01	2026-01-01	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2026-01-01	2026-07-01	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2026-07-01	2026-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Data Management Environment and Network Platform	2026-07-01	2027-01-01	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2027-01-01	2027-04-01	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2027-04-01	2027-04-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Verification of Procedural Data	2027-04-01	2027-07-01	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2027-07-01	2028-04-01	Implement visualisation tool,	Implement validation tool for BIM	BIM Server Centre

			Use CHEK IDS		Validation, Verify 3D	
Data Validation for Spatial Data	2027-07-01	2028-04-01	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard	
	Content Analyser and Regulations' Checking Tool	2028-04-01	2029-01-01	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2029-01-01	2030-01-01	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS	
Building Data to Geospatial Data (e.g. BIM to GIS)	2030-01-01	2030-10-01	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit	
Geospatial Data to Building Data (e.g. GIS to BIM)	2030-01-01	2030-10-01	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC	
Data Quality Control	2030-10-01	2031-07-01	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material	
Building/Intervention Design Data	2030-10-01	2031-07-01	Use CHEK rules repository	Use CHEK IDS	CHEK IDS	
City Context Data	2030-10-01	2031-07-01	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS	
Data Standards and Guidelines	2025-07-01	2026-01-01	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS	
Regulations Formats	2026-01-01	2026-07-01	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool	
Regulations Accessibility	2026-07-01	2026-10-01	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material	
Understanding of the Process and Mapping of Steps	2025-01-01	2025-07-01	None	Have process map	CHEK Virtual Assistant	
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-07-01	2026-01-01	Have process map	Implement tracking platform	CHEK Guidelines and support material	
Benchmarks and Key	2026-01-01	2027-	Have process map,	Define KPIs, Define	CHEK	

Performance Indicators		01-01	Define KPIs	measurement for KPIs	Guidelines and support material
Standardised Process	2026-01-01	2026-07-01	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2026-01-01	2026-07-01	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response Time	2026-07-01	2026-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Accessibility of Stakeholders	2027-01-01	2027-04-01	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre
Transparency	2027-04-01	2027-07-01	Implement data sharing	Connect stakeholders	BIM Server Centre

Conclusion

The roadmap outlined above provides a comprehensive plan for achieving the benchmark value through a series of strategic actions and dependencies. Each key milestone area (KMA) is carefully structured to ensure a seamless transition from one phase to the next, leveraging the appropriate CHEK tools and methodologies. The plan emphasizes the importance of training, data management, and stakeholder engagement, ensuring that all parties are well-informed and equipped to contribute to the project's success. By following this roadmap, the organization can achieve its strategic objectives and enhance its data ecosystem implementation, ultimately leading to improved efficiency and effectiveness in building permit processes.


APPLICANT
Start
Collect city regulatory information
Collect city planning information
Collect building regulatory information
Collect existing building and regulatory information
Draft initial design
Require pre-application consulting
Pre-application consulting received
Prepare Application Documents
Submit application
Pay Application Fees
Revision received
Collect Additional Information
Resubmit application
Receive request for changes
Implement required changes
Resubmit updated project
Approval notification received
Applicant sends other compliance documentation
Project accepted
public notification
Receive request for changes
Implement required changes
Resubmit updated project
Approval notification received
Fulfill final conditions
Pay fees
Send final documents
Building permit issued
BUILDING AUTHORITY
City regulatory information
City planning information
Building regulatory information
Pre-application consulting request received
Provide pre-application consulting
Application received
Initiate Application Review
Issue application number
Check administrative requirements
Geolocate the plot
Application received
Check documentation completeness
Is the documentation complete?
No
Return application for revision
Yes
Accept application
Application Status update
Is external evaluation needed
YES
Require external evaluation
Receive external evaluation report
Assign responsible technician for the process
Assign internal evaluators
Check compliance with regulations
Check compliance with building regulation
Check compliance with urban regulation
Check external evaluation report
Check compliance with regulations
Are changes required?
Require changes
Receive updated project
Are changes accepted?
No
Changes accepted
No
No project changes required
Architectural project approved
Notify applicant that the architectural project is approved
Receive other compliance documentation
Accept compliance checks
All compliance checks accepted
Receive public feedback
Evaluate public feedback
Are changes required?
Yes
No
Require changes
Receive updated project
No
Are changes accepted?
Building permit denied
No
Changes accepted
Yes
Final Approval
Is the building permit approved?
Yes
Building permit approved
Approval notification sent and permit available on the platform
Receive final documents
Issue building permit
Update Building Permit Database
End
THIRD PARTIES
Request for external evaluation received
Evaluate project
Send external evaluation
PUBLIC
Public notified
Send public feedback
Changes accepted

ANNEX III

ASCOLI RESULTS


BUILDING AUTHORITY
THIRD PARTIES
PUBLIC
City regulatory information
City planning information
Building regulatory information
Pre-application consulting request received NOT COMPULSORY
Provide pre-application consulting
Application received
Initiate Application Review
Issue application number
Assign responsible technician for the process
Notify acceptance
Assign internal evaluators
Check administrative requirements
Geolcate the plot
Application received
Check documentation completenes
Return application for revision
No
Yes
Is the documentation complete?
Accept application
Application Status updated
Is external evaluation needed
Yes
No
Require external evaluation
Receive external evaluation report
Are changes required?
Yes
No
Require changes
No project changes required
Receive updated project
Are changes accepted?
No
Changes accepted
Check compliance with regulations
Check compliance with fire and safety regulation
Check compliance with building regulation
Check DECLARATION of compliance with energy efficiency standards
Check compliance with urban regulation
Check compliance with regulations
Are all checks compliant?
No
Require changes
Receive updated project
No
Are changes accepted?
Yes
Changes accepted
Approve compliance checks and Final Assessment
Permit Document Preparation
Building permit denied
No
Yes
Is the building permit approved?
Building permit approved
Issue building permit
Approval notification sent
Update Building Permit Database
End
Request for external evaluation received
Evaluate project
Send external evaluation
Public notified
Changes accepted

LISBON RESULTS

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a complex and multifaceted procedure that involves various stakeholders, including the Applicant, Building Authority, Public, and Third Parties. This report provides a comprehensive overview of the current process, detailing each step and the roles of the involved parties. The process is designed to ensure compliance with all relevant regulations and standards before a building permit is issued. This document serves as an official record of the procedures and interactions that occur during the building permit process.

Table with Tasks and Descriptions

Process	Task/Event	Description
Applicant	Start	The process begins with the applicant initiating the application.
	Collect City Regulatory Information	The applicant gathers necessary city regulatory information.
	Collect City Planning Information	The applicant collects city planning information.
	Collect Building Regulatory Information	The applicant gathers building regulatory information.
	Collect Existing Building and Regulatory Information	The applicant collects existing building and regulatory information.
	Draft Initial Design	The applicant drafts the initial design of the project.
	e-Urban Platform	The applicant accesses the e-Urban platform.
	Access to the Applicant's Account on the e-Urban Digital Platform	The applicant accesses their account on the e-Urban digital platform.
	Architecture Documents and Project to be Uploaded	The applicant uploads architecture documents and the project.
	Geolocate the Plot	The applicant geolocates the plot.
	Assigned Submission Number	The applicant receives an assigned submission number.
	Pay Application Fees	The applicant pays the application fees.
	Assigned Process Number	The applicant receives an assigned process number.
	Submit Application	The applicant submits the application.
Building Authority	Application Received	The building authority receives the application and documents via email.
	Distribution of the Process in the Respective Department	The authority distributes the process to the respective department.
	Department Assign Responsible Technicians for the Process	The department assigns responsible technicians for the process.
	Administration Check Application Properly Instructed	The authority checks if the application is properly instructed using a document checklist.

	Prior Architecture Check	The authority performs a prior architecture check to ensure compliance with building regulations.
	Properly Instructed?	The authority decides if the application is properly instructed.
	Check Compliance with Building Regulation	The authority checks compliance with building regulations.
	Check Compliance with Urban Regulation	The authority checks compliance with urban regulations.
	Check Structural Project Compliance	The authority checks structural project compliance.
	Check Compliance with Fire and Safety Regulation	The authority checks compliance with fire and safety regulations.
	Check Compliance with Regulations	The authority checks compliance with all regulations.
	Are All Checks Compliant?	The authority decides if all checks are compliant.
	Receive Request for Changes	The authority receives a request for changes.
	Implement Required Changes	The authority implements the required changes.
	Resubmit Updated Project	The authority resubmits the updated project.
	Receive Updated Project	The authority receives the updated project.
	Require Changes	The authority requires changes if necessary.
	Approval Notification Sent	The authority sends an approval notification.
	Receive Final Documents	The authority receives the final documents.
	Permit Document Preparation	The authority prepares the permit document.
	Issue Building Permit	The authority issues the building permit.
	Update Building Permit Database	The authority updates the building permit database.
	End	The process ends.
Public	Public Notified	The public is notified about the application.
	Is There Public Feedback?	The process checks if there is public feedback.
Third Parties	Not Detailed	The process for third parties is not detailed in the provided XML segment.

In Detail: The Different Applicants

Applicant

The applicant initiates the building permit process by gathering all necessary information related to city regulations, planning, and existing building codes. This involves accessing the e-Urban platform, where they can manage their application digitally. The applicant is responsible for drafting the initial design of the project and uploading all relevant architectural documents. They must geolocate the plot and ensure that all fees are paid before submitting the application. Upon submission, the applicant receives both a submission and a process number, which are crucial for tracking the application through the subsequent stages.

Building Authority

The building authority plays a pivotal role in the building permit process. Upon receiving the application, the authority distributes it to the appropriate department, where responsible technicians are assigned to oversee the process. The authority conducts a thorough review of the application, ensuring it is properly instructed and compliant with all relevant regulations, including building, urban, structural, fire, and safety standards. If any discrepancies are found, the authority requests changes and works with the applicant to implement them. Once all checks are compliant, the authority prepares and issues the building permit, updating the building permit database accordingly.

Public

The public is notified of the application, providing an opportunity for feedback. This step ensures transparency and allows for community input in the building process. If feedback is received, it is considered in the decision-making process; otherwise, the process proceeds without changes.

Third Parties

The involvement of third parties in the building permit process is not detailed in the provided information. However, third parties may include external consultants or agencies that provide additional expertise or services as required.

Conclusion

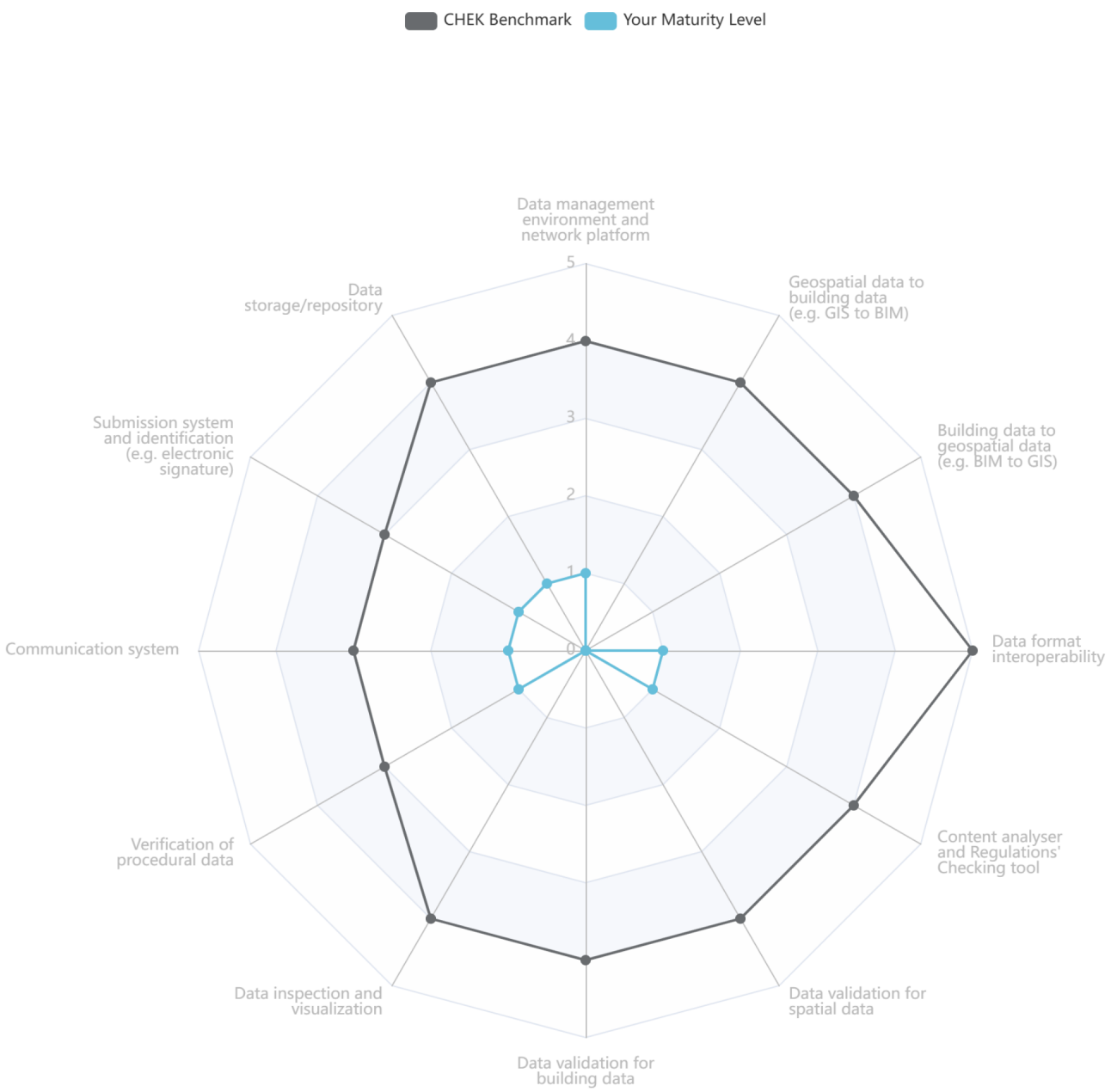
The building permit process is a comprehensive procedure that involves multiple stakeholders working collaboratively to ensure compliance with all relevant regulations and standards. From the initial application by the applicant to the final issuance of the building permit by the building authority, each step is meticulously designed to uphold the integrity and safety of building projects. The involvement of the public further enhances the transparency and accountability of the process. This report serves as a detailed account of the current procedures, providing a foundation for future improvements and optimizations in the building permit process.

Final Report: Maturity Assessment by IntelliCHEK

Maturity Models with Average Maturity Level

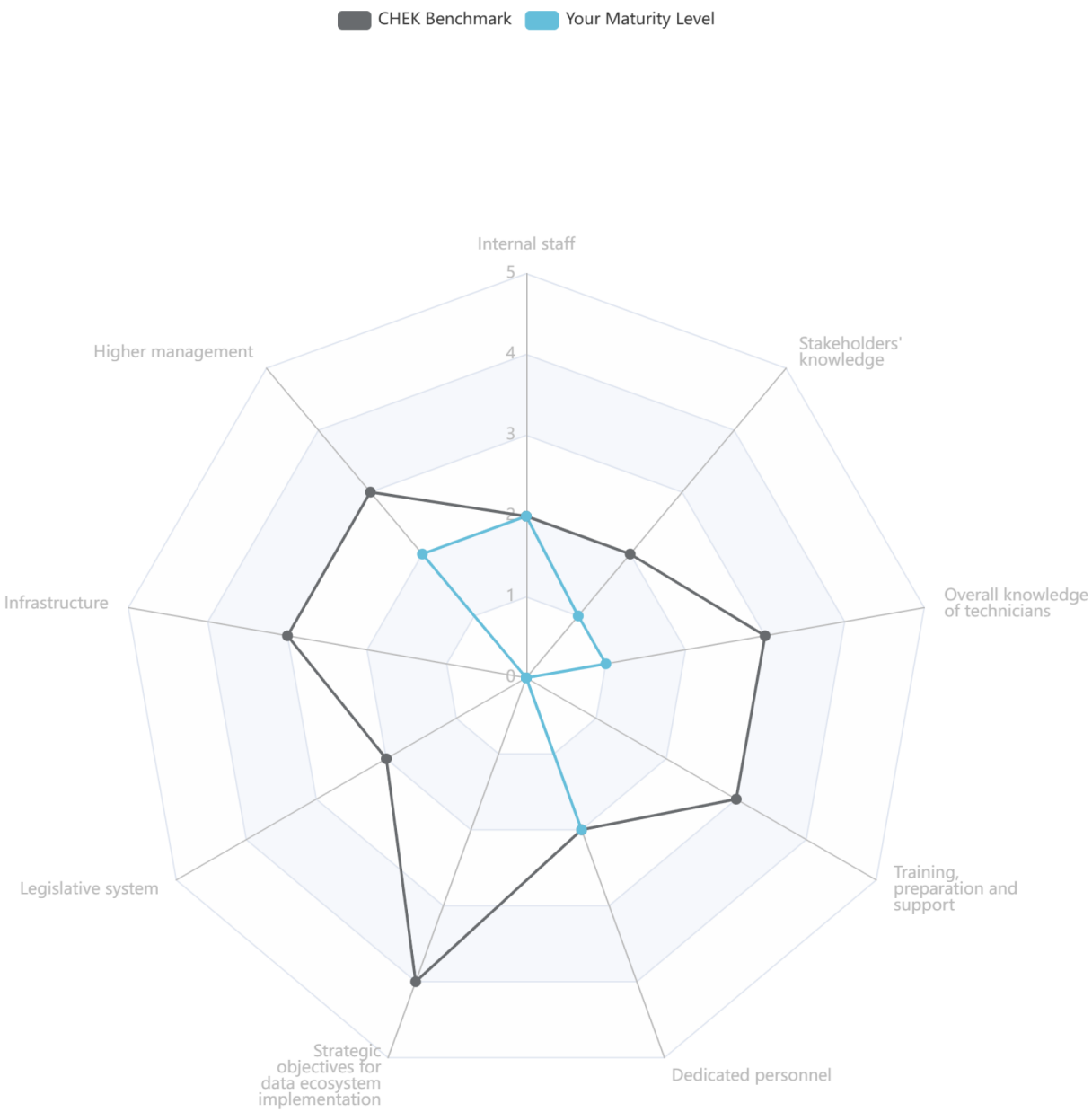
Technology (0.6)

- **Digital Submission and Communication**: Level 1
  - Digital submission and communication exist, but no digital data management process.
- **Data Storage/Repository**: Level 1
  - Documents are stored digitally but lack a centralized system.
- **Data Inspection, Visualization, and Validation Tools**: Level 0
  - Complete absence of tools for both building and spatial data.
- **Integration Between Building and Geospatial Data**: Level 0
  - Non-existent integration.



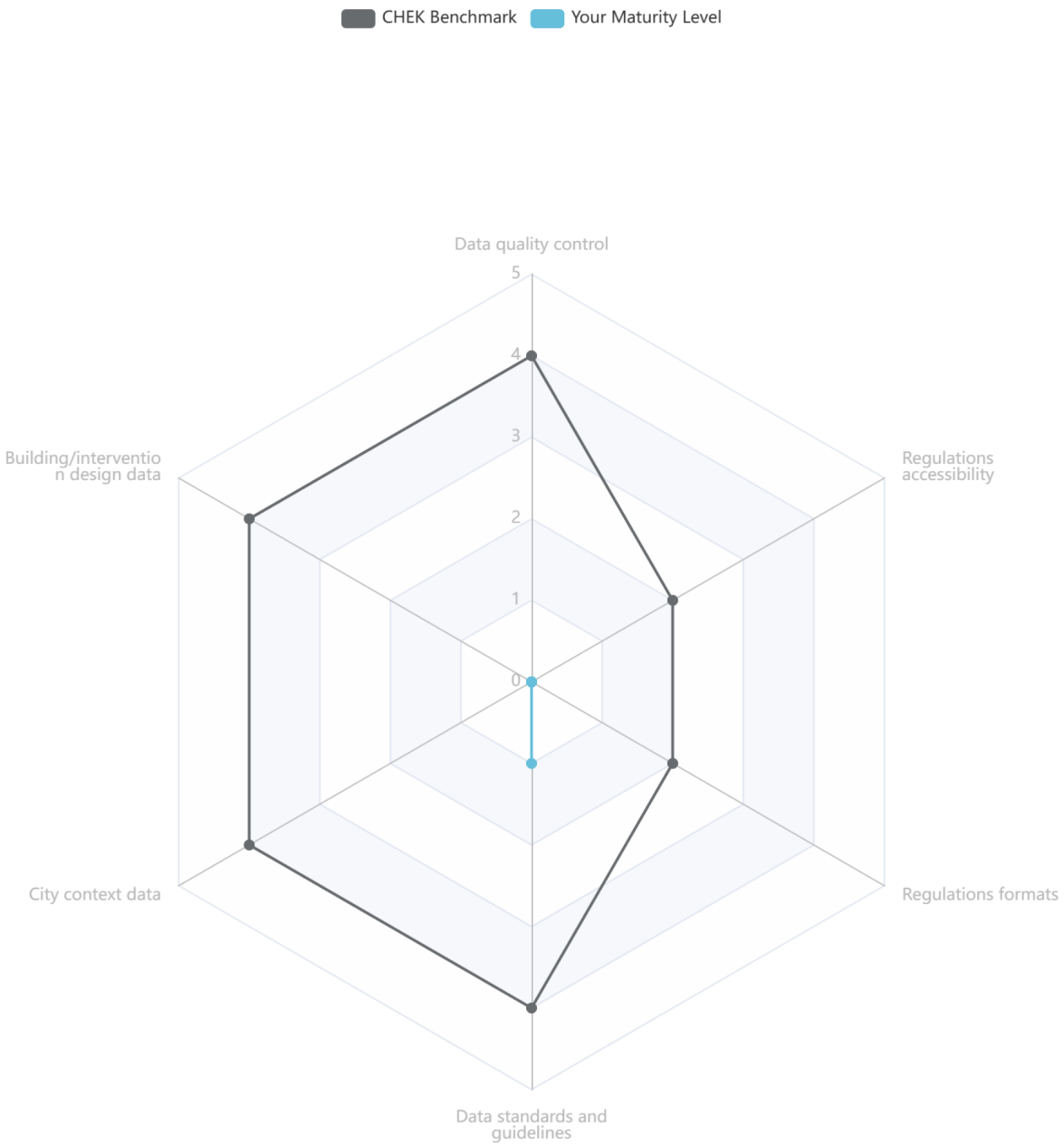
Information (0.0)

- **Data Quality Control and Advanced Data Models**: Level 0
  - No structured data quality control or use of advanced data models.
- **Standardization and Accessibility of Regulations**: Level 0
  - Basic guidelines exist, but no standardization or accessibility in digital formats.



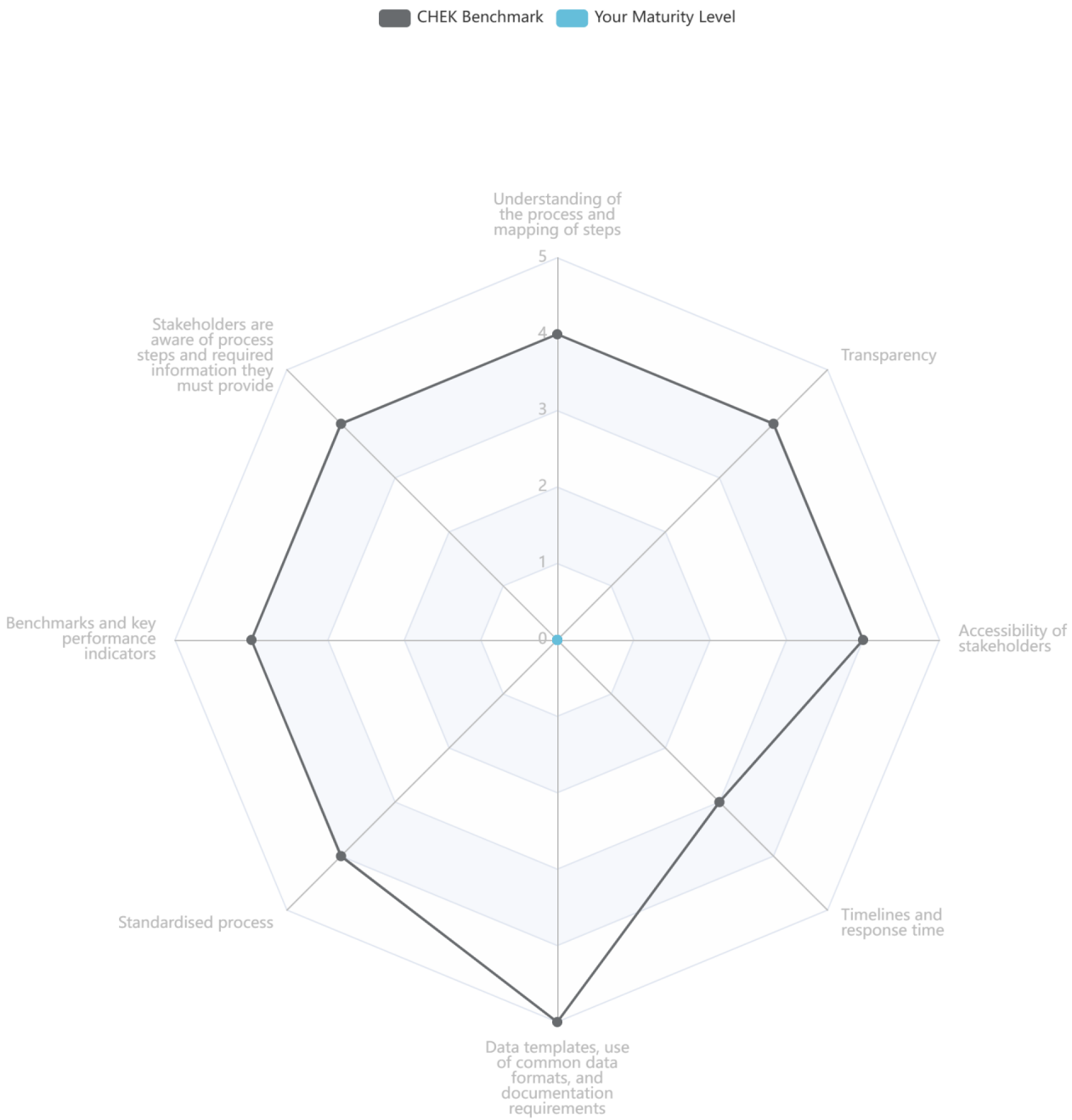
Process (0.0)

- **Understanding and Mapping of Process Steps**: Level 0
  - No clear understanding or mapping of process steps.
- **Benchmarks and Standardized Processes**: Level 0
  - No benchmarks or standardized processes.
- **Stakeholder Awareness and Information on Timelines**: Level 0
  - Lack of awareness and no information on timelines, transparency, or accessibility.



Organization (1.0)

- **Staff Involvement in Digitalization**: Level 2
  - A portion of the staff is involved in digitalization efforts.
- **Dedicated Team for Implementing Technologies**: Level 2
  - Small dedicated team for implementing technologies like BIM and GIS.
- **Infrastructure, Strategic Objectives, and Training Support**: Level 0
  - No capable infrastructure, strategic objectives, or training support.
- **Overall Knowledge and Use of Digital Data**: Level 1
  - Minimal knowledge among technicians and stakeholders with limited use of digital data.



Conclusion

In summary, the building permit process is in the early stages of digital transformation, with significant gaps in technology integration, information management, process standardization, and organizational readiness. The maturity levels across the four critical dimensions—Technology, Information, Process, and Organization—are predominantly low, indicating a need for a strategic approach to enhance digital capabilities. Improving these areas will be crucial to increasing the efficiency and effectiveness of the building permit process.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Higher Management	2025-01-01	2025-04-01	None	Create strategic plan	Municipality's domain
Legislative System	2025-01-01	2025-07-01	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-04-01	2026-04-01	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2025-04-01	2025-04-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Training, Preparation, and Support	2025-04-01	2025-10-01	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2025-10-01	2026-01-01	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2025-10-01	2026-01-01	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2026-01-01	2026-07-01	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g., Electronic Signature)	2026-07-01	2027-01-01	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2027-01-01	2027-07-01	Use BIMserver.centre for BIM and GIS, Integrate IFC signature	Connect web portal	BIM Server Centre
Verification of Procedural Data	2027-01-01	2027-07-01	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2027-07-01	2028-07-01	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2027-07-01	2028-07-01	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and Regulations' Checking Tool	2028-07-01	2029-01-01	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2029-01-01	2030-01-01	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g., BIM to GIS)	2030-01-01	2031-01-01	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building	2030-	2031-	Connect checking	Implement GIS to BIM	CityGML to IFC

Geospatial Data to Building Data (e.g., GIS to BIM)	2030-01-01	2031-01-01	Connect checking software to BIMserver.centre	Implement GIS to BIM	City GML to IFC
Data Quality Control	2031-01-01	2032-01-01	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2031-01-01	2032-01-01	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2031-01-01	2032-01-01	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2026-04-01	2027-01-01	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2027-07-01	2028-01-01	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2028-01-01	2028-07-01	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2026-01-01	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2026-01-01	2027-01-01	Have process map	Implement tracking platform	CHEK Guidelines and support material
Benchmarks and Key Performance Indicators	2026-01-01	2027-01-01	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Standardised Process	2027-01-01	2028-01-01	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2027-01-01	2028-04-01	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response Time	2028-01-01	2028-10-01	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material
Accessibility of Stakeholders	2028-10-01	2029-10-01	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre
Transparency	2029-10-01	2030-10-01	Implement data sharing	Connect stakeholders	BIM Server Centre

Conclusion

The roadmap outlined above provides a comprehensive plan for achieving a benchmark value in the future. It involves a series of strategic actions, dependencies, and the use of various CHEK tools to ensure a smooth transition and implementation of the necessary systems and processes. The roadmap is designed to enhance the efficiency, transparency, and interoperability of building data management, ultimately leading to improved data quality and stakeholder engagement. By following this roadmap, the organization can achieve its strategic objectives and ensure compliance with legislative requirements, while also fostering innovation and collaboration among stakeholders.

APPLICANT
Start
Collect city regulatory information
Collect city planning information
Collect building regulatory information
Collect existing building and regulatory information
Draft initial design
e-Urban Platform
Access to the applicant's account on the e-urban digital platform
Architecture Documents and Project to be uploaded
Geolcate the plot
assigned submission number
Pay Application Fees
assigned process number
Submit application
Resubmit application
Revision
Collect Additional Information
Revision received
Receive request for changes
Implement required changes
Resubmit updated project
Receive notification for application acceptance
Public feedback received
Approval notification received
Fulfill final conditions
Pay fees
Send final documents
Building permit issued
BUILDING AUTHORITY
City regulatory information
City planning information
Building regulatory information
Application received
Distribution of the process in the respective department
Department assign responsible technicians for the process
Administration Check application properly instructed
Prior Architecture Check
Properly instructed ?
Yes
No
Return application for revision
Check compliance with building regulation
Check compliance compliance with urban regulation
Require external or/and internal evaluation needed
Request for external or/and internal evaluation received
Evaluate Architecture
Send external or/and internal evaluation
Receive external or/and internal evaluation report
Are all checks compliant?
yes
Approve compliance checks
Require changes
Receive updated project
Notify Applicant Architecture acceptance
Check compliance with regulations
Check compliance with fire and safety regulation
Check structural project compliance
Check compliance with urban regulation
Are changes accepted?
Changes accepted
Check compliance withe regulations
Check compliance with energy efficiency standards
Check compliance with natural disaster regulation
All compliance checks approved
Public notification
Share public feedback
Receive public feedback
Evaluate public feedback
Are changes required?
Final Assessment
Building permit denied
Is the building permit approved?
Building permit approved
Approval notification sent
Receive final documents
Permit Document Preparation
Issue building permit
Update Building Permit Database
End
THIRD PARTIES
PUBLIC
Public notified
Is there public feedback?
Send public feedback
Changes accepted

PRAGUE RESULTS

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a critical component in the development and construction industry, ensuring that all building activities comply with local regulations and standards. This report provides a comprehensive overview of the building permit procedure as executed by IntelliCHEK, detailing the roles and responsibilities of various participants, including the applicant, the public, third parties, and the building authority. The process is designed to ensure that all necessary regulatory requirements are met before the commencement of any construction activities.

Process Overview

Task/Event	Description
Start	The process initiates with the applicant gathering necessary regulatory information.
Collect city regulatory information	The applicant gathers information about city regulations.
Collect city planning information	The applicant collects information related to city planning.
Collect building regulatory information	The applicant gathers building-specific regulatory information.
Collect existing building and regulatory information	The applicant collects information on existing buildings and regulations.
Draft Initial Design	The applicant drafts an initial design based on the collected information.
Require Pre-application Consulting	The applicant requests pre-application consulting, which can be done by email or in person.
Pre-application Consulting Received	The applicant receives pre-application consulting, including a list of third parties involved.
Prepare Application Documents	The applicant prepares the necessary application documents.
Submit Application for Planning Permit	The applicant submits the application for a planning permit.
Collect Positive Statements from Third Parties	The applicant collects positive statements from third parties involved in the process.
Receive Notification for Application Acceptance	The applicant receives a notification indicating the acceptance of the application.
Receive Request for Changes	If required, the applicant receives a request for changes to the application.
Implement Required Changes	The applicant implements the necessary changes to the application.
Resubmit Updated Project	The applicant resubmits the updated project.
Receive Notification for Application Acceptance and Start of the Building Permit Process	The applicant receives a notification indicating the acceptance of the application.
Receive of Planning Permit	The applicant receives the planning permit.
Receive of Building Permit	The applicant receives the building permit.
End	The process concludes with the issuance of the building permit.

Detailed Process Description

The building permit process commences with the applicant's initiative to gather comprehensive regulatory information. This initial phase involves the collection of city regulatory, city planning, building-specific, and existing building information. This foundational step ensures that the applicant is well-informed about the regulatory landscape, which is crucial for drafting an initial design that aligns with local standards and requirements.

Following the information-gathering phase, the applicant proceeds to draft an initial design. This design serves as a preliminary blueprint that incorporates the regulatory insights obtained earlier. Recognizing the complexity of the regulatory environment, the applicant may seek pre-application consulting. This consultation can be conducted via email or in person and provides the applicant with valuable guidance, including a list of third parties whose input is essential for the application process.

Armed with the necessary insights and guidance, the applicant prepares the application documents meticulously. These documents are then submitted as part of the application for a planning permit. A critical aspect of this stage is the collection of positive statements from third parties, which are integral to the application's success. These statements affirm the project's compliance with various regulatory and community standards.

Upon submission, the applicant receives a notification indicating the acceptance of the application, marking the commencement of the planning permit process. However, the process is dynamic, and the applicant may receive requests for changes to the application. In such instances, the applicant is responsible for implementing the required changes and resubmitting the updated project.

Once the application is deemed satisfactory, the applicant receives a notification confirming the acceptance of the application and the initiation of the building permit process. This milestone is followed by the issuance of the planning permit, which signifies the project's alignment with planning regulations. The culmination of the process is the receipt of the building permit, which authorizes the commencement of construction activities.

Throughout this intricate process, the building authority plays a pivotal role in reviewing the application, ensuring compliance with a myriad of regulations, and issuing the necessary permits. The involvement of third parties is also crucial, as their statements provide additional validation of the project's adherence to regulatory and community standards. The applicant, as the primary driver of the process, is tasked with gathering information, preparing documents, and responding to any requests for changes, thereby ensuring a seamless progression through the various stages of the building permit process.

Conclusion

The building permit process, as delineated in this report, underscores the collaborative effort required among various stakeholders, including the applicant, the building authority, and third parties. Each participant plays a vital role in ensuring that the project complies with all relevant regulations and standards. The process is characterized by a series of methodical steps, from the initial gathering of regulatory information to the final issuance of the building permit. This structured approach not only facilitates compliance but also promotes transparency and accountability in the construction industry. Through diligent adherence to the outlined procedures, the building permit process serves as a cornerstone for safe and sustainable development within the community.

Final Report: Maturity Assessment by IntelliCHEK

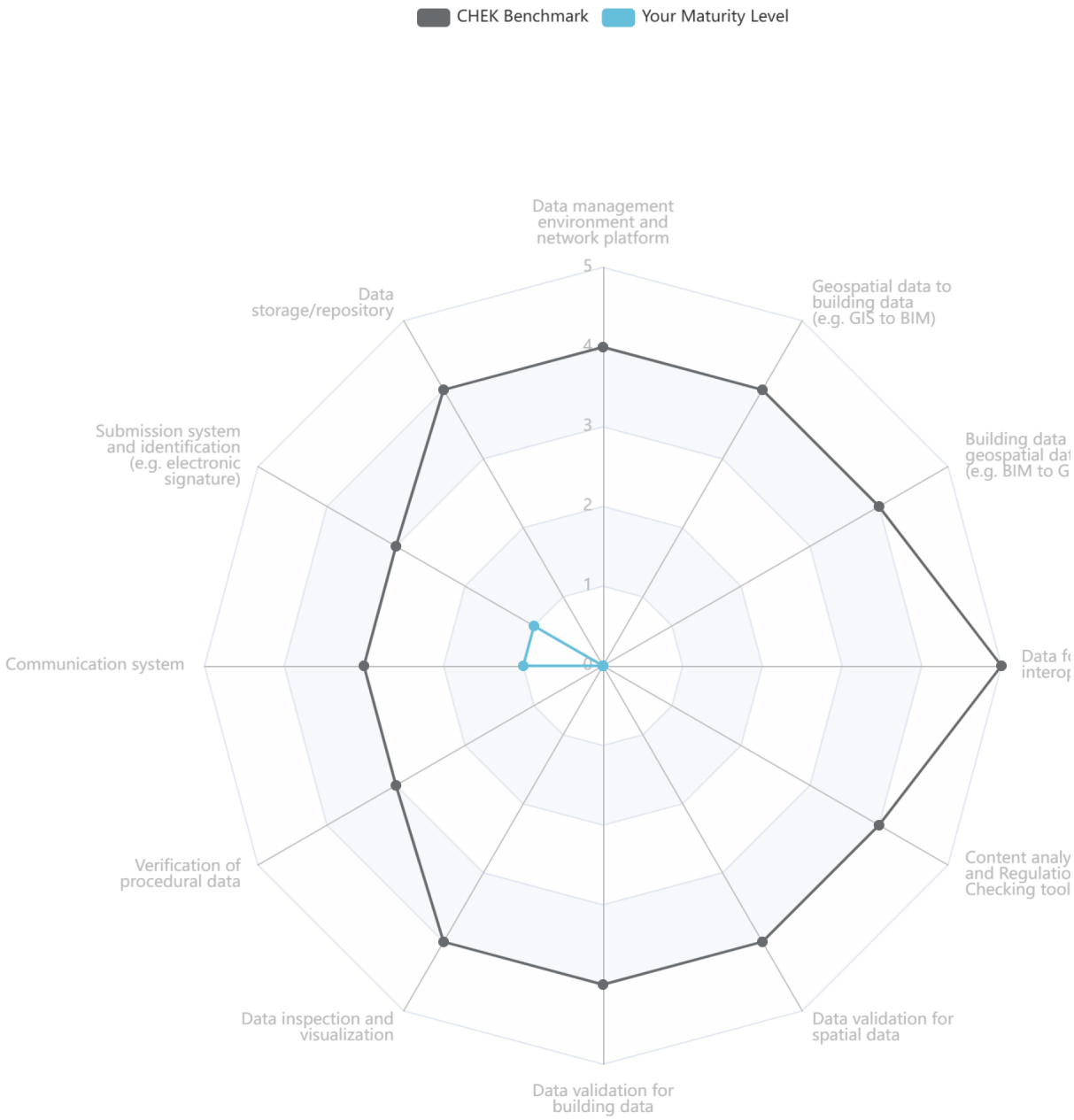
Maturity Models with Average Maturity Level

Technology (0.3)

- **Data Management Environment and Network Platform**: Level 0
  - The absence of a digital platform for data management, storage, or sharing highlights a reliance on physical visits, paper submissions, and manual checks.
- **Data Storage/Repository**: Level 0
  - The process is heavily dependent on physical documents, with no digital repository or centralized storage system.

- **Submission System and Identification**: Level 1
  - While documents can be submitted via email, the requirement for paper submissions and lack of electronic signatures indicate a rudimentary digital submission system.
- **Communication System**: Level 1
  - Communication is primarily through email and physical mail, lacking a structured digital communication system or portal.
- **Verification of Procedural Data**: Level 0
  - Manual verification through physical document checks, with no digital data verification or software use.
- **Data Inspection and Visualization**: Level 0
  - No digital tools or software for data inspection or visualization, relying on manual inspection.
- **Data Validation for Building and Spatial Data**: Level 0
  - Validation is manual, with no automated or digital processes for building or spatial data.
- **Content Analyser and Regulations' Checking Tool**: Level 0
  - Compliance checks are manual, with no digital tools or automated rule checking.
- **Data Format Interoperability**: Level 0
  - The process relies on physical documents, with no digital formats or interoperability between systems.

- **Building to Geospatial Data Integration**: Level 0
    - No mention of building or geospatial data integration, indicating a lack of digital processes for data conversion or mapping.



Information (0.2)

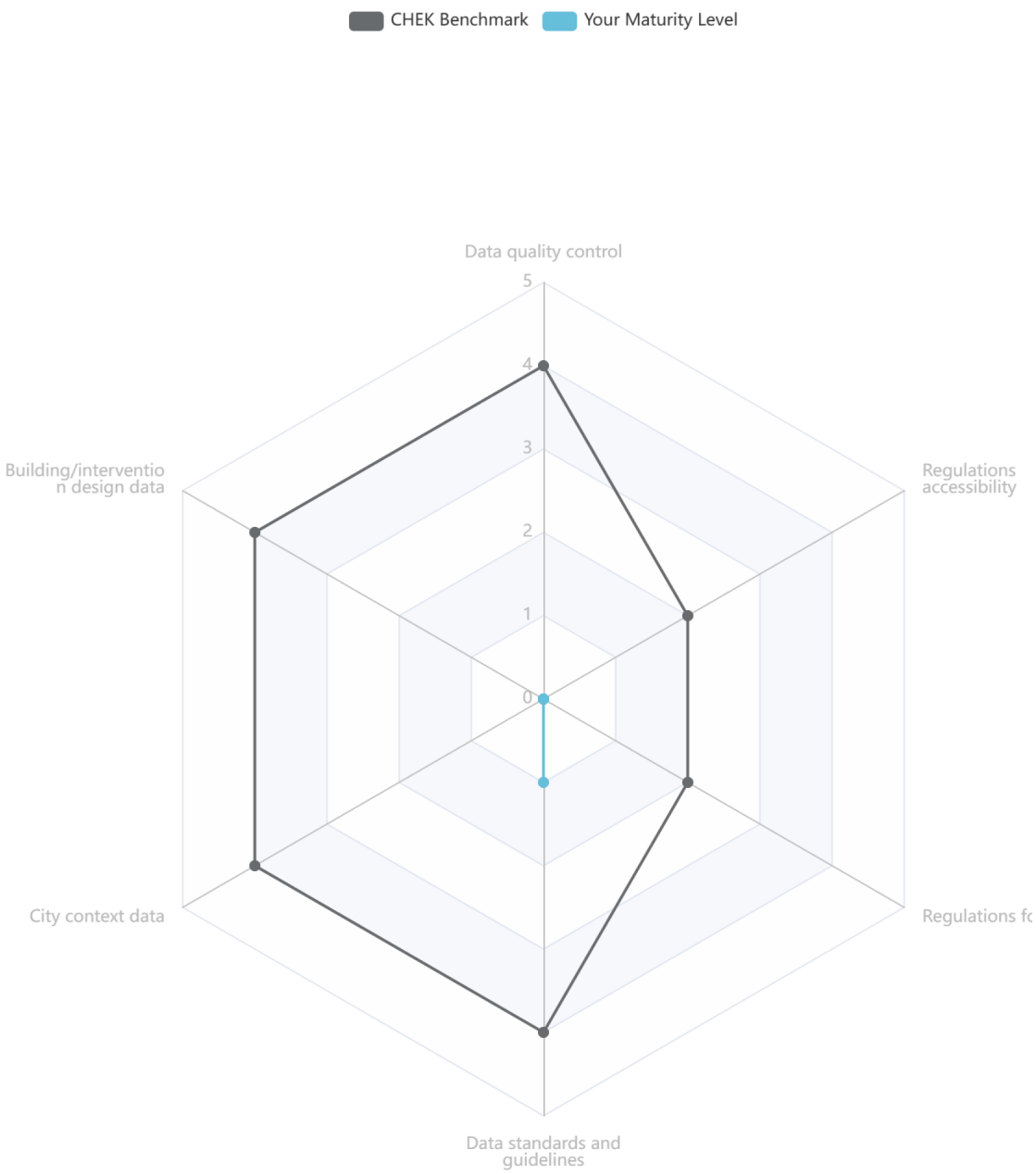
- **Data Quality Control**: Level 0
  - No structured quality control measures or performance benchmarks, with a focus on manual processes.
- **Building/Intervention Design Data**: Level 0
  - Reliance on analog methods, with no digital models or standardized data formats.
- **City Context Data**: Level 0
  - Collection through physical visits, with no digital city models or geospatial data.
- **Data Standards and Guidelines**: Level 1
  - Basic guidelines and documentation protocols exist, but are human-readable.
- **Regulations Formats and Accessibility**: Level 0
  - Regulations are in natural language, requiring interpretation, and are accessible only in paper or PDF format.

Process (0.4)

- **Understanding of the Process and Mapping of Steps**: Level 1
    - General mapping of the process exists, but lacks detailed documentation or digital integration.
- **Stakeholder Awareness**: Level 1
    - Basic understanding of process steps, but no guidelines or standards for clarity.
- **Benchmarks and KPIs**: Level 0
    - No information on quality control plans, performance benchmarks, or KPIs.
- **Standardised Process**: Level 1
    - Some level of standardization from an administrative standpoint, but lacks detailed guidelines.
- **Data Templates and Documentation Requirements**: Level 0
    - No information on data templates or common data formats.
- **Timelines and Response Time**: Level 0
    - No predefined timelines or response times.

- **Accessibility and Transparency**: Level 0

◦ No information on stakeholder accessibility or transparency in information workflow.



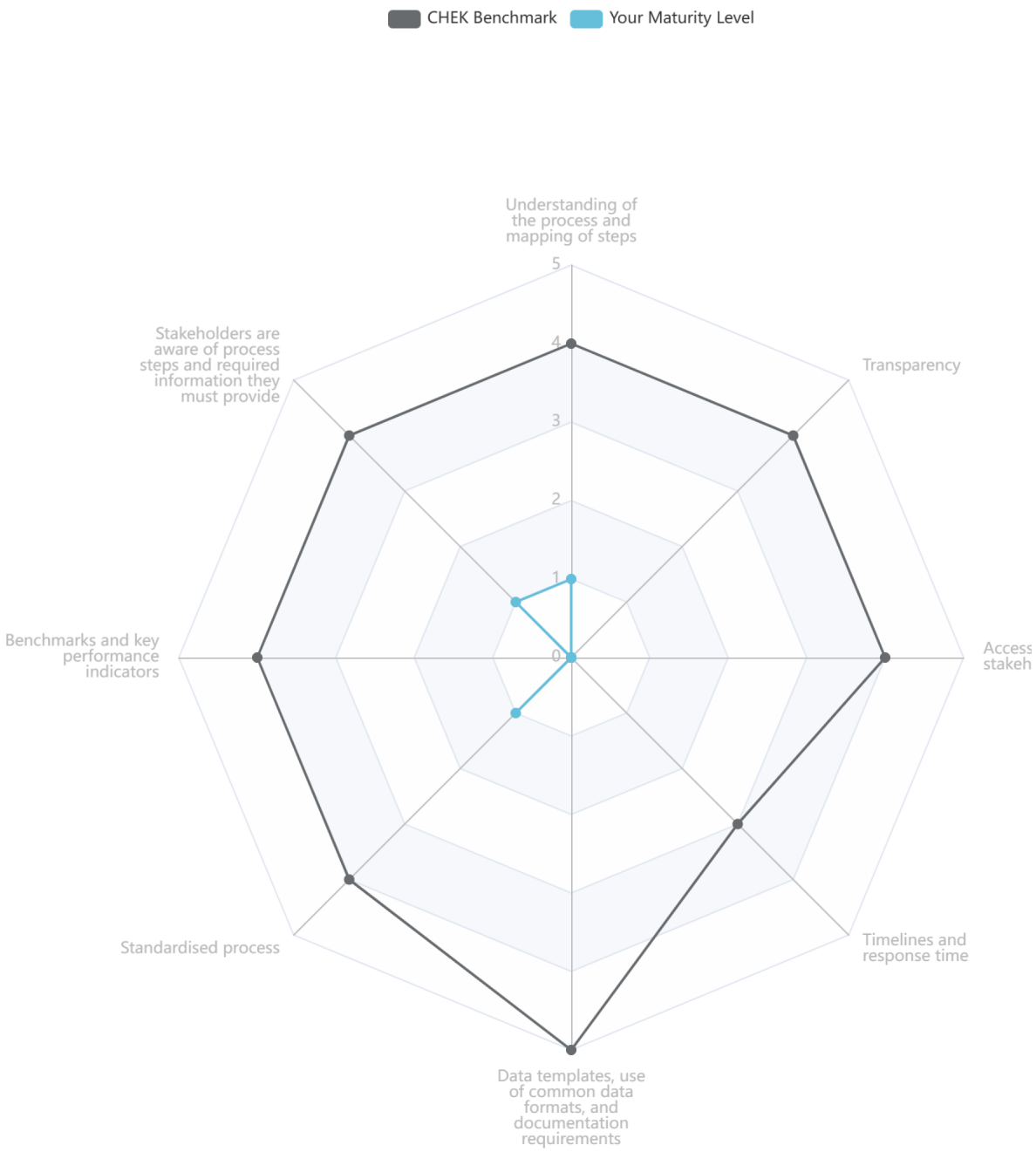
Organization (0.6)

- **Internal Staff**: Level 1
  - Less than 25% acknowledge the need for digital transformation, with ad-hoc cooperation on digitalization.
- **Higher Management**: Level 0
  - No openness to changes or digital transformation.
- **Infrastructure**: Level 0
  - Inadequate hardware/software infrastructure to support required tools.

- **Legislative System**: Level 1

- Efforts to simplify the process are ongoing, but rules lack flexibility.

- **Strategic Objectives**: Level 0
  - No implementation strategy for a data ecosystem.
- **Dedicated Personnel**: Level 1
  - Up to 20% of staff work part-time on technologies like BIM and GIS.
- **Training and Support**: Level 1
  - Lack of dedicated training, with ad-hoc external training and minimal hours per employee.
- **Overall Knowledge of Technicians**: Level 1
  - Less than 25% have basic conceptual knowledge and minimal practical experience.
- **Stakeholders' Knowledge**: Level 1
  - Up to 50% of key stakeholders use basic digital data, with no data re-use throughout the process.



Conclusion

The maturity assessment of the building permit process indicates a significant need for digital transformation across all dimensions. The current system is predominantly analogue, with minimal digital integration, which affects efficiency, accuracy, and accessibility. To enhance the building permit process, a comprehensive strategy focusing on digital infrastructure, process standardization, and stakeholder training is essential. This transformation will require commitment from all levels of the organization, including management and staff, to embrace digital tools and methodologies.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-03-31	None	Make online trainings	CHEK training package
Higher Management	2025-04-01	2025-12-31	None	Create strategic plan	Municipality's domain
Legislative System	2025-01-01	2025-03-31	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2026-01-01	2026-12-31	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2027-01-01	2027-03-31	Share strategic vision	Create BIM/GIS groups	Municipality's domain
Training, Preparation and Support	2027-04-01	2027-09-30	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2027-10-01	2028-03-31	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2027-10-01	2028-03-31	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2028-04-01	2029-03-31	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g. Electronic Signature)	2029-04-01	2029-09-30	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2029-10-01	2030-03-31	Use BIMserver.centre for BIM and GIS, Integrate IFC signature	Connect web portal	BIM Server Centre
Verification of Procedural Data	2028-04-01	2029-03-31	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2030-04-01	2031-03-31	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial	2030-	2031-	Implement visualisation	Implement validation	CHEK GIS

Data	04-01	03-31	tool, Use CHEK GIS standards	tool for GIS	standard
Content Analyser and Regulations' Checking Tool	2031-04-01	2032-03-31	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2032-04-01	2033-06-30	Implement checking tool	Connect checking software to BIMserver.centre	CHEK IDS
Building Data to Geospatial Data (e.g. BIM to GIS)	2033-07-01	2034-06-30	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g. GIS to BIM)	2033-07-01	2034-06-30	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2030-04-01	2031-03-31	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2031-04-01	2032-03-31	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2031-04-01	2032-03-31	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2027-01-01	2027-09-30	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2025-04-01	2025-09-30	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2025-10-01	2026-03-31	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-09-30	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-10-01	2026-06-30	Have process map	Implement tracking platform	CHEK Guidelines and support material
Benchmarks and Key Performance Indicators	2026-07-01	2027-06-30	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Standardised Process	2026-07-01	2027-03-31	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of	2027-	2028-	Have process map,	Implement	CHEK Guidelines

Common Data Formats, and Documentation Requirements	07-01	12-31	Implement BIMserver.centre	BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	and support material
Timelines and Response Time	2028-01-01	2028-09-30	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material
Accessibility of Stakeholders	2028-10-01	2029-09-30	Define measurement for KPIs, Create guidelines, Implement IFC and GIS use	Implement data sharing	BIM Server Centre
Transparency	2029-10-01	2030-09-30	Implement data sharing	Connect stakeholders	BIM Server Centre

Conclusion

The roadmap outlined above provides a comprehensive plan to achieve the benchmark value in the future. It involves a series of strategic actions, dependencies, and the use of specific CHEK tools to ensure a smooth transition and implementation of the necessary processes. By following this roadmap, the organization can enhance its data management capabilities, improve stakeholder engagement, and ensure compliance with legislative requirements. The successful execution of this plan will lead to improved efficiency, transparency, and interoperability within the building permit process.

APPLICANT The responsible technician from building authority issue the planning paper and send it by email to the applicant.
Start
Collect city regulatory information
Collect city planning information
Collect building regulatory information
ollect existing building and regulatory information
Draft initial design
Require pre-application consulting
Pre-application consulting received
Prepare Application Documents
Ask for statement from 3rd parties
Receive statements
ollect positive statements from 3rd parties involved
Submit application for planning permit
Revision received
Collect Additional Information
Resubmit application
Receive notification for application acceptance and start of the planning permit process
Receive request for changes
Implement required changes
Resubmit updated project
Receive of planning permit
Prepare Application Documents
Request for the statement
Receive statement
ollect positive statements from 3rd parties involved
Submit application for building permit
Revision received
Collect Additional Information
Resubmit application
Receive notification for application acceptance and start of the building permit process
Receive request for changes
Implement required changes
Resubmit updated project
Receive of building permit
BUILDING AUTHORITY
City regulatory information
City planning information
Building regulatory information
Pre-application consulting request received
Provide pre-application consulting
Application received
Initiate Application Review
Issue application number
Assign responsible technician for the process
Check administrative requirements
Check documentation completenes
Application received
Return application for revision
No
Is the documentation complete?
Yes
Accept application
Notify acceptance and start of planning permit process
Application Status updated
Check compliance with regulations
Check compliance with urban regulation
Check compliance from 3rd parties
Are changes required?
Yes
No
Require changes
Receive updated project
Are changes accepted?
No
Changes accepted
No project changes required
All compliance checks approved
Issue planning permit
Planning permit notification
Application received
Initiate Application Review
Issue application number
Assign responsible technician for the process
Check administrative requirements
Check documentation completenes
Application received
Return application for revision
No
Is the documentation complete?
Yes
Accept application
Notify acceptance and start building permit process
Application Status updated
Check compliance with regulations
Check compliance with fire and safety regulation
Check structural project compliance
Check compliance with accessibility standards
Checkpositive statements from 3rd parties
Check compliance with regulations
Are all checks compliant?
No
Yes
Require changes
No
Receive updated project
Are changes accepted?
Yes
Changes accepted
Approve compliance checks
All compliance checks approved
Issue building permit
Building permit notification
End
THIRD PARTIES
Receive request for the statement
Issue the statement
Receive request for the statement
Issue the statement
PUBLIC

VILA NOVA DE GAIA RESULTS

Final CHEK Report: As-Is Process by IntelliCHEK

Introduction

The building permit process is a comprehensive procedure involving multiple stakeholders, including the Applicant, Building Authority, Public, and Third Parties. This report provides a detailed examination of the tasks and events associated with each participant in the process. The objective is to ensure that the application is complete, compliant with regulations, and thoroughly evaluated by both internal and external parties before a building permit is either issued or denied. The following sections outline the process in detail, providing insights into the roles and responsibilities of each participant.

Table with Tasks and Descriptions

Participant	Task/Event	Description
Applicant	Start	The process begins with the applicant initiating the process.
	Collect city regulatory information	The applicant gathers information about city regulations.
	Collect city planning information	The applicant collects information related to city planning.
	Collect building regulatory information	The applicant gathers building regulatory information.
	Collect existing building and regulatory information	The applicant collects information on existing buildings and regulations.
	Draft initial design	The applicant drafts the initial design of the project.
	Prepare Application Documents	The applicant prepares the necessary application documents.
	Submit application	The applicant submits the application.
	Fulfill fiscal obligation (pay taxes)	The applicant fulfills fiscal obligations by paying taxes.
	Pay Application Fees	The applicant pays the application fees.
	Receive request for changes	The applicant receives a request for changes, if necessary.
	Implement required changes	The applicant implements any required changes.
	Resubmit updated project	The applicant resubmits the updated project.
	Receive approval notification	The applicant receives a notification of approval.
	Fulfill final conditions	The applicant fulfills any final conditions required.
	Pay fees	The applicant pays any remaining fees.
	Send final documents	The applicant sends the final documents.
Building Authority	Application received	The building authority receives the application submitted by the applicant.

	Initiate Application Review	A technician checks if the files are correct and digitally signed by the applicant.
	Issue application number	The system assigns a number to the process after verifying the files.
	Check administrative requirements	Administrative staff verifies the applicant's entitlement and fee payment.
	Geolocate the plot	The geographic systems division verifies the project's georeferencing.
	Check documentation completeness	A technician verifies the completeness and consistency of the documents.
	Is the documentation complete?	A decision is made on the completeness of the documentation.
	Assign responsible technician for the process	The Architects' Coordinator assigns an architect to analyze the project.
	Assign internal evaluators	A request for analysis is sent to the designated architect.
	Is external evaluation needed?	A decision is made on the need for external evaluation.
	Check compliance with urban regulation	The architect evaluates compliance with urban regulations.
	Check compliance with building regulation	The architect checks compliance with building regulations.
	Check compliance with regulations	A parallel gateway checks compliance with all regulations.
	Are all checks compliant?	A decision is made on compliance.
	Final Assessment	A final assessment is conducted.
	Is the building permit approved?	A decision is made on the approval of the building permit.
	Permit Document Preparation	The technician prepares the permit document.
	Issue building permit	The building permit is issued and sent to the applicant.
	Update Building Permit Database	The system is updated with the issued license and inspection deadline.
Third Parties	Request for external evaluation received	Third parties receive a request for external evaluation.
	Evaluate project	Third parties evaluate the project.
	Send external evaluation	Third parties send the external evaluation report.

In Detail: The Different Applicants

Applicant

The applicant initiates the building permit process by gathering essential information related to city regulations, city planning, building regulations, and existing buildings. This comprehensive data collection is crucial for drafting an initial design that aligns with regulatory requirements. Once the design is prepared, the applicant compiles the necessary application documents and submits them to the Building Authority. The applicant is also responsible for fulfilling fiscal obligations, including paying taxes and application fees. If the Building Authority requests changes, the applicant must implement these changes and resubmit the updated project. Upon receiving approval, the applicant fulfills any final conditions, pays any remaining fees, and sends the final documents to complete the process.

Building Authority

The Building Authority plays a pivotal role in the building permit process. Upon receiving the application, a technician reviews the files for correctness and digital signatures. The system then assigns an application number, and administrative staff verify the applicant's entitlement and fee payment. The geographic systems division ensures the project's georeferencing is accurate. A technician checks the completeness and consistency of the documents, and a decision is made on whether the documentation is complete. If complete, the application is accepted, and an architect is assigned to analyze the project. The architect evaluates compliance with urban and building regulations, and a parallel gateway checks compliance with all regulations. A final assessment is conducted, and a decision is made on the approval of the building permit. If approved, the technician prepares the permit document, issues the building permit, and updates the Building Permit Database.

Third Parties

Third parties are involved in the process when an external evaluation is required. Upon receiving a request for external evaluation, third parties evaluate the project and send an external evaluation report. This step ensures that the project meets all necessary standards and regulations from an independent perspective.

Conclusion

The building permit process is a meticulous and multi-faceted procedure that involves the collaboration of various stakeholders, including the Applicant, Building Authority, and Third Parties. Each participant plays a critical role in ensuring that the application is complete, compliant with regulations, and thoroughly evaluated. The process is designed to uphold the integrity of building standards and ensure that all projects meet the necessary legal and regulatory requirements. Through a series of well-defined tasks and decisions, the process culminates in the issuance or denial of a building permit, thereby facilitating orderly and compliant urban development.

Final Report: Maturity Assessment by IntelliCHEK

Maturity Models with Average Maturity Level

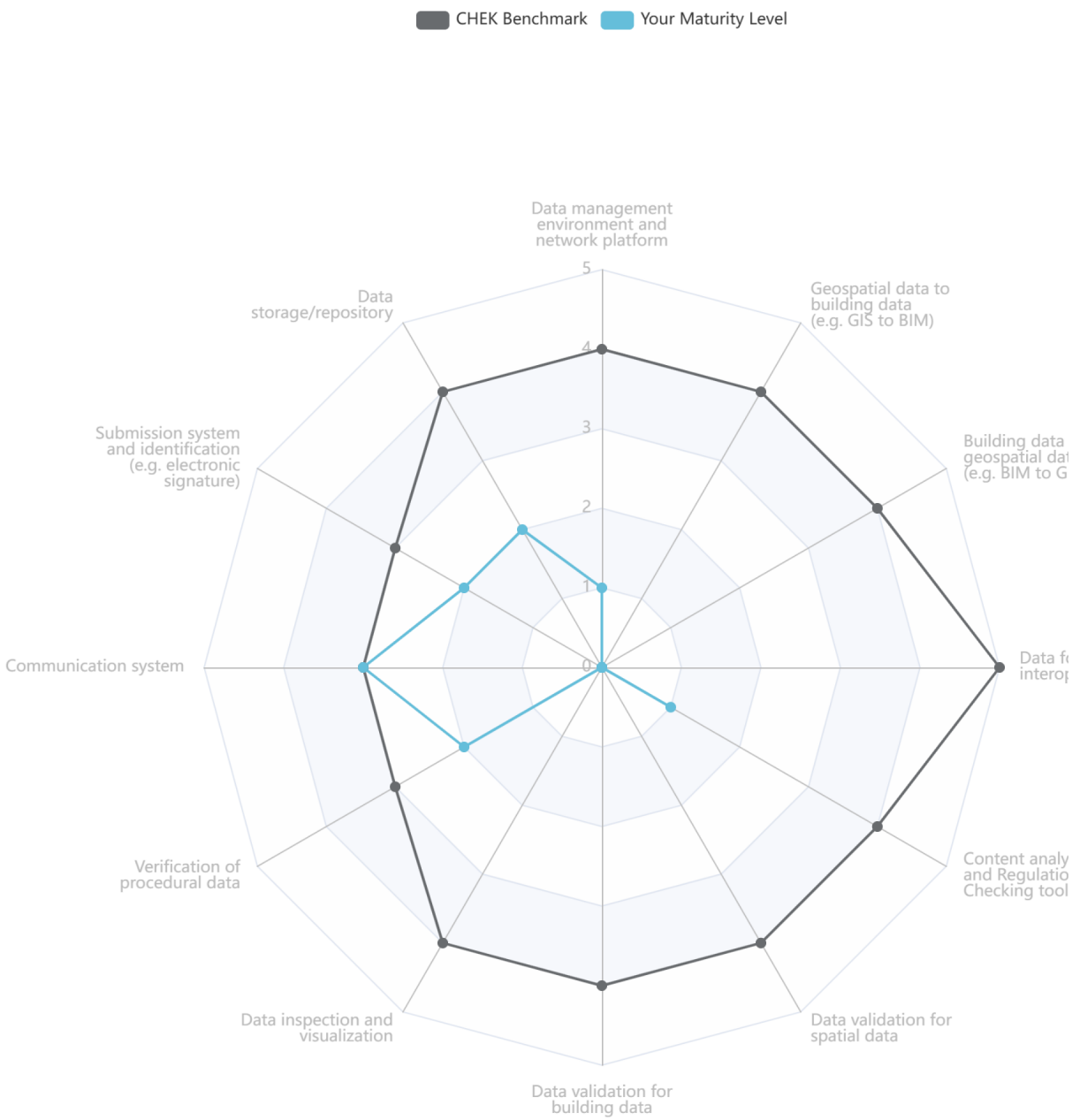
Technology (1.1)

- **Data Management Environment and Network Platform**: Level 1
  - The process utilizes a digital platform for submission and communication, but lacks a comprehensive digital data management system.
- **Data Storage/Repository**: Level 2
  - A centralized repository exists for ongoing and archived processes, accessible to internal staff.

- **Submission System and Identification**: Level 2
    - Digital submission with electronic signatures is in place, but lacks automatic verification of additional necessary information.
- **Communication System**: Level 3
    - An online portal facilitates status tracking and document submissions, with integration between internal systems and the applicant's portal.
- **Verification of Procedural Data**: Level 2
    - Semi-digital verification with unified software usage is present, focusing on document completeness and compliance.
- **Data Inspection and Visualization**: Level 0
    - No software applications are used for data inspection and visualization.
- **Data Validation for Building and Spatial Data**: Level 0
    - No automated or manual validation methods are reported for building or spatial data.
- **Content Analyser and Regulations' Checking Tool**: Level 1
    - Manual content analysis and rule checking are performed digitally.
- **Data Format Interoperability**: Level 0
    - No practices for digital format interoperability are reported.

- **Building Data to Geospatial Data and Vice Versa**: Level 0

- **Building Data to Geospatial Data and Vice Versa**: Level 0
    - No integration between building data and geospatial data is reported.

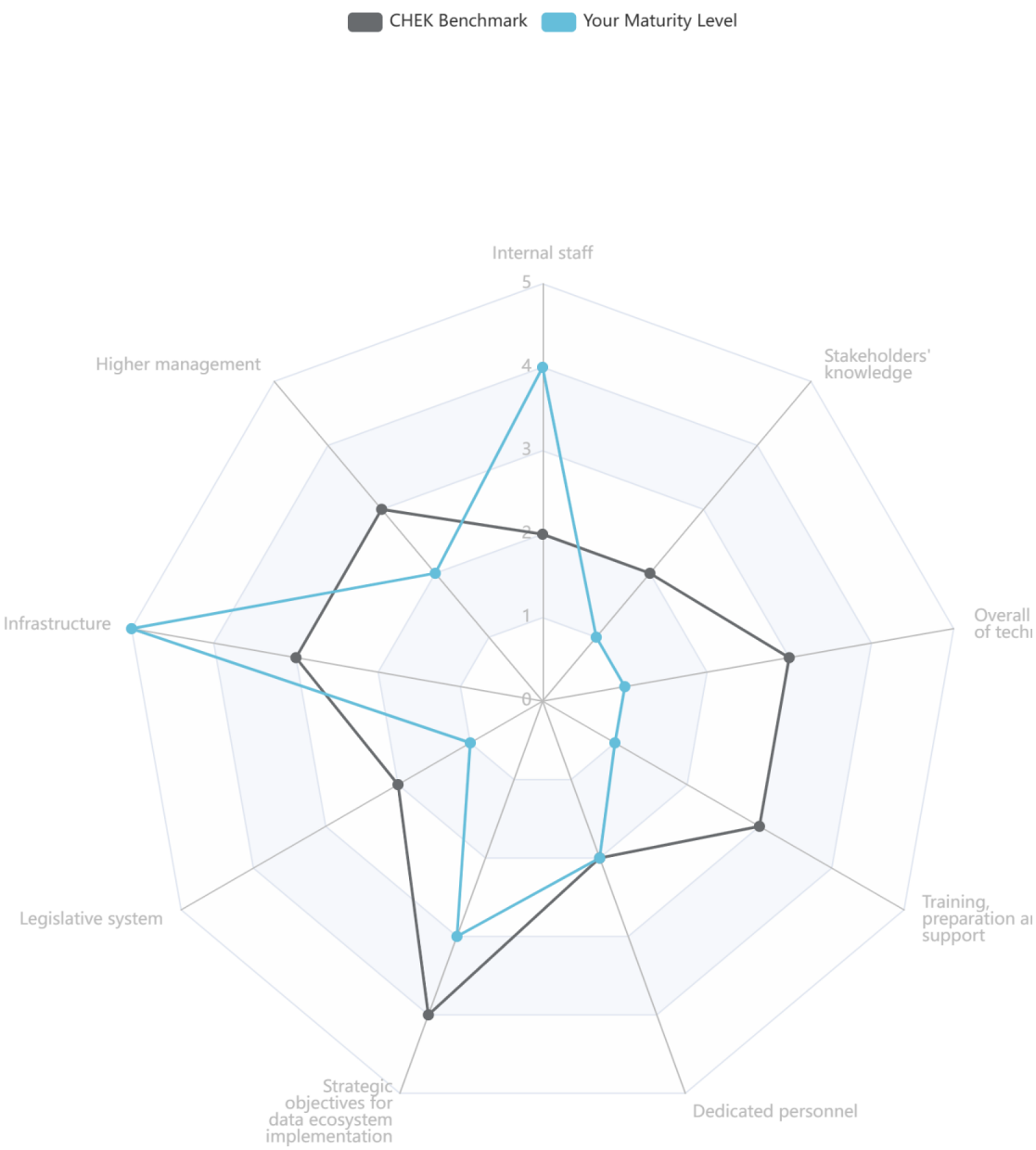


Information (0.7)

- **Data Quality Control**: Level 0
    - No structured quality control measures or practices are reported.
- **Building/Intervention Design Data**: Level 0
    - No use of 2D drawings, building models, or sophisticated design data is reported.
- **City Context Data**: Level 1
    - City regulatory and planning information is available on open data, suggesting a basic city model leveraging geospatial data.
- **Data Standards and Guidelines**: Level 2
    - Basic guidelines for data standardization are in place, including training manuals and delivery standards.
- **Regulations Formats**: Level 0
    - Regulations are in natural language, requiring interpretation and referencing external laws.

- **Regulations Accessibility**: Level 1

- **Regulations Accessibility**: Level 1
    - Normative texts are accessible online and through a webGIS system.



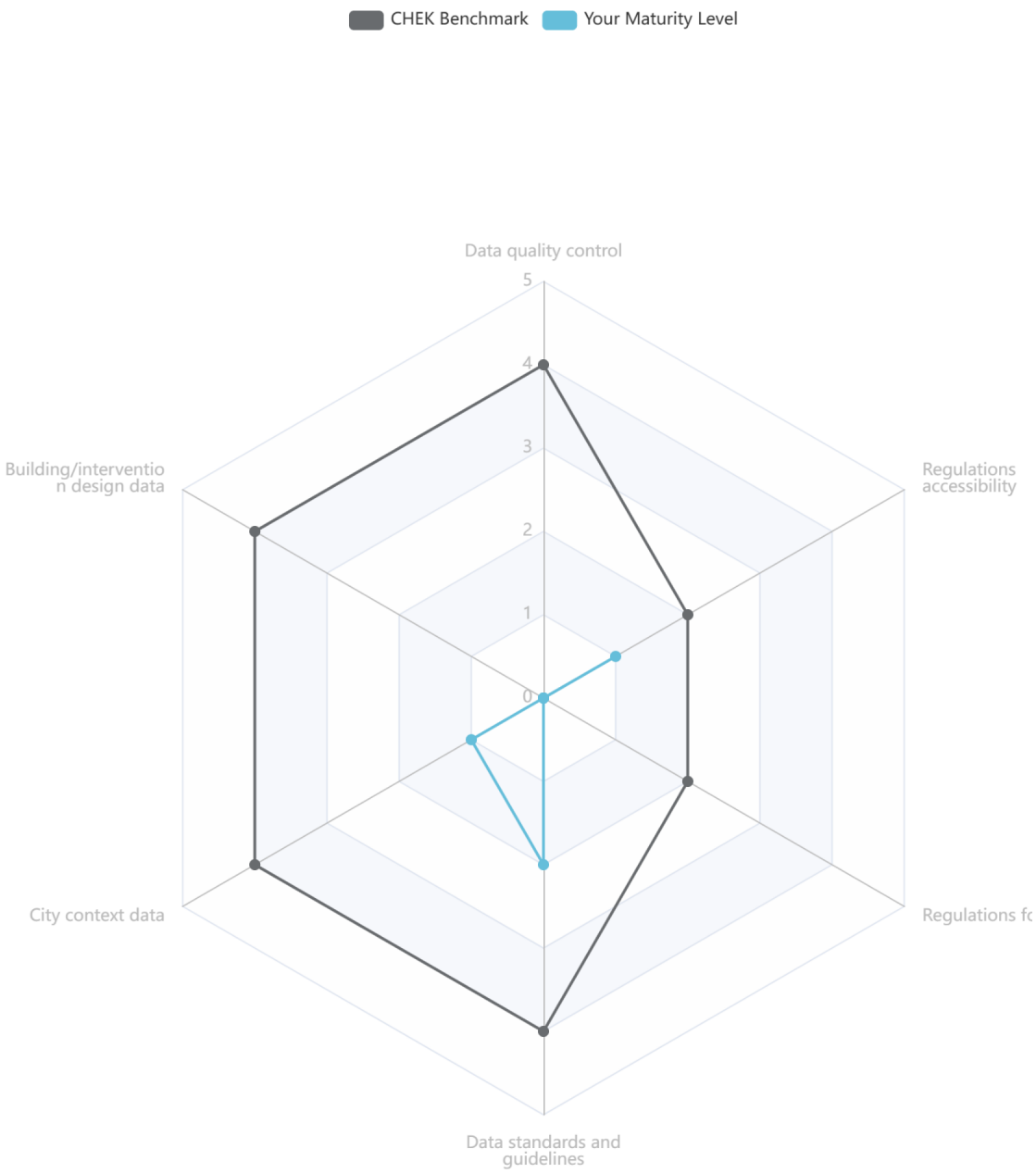
Process (1.0)

- **Understanding of the Process and Mapping of Steps**: Level 2
    - Detailed documentation identifies process steps within a digital environment.
- **Stakeholders' Awareness of Process Steps**: Level 2
    - Stakeholders have a clear understanding facilitated by guidelines and standards.
- **Benchmarks and Key Performance Indicators**: Level 0
    - No formal quality control plans or performance benchmarks are reported.
- **Standardised Process**: Level 2
    - Detailed guidelines support technicians at each process step.

- **Data Templates and Documentation Requirements**: Level 0

- No information on templates, common data formats, or documentation requirements.

- **Timelines and Response Time**: Level 0
  - No predefined timelines or response times are reported.
- **Accessibility of Stakeholders**: Level 2
  - Stakeholders access the same data source, but without automated workflows or real-time updates.
- **Transparency**: Level 2
  - Stakeholders access information influencing their workflow, but without real-time tracking or performance monitoring.



Organization (2.2)

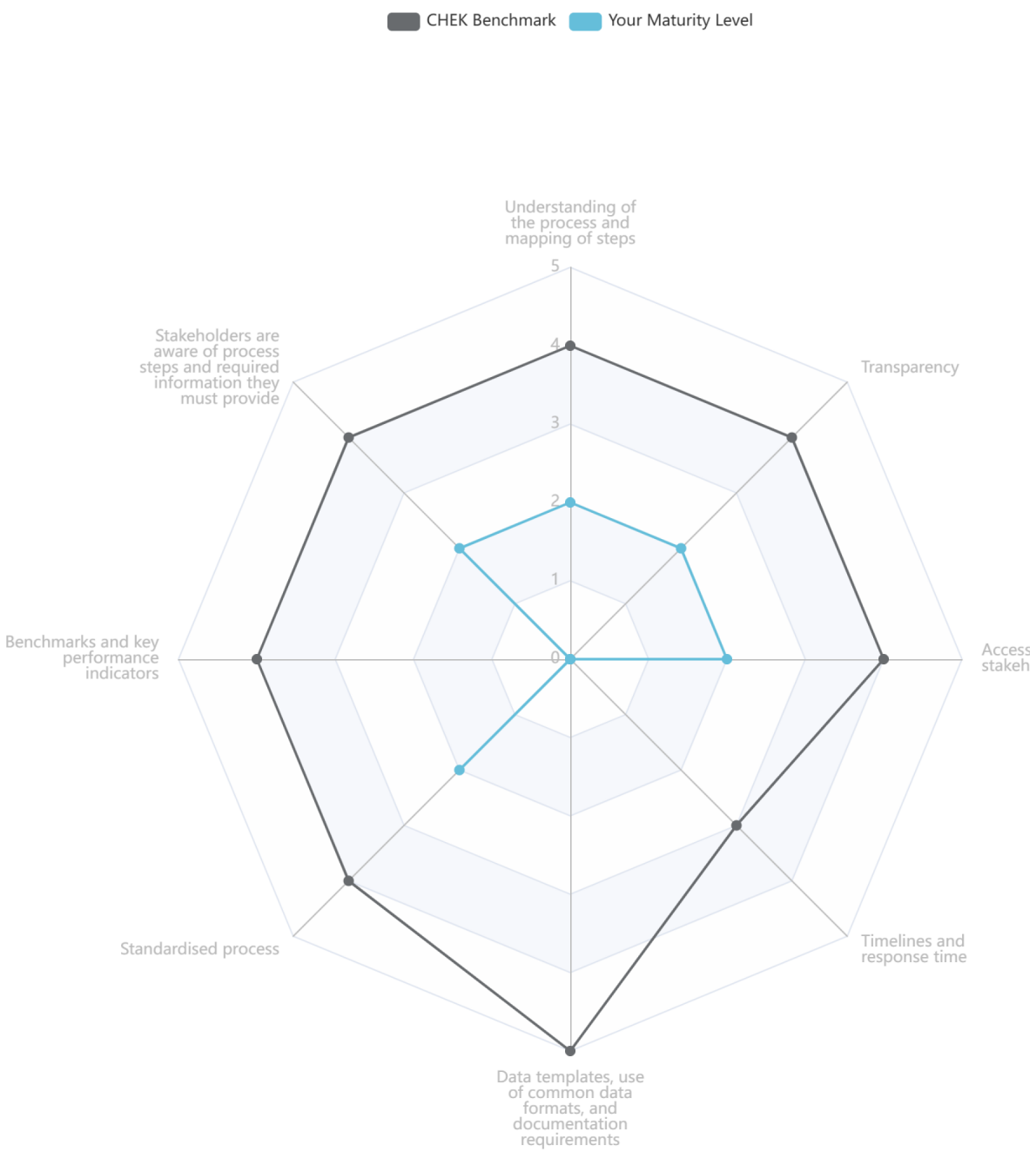
- **Internal Staff**: Level 4

- Over 75% of staff are open to digitalization, with some participating in digital innovation networks.

- **Higher Management**: Level 2
  - Digital process initiatives are bottom-up, with no clear management plans.
- **Infrastructure**: Level 5
  - Continuous infrastructure upgrades and regular updates are in place.
- **Legislative System**: Level 1
  - Efforts to simplify the process are ongoing, but rules lack flexibility.
- **Strategic Objectives for Data Ecosystem Implementation**: Level 3
  - Comprehensive action plans and monitoring are in place, recognizing the need for improvements in technology, process, and policy.
- **Dedicated Personnel**: Level 2
  - A small team is dedicated to implementing technologies like BIM and GIS.
- **Training, Preparation, and Support**: Level 1
  - Training is ad hoc, with less than 8 hours per employee per year.
- **Overall Knowledge of Technicians**: Level 1
  - Less than 25% have basic conceptual knowledge and practical experience.

- **Stakeholders' Knowledge**: Level 1

◦ Up to 50% of key stakeholders use basic digital data, with no data re-use throughout the process.



Conclusion

The maturity assessment of building permits reveals a mixed level of digitization across the four critical dimensions: Technology, Information, Process, and Organization. While there are strengths in infrastructure and staff openness to digitalization, significant gaps exist in data validation, quality control, and process benchmarks. Addressing these gaps is essential for advancing the maturity of building permit processes and achieving a more integrated and efficient system. The focus should be on enhancing data management systems, establishing quality control measures, and improving stakeholder engagement and training.

Final Report: Roadmap by IntelliCHEK

KMA	Start Date	End Date	Dependencies	Actions	CHEK Tools
Internal Staff	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Higher Management	2025-01-01	2025-03-31	None	Create strategic plan	Municipality's domain
Infrastructure	2025-01-01	2025-01-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Legislative System	2025-01-01	2025-03-31	None	Understand the legislative system	CHEK Regulation Tool
Strategic Objectives for Data Ecosystem Implementation	2025-04-01	2025-06-30	Create strategic plan	Share strategic vision	Municipality's domain
Dedicated Personnel	2025-07-01	2025-07-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Training, Preparation, and Support	2025-07-01	2025-12-31	Create BIM/GIS groups	Provide training	CHEK training package
Overall Knowledge of Technicians	2026-01-01	2026-06-30	Provide training	Provide certifications	CHEK training package
Stakeholders' Knowledge	2026-01-01	2026-03-31	Provide training	Train stakeholders	CHEK training package
Data Management Environment and Network Platform	2026-04-01	2026-12-31	Integrate IFC signature	Use BIMserver.centre for BIM and GIS, Assign users	BIM Server Centre
Submission System and Identification (e.g., Electronic Signature)	2027-01-01	2027-03-31	Implement BIMserver.centre	Integrate IFC signature	BIM Server Centre, IFC Signature
Communication System	2027-04-01	2027-04-01	Chek benchmark level reached	Chek benchmark level reached	Chek benchmark level reached
Verification of Procedural Data	2027-04-01	2027-06-30	Use BIMserver.centre for BIM and GIS	Identify procedural data	CHEK IDS
Data Validation for Building Data	2027-07-01	2028-06-30	Implement visualisation tool, Use CHEK IDS	Implement validation tool for BIM	BIM Server Centre Validation, Verify 3D
Data Validation for Spatial Data	2027-07-01	2028-06-30	Implement visualisation tool, Use CHEK GIS standards	Implement validation tool for GIS	CHEK GIS standard
Content Analyser and Regulations' Checking Tool	2028-07-01	2029-03-31	Implement validation tool for BIM, Implement validation tool for GIS, Use CHEK rules repository	Implement checking tool	CYPE Urban
Data Format Interoperability	2029-	2030-	Implement checking tool	Connect checking	CHEK IDS

	04-01	06-30		software to BIMserver.centre	
Building Data to Geospatial Data (e.g., BIM to GIS)	2030-07-01	2031-06-30	Connect checking software to BIMserver.centre	Implement BIM to GIS	BIM to CityGML, Plugin CityJSON to Revit
Geospatial Data to Building Data (e.g., GIS to BIM)	2030-07-01	2031-06-30	Connect checking software to BIMserver.centre	Implement GIS to BIM	CityGML to IFC
Data Quality Control	2031-07-01	2032-06-30	Use CHEK IDS, Use CHEK GIS standards	Create quality control plan	CHEK Guidelines and support material
Building/Intervention Design Data	2031-07-01	2032-06-30	Use CHEK rules repository	Use CHEK IDS	CHEK IDS
City Context Data	2032-07-01	2033-03-31	Use CHEK rules repository	Use CHEK GIS standards	CHEK IDS
Data Standards and Guidelines	2033-04-01	2033-09-30	Implement IFC and GIS use, Share strategic vision	Implement CHEK IDS	CHEK IDS
Regulations Formats	2033-10-01	2034-03-31	Understand the legislative system, Implement CHEK IDS	Assess rules to translate, Translate rules	CHEK Regulation Tool
Regulations Accessibility	2034-04-01	2034-06-30	Translate rules	Use CHEK rules repository	CHEK Guidelines and support material
Understanding of the Process and Mapping of Steps	2025-01-01	2025-06-30	None	Have process map	CHEK Virtual Assistant
Stakeholders are Aware of Process Steps and Required Information They Must Provide	2025-07-01	2025-12-31	Have process map	Implement tracking platform	CHEK Guidelines and support material
Benchmarks and Key Performance Indicators	2026-01-01	2026-12-31	Have process map, Define KPIs	Define KPIs, Define measurement for KPIs	CHEK Guidelines and support material
Standardised Process	2027-01-01	2027-06-30	Implement tracking platform	Create guidelines	CHEK Guidelines and support material
Data Templates, Use of Common Data Formats, and Documentation Requirements	2027-07-01	2028-12-31	Have process map, Implement BIMserver.centre	Implement BIMserver.centre, Connect BIMserver.centre, Implement IFC and GIS use	CHEK Guidelines and support material
Timelines and Response Time	2029-01-01	2029-09-30	Connect stakeholders	Communicate timelines	CHEK Guidelines and support material
Accessibility of Stakeholders	2029-	2030-	Define measurement for	Implement data sharing	BIM Server

	10-01	03-31	KPIs, Create guidelines, Implement IFC and GIS use		Centre
Transparency	2030-04-01	2030-09-30	Implement data sharing	Connect stakeholders	BIM Server Centre

Conclusion

The roadmap outlined above provides a comprehensive plan for achieving the benchmark value through a series of strategic actions and dependencies. Each step is designed to build upon the previous one, ensuring a cohesive and integrated approach to data management, stakeholder engagement, and regulatory compliance. By following this roadmap, IntelliCHEK aims to enhance the efficiency and effectiveness of building permit processes, ultimately leading to improved transparency, data quality, and stakeholder satisfaction.

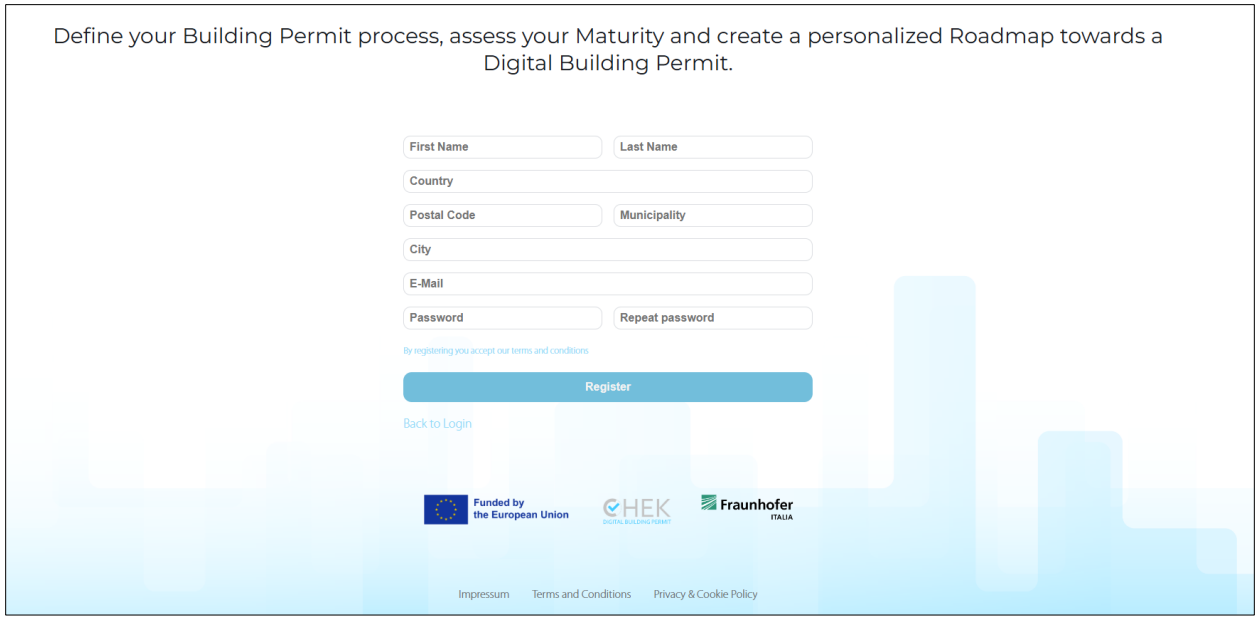
ANNEX IV

Tutorial for CHEK VA self-testing

Before Start:

Account Creation:

- Click the link "**Register here**" and create an account on the website.
- After registering go to "Log in"
- Fill in all the information in the registration form.
- If you run into problems to login, clear the cache of your browser. If problems remain, please contact Fraunhofer Italia.



Purpose:

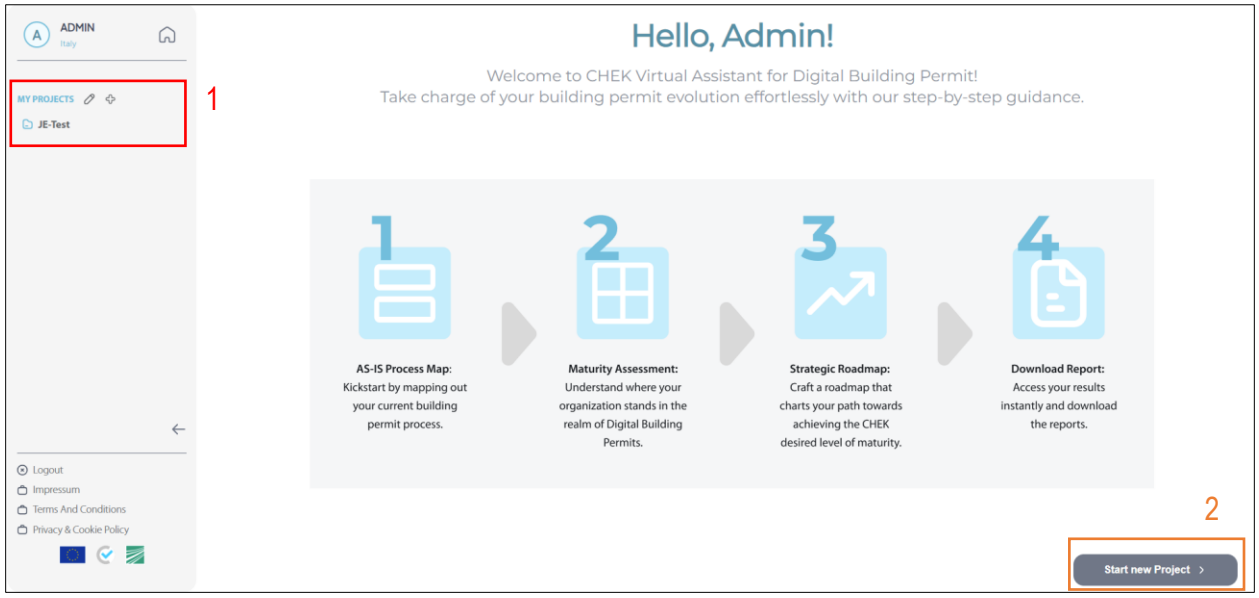
- The goal of the test is to create a process map of your municipality's current Building Permit process. For this, the CHEK VA requires detailed and clear information.

Tips Before Starting:

- Complete the test in English.
- Be precise about the methods and technologies you use. For example, write "**e-mail**" for electronic mail and "**physical letter**" for standard mail; avoid using just "mail".

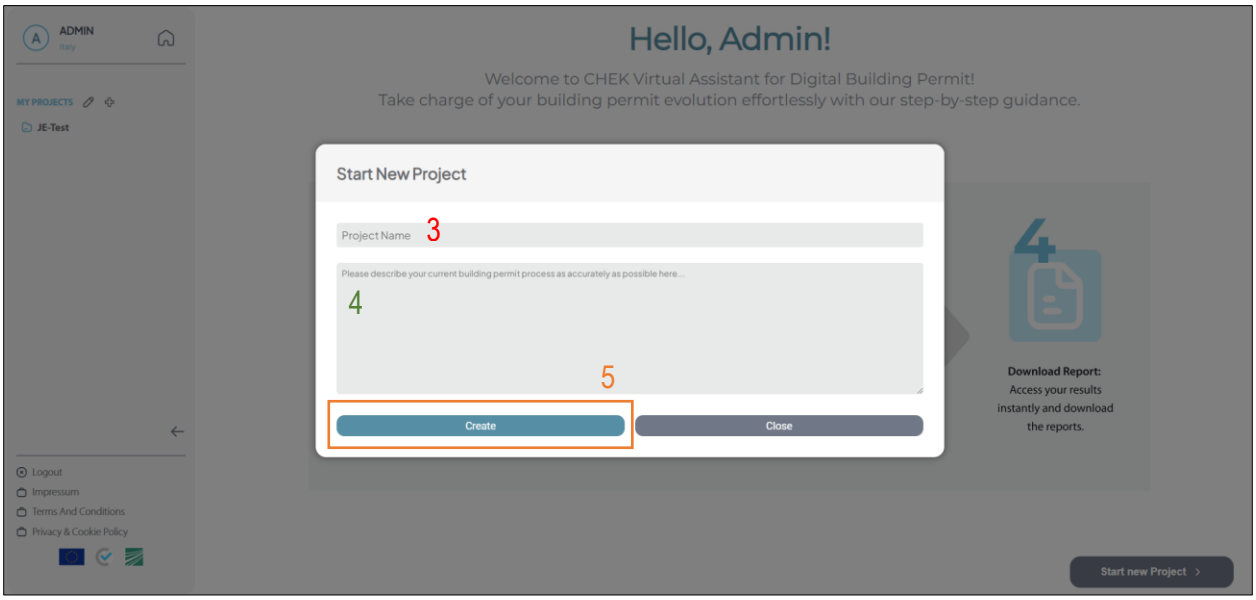
Starting the Test:

- After logging into your account, you will see the initial page with information about the CHEK VA and the steps of the process.
- Once you have saved projects, you can navigate through them using the left bar (1).
- To start the test, click on "**Start new Project**" (2) located at the bottom right of the screen.



Project Setup:

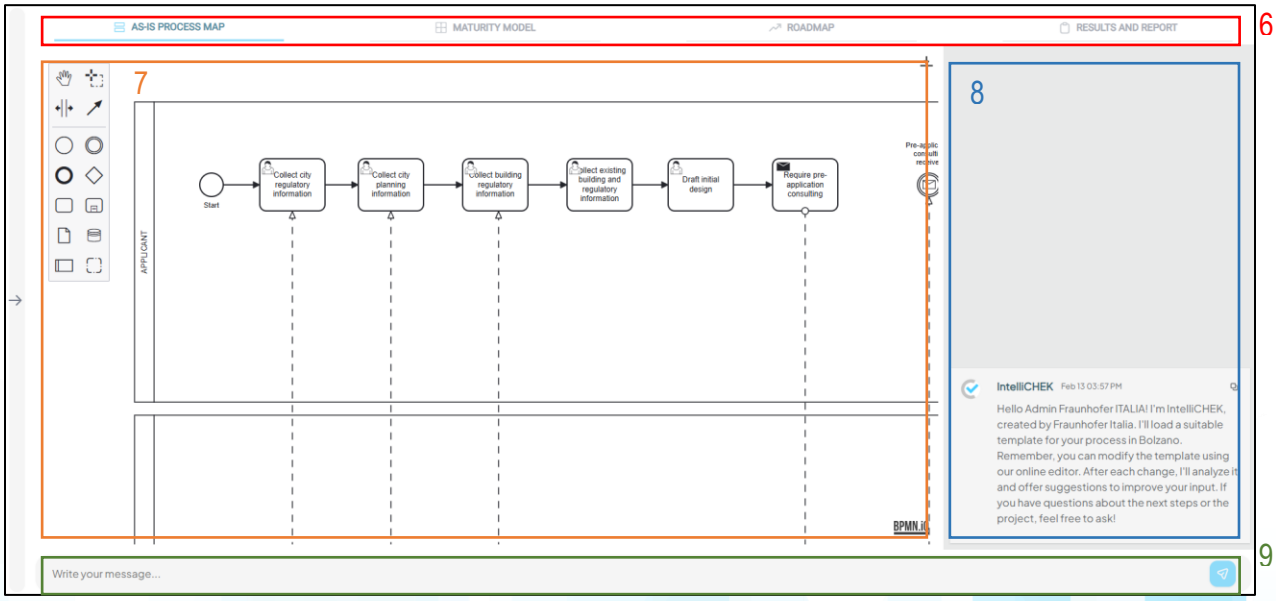
- Choose the name for your new project (3).
- Write a description of your current building permit process (4).
  Tip: Provide an accurate description by detailing the main processes and technologies used.
- When you are satisfied with your description, click the **"Create"** button (5).



Project Interface:

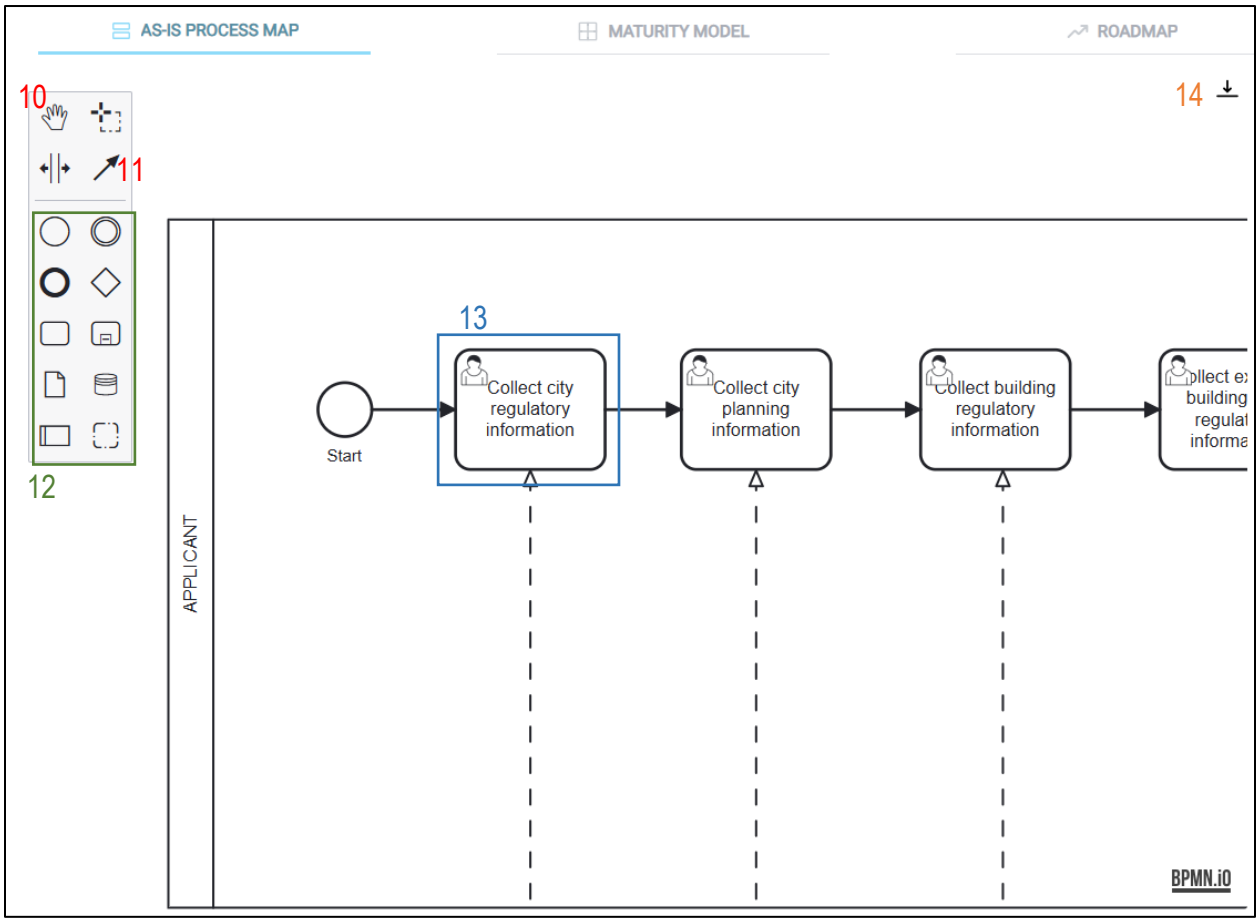
A new window will open, displaying the following components:

- **6:** Tabs representing the steps of the VA (as indicated on the Homepage). The highlighted tab represents your current step.
- **7:** BPMN editing tool. You can navigate and modify the process map as needed.
- **8:** Chat history. Any interactions with the VA will appear here.
- **9:** Message bar. Type your responses here and click the blue button on the right to send your message.



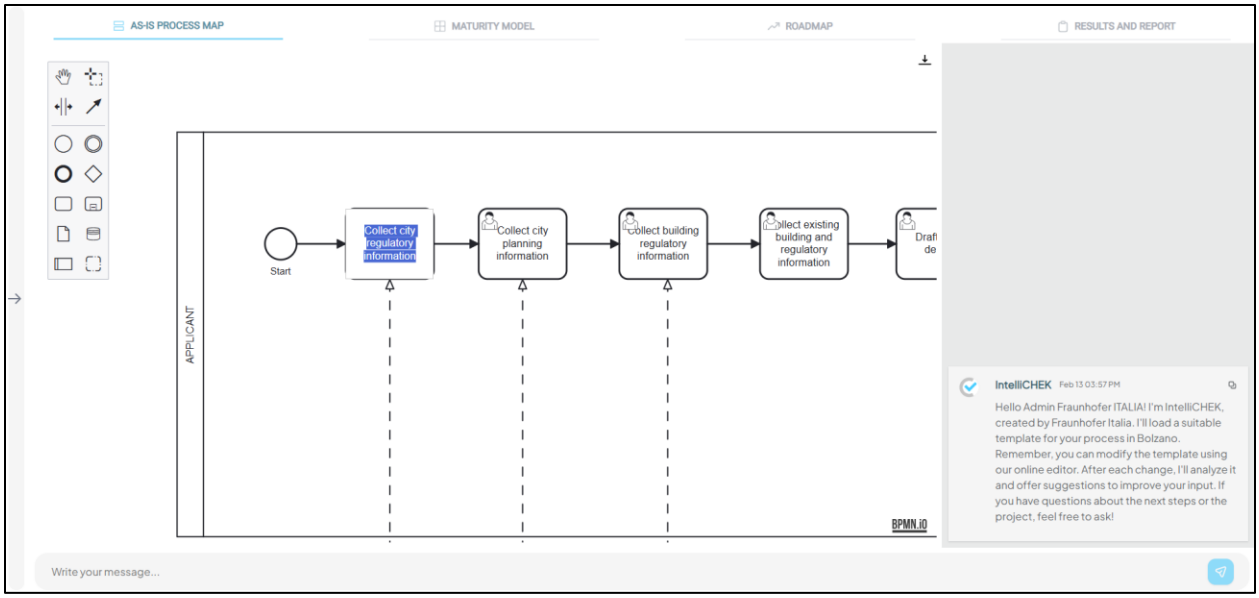
BPMN Editor Navigation:

- **10:** Hand tool – used for navigating your map.
- **11:** Connect tool – used to create connections between actions.
- **12:** Tool for creating new elements in the process map.
- **13:** Click on an existing element to modify it.
- **14:** Option to download the BPMN map.
- Use **CTRL + Mouse Scroll** to zoom in and out on the process map.

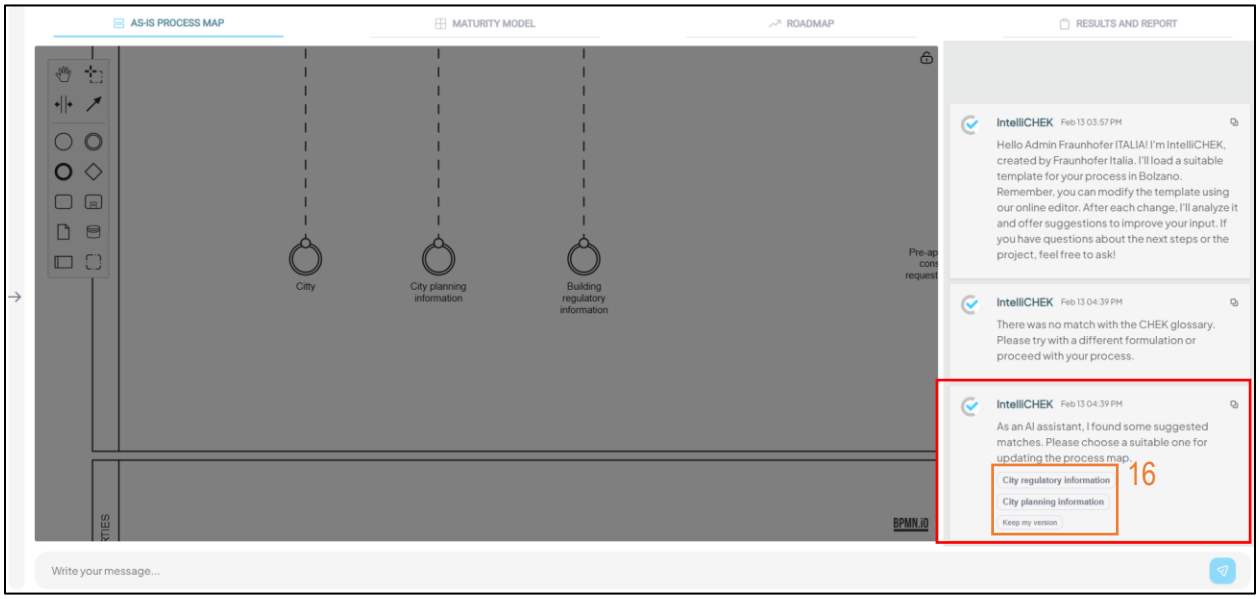


Creating your Process Map:

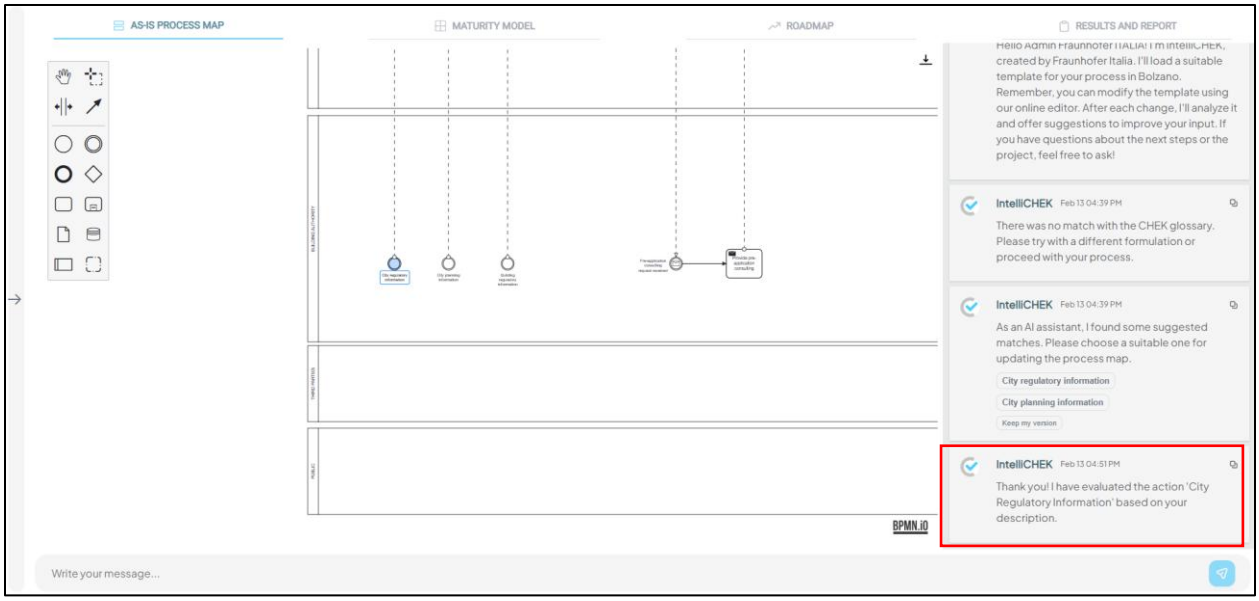
- The first step is to create a process map of your building permit process using a template for a generic building permit.
- Modify each action according to your scenario. If a particular action is according to your process, keep it; otherwise, change or delete it.
- To change the text, simply double-click the action and type the new name.



- Press **Enter** and wait for the VA to review your action. If the VA provides a message, address it before proceeding to the next action (15).
- If the VA offers naming options for your action, choose the one that fits best. If none of the options are satisfactory, you can choose to **"Keep your own version"** (16).



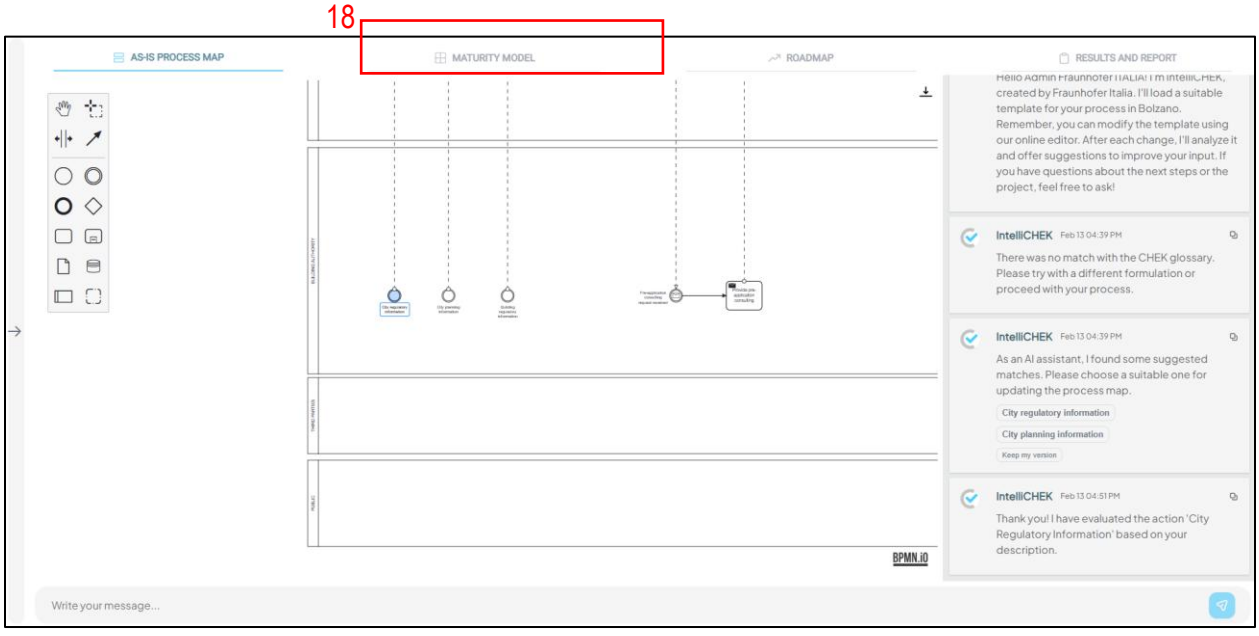
- If the VA asks further questions, type your answer in the message bar.
- Repeat this process until the BPMN screen is unlocked and you receive a confirmation message from the VA (17).



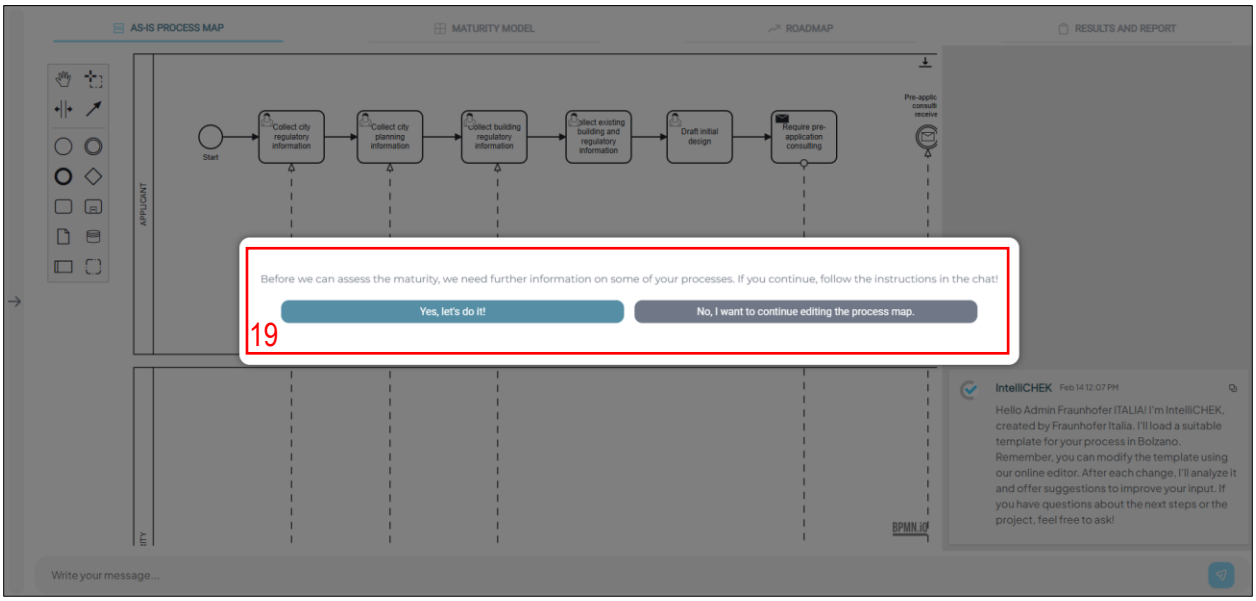
17

Finishing your Process Map:

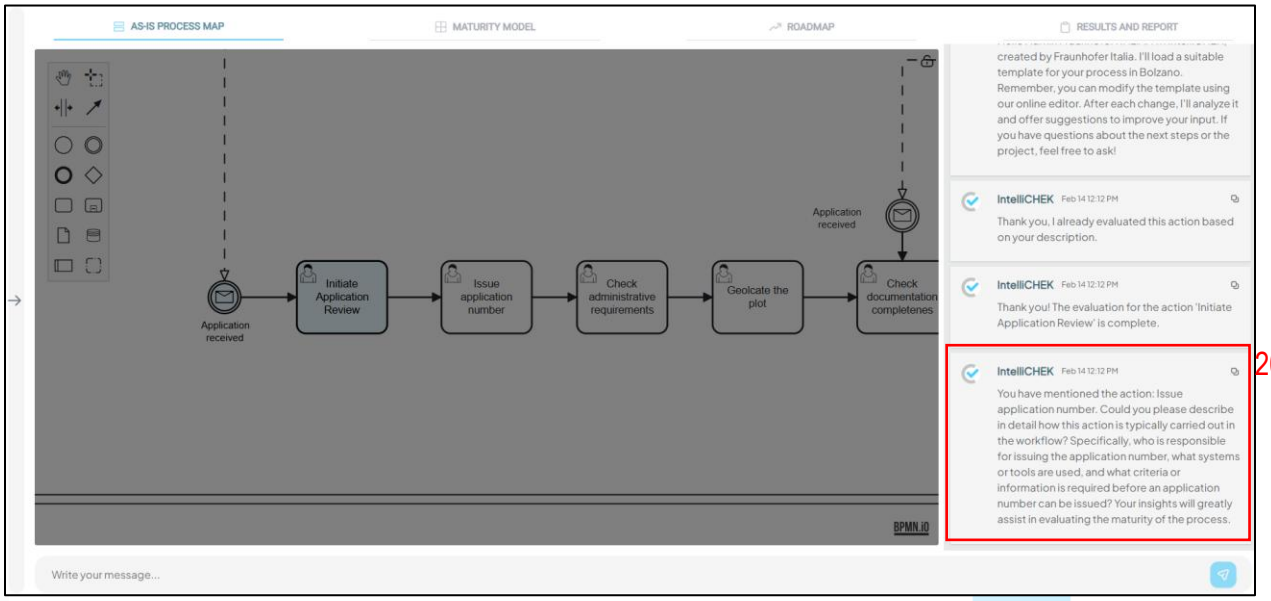
- Once the process map is complete with all relevant actions, click on the "**Maturity Model**" tab (18).



- If the VA has not finished evaluating all your actions, it will prompt you to answer extra questions (19). You can choose to further modify the process map by clicking "**No, I want to continue editing the process map**".

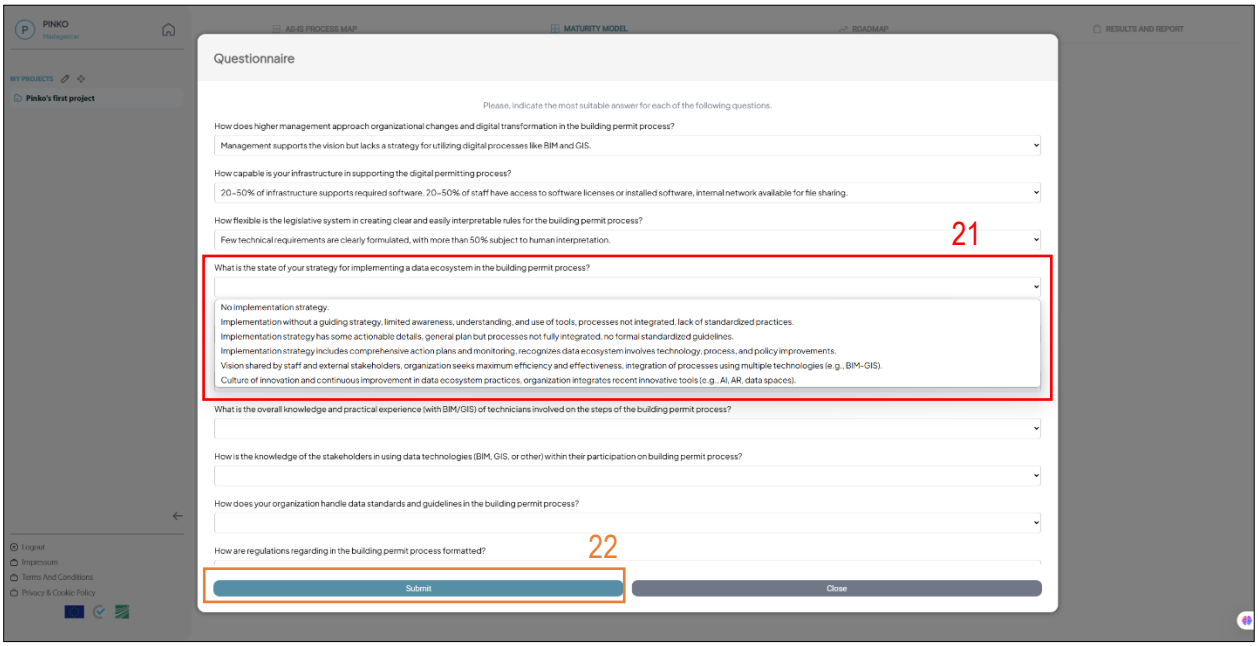


- The VA will review the actions and identify any that still need clarification (20). For each remaining action, it will ask questions that you should answer thoroughly.
- Type your answers in the message bar, send them, and repeat until all actions are evaluated.



- Once all actions are fully evaluated, a new screen will appear with a multiple-choice form (21).
- Select the description that best fits your municipality for each question.

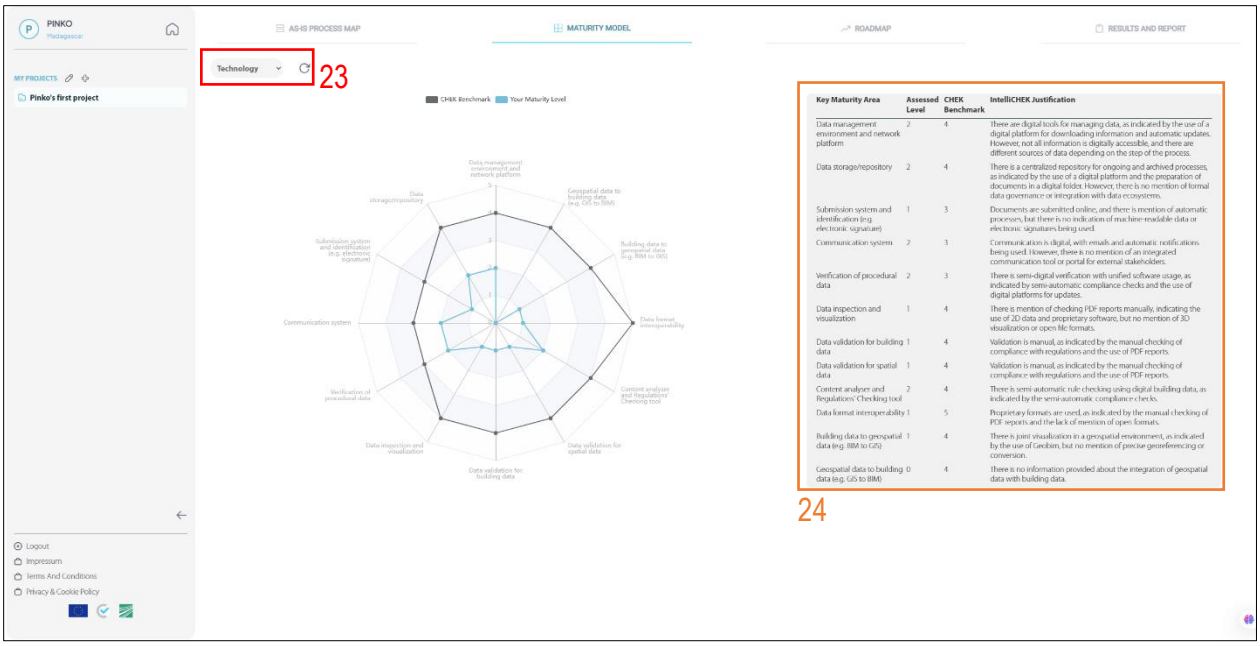
- Proceed to finish the maturity model evaluation (22).



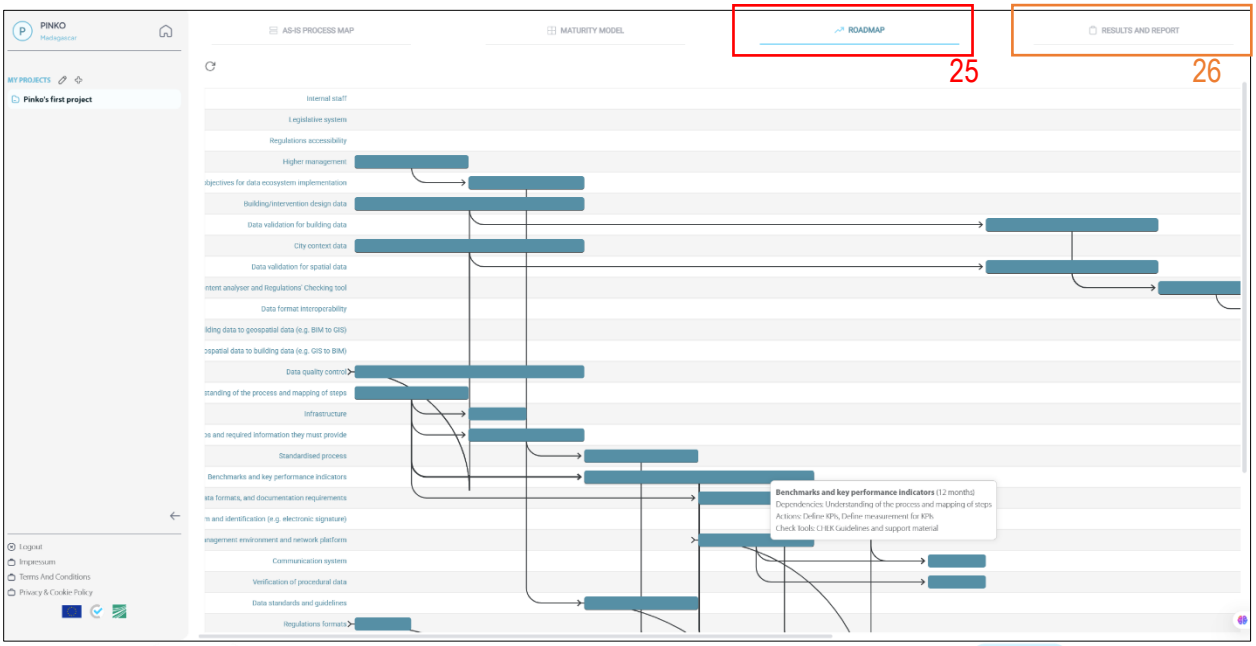
- The process to generate the maturity results might take a few minutes. Wait until the screen is unblocked to view your results.

Maturity model results:

- With the map results, you can view radar graphics for each category. Change the category using the field in the top left corner (23).
- You can see a combined result that includes all key maturity areas along with the level assigned to each by the VA (24).

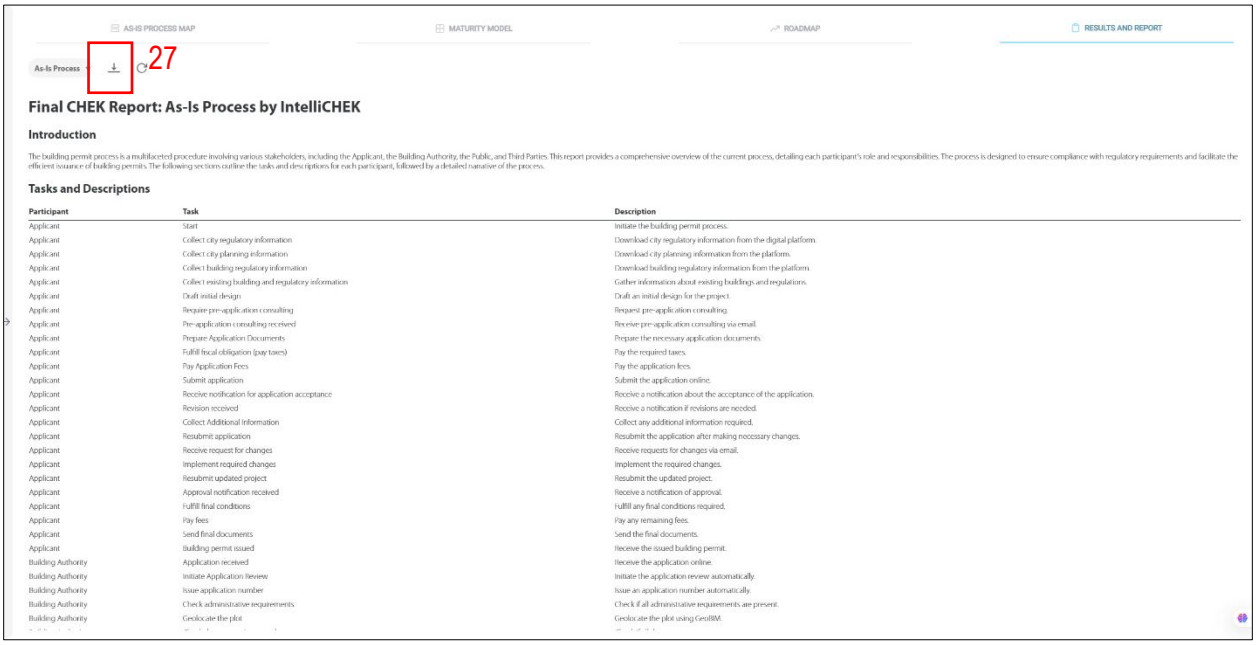


- Click on **"Roadmap"** tab to generate the CHEK roadmap (25) and on the **"Results and Report"** tab to generate the report of your process (26).



Finishing the testing:

- Once you have reviewed the results, please download the report from **"Results and Report"** (27) and send it to Fraunhofer Italia.



- Finally, please answer the questionnaire about the usability of the tool. You can find the link to the questionnaire bellow or in the same email you received the link for the VA access. https://forms.office.com/e/wjKXCRbY0A

Thank you for your time!

View results

Respondent

2 Anonymous

135:15
Time to complete

Usability, navigation and layout

This section assesses the ease of use and clarity of the CHEK Virtual Assistant (VA) interface and tutorial. Participants will provide feedback on navigation, intuitiveness, and the effectiveness of instructions. The insights gathered will help identify areas for improvement to enhance the user experience.

1. On a scale of 1-5, how would you rate the overall ease of navigating the CHEK VA interface?

1 Very Easy – Navigation is intuitive and effortless; all features are easy to find and use without assistance.
2 Easy – Navigation is mostly straightforward, with minor challenges that do not significantly impact usability.
3 Neutral – Navigation is somewhat clear, but some features require effort to locate or understand.
4 Difficult – Navigation is confusing, requiring guidance or repeated attempts to find and use features effectively.
5 Very Difficult – Navigation is frustrating and unclear, making it hard to complete tasks without extensive help.
*

1	2	3	4	5

2. What specific aspects of the interface made navigation easy or difficult for you? Please share any suggestions for improvement.
*

undo buton

3. On a scale of 1-5, how intuitive was the layout of the tool (e.g., locating the project tabs, BPMN editor, and message bar)?

1 Very Unintuitive – The layout was confusing, and I had difficulty finding key features.
2 Unintuitive – The layout was somewhat confusing, and I had trouble locating some features.
3 Neutral – The layout was okay, but I had to spend some time locating features.
4 Intuitive – The layout was generally easy to understand, and I could locate features without difficulty.
5 Very Intuitive – The layout was clear and well-organized, making it easy to locate all features right away.
*

1	2	3	4	5

4. Did you experience any difficulties finding or using any of the features? *

- (●) Yes
- ( ) No
- ( ) Other

5. If yes, please explain.

every time i made a change in the as-is map it wasnt possible to undo and sometimes i had to redu the all thing

Relevance & Content

This section assesses the relevance of the CHEK Virtual Assistant (VA) tool in supporting your municipality's digitalization efforts. It covers the applicability of the process mapping template, the digital maturity assessment, and the generated CHEK roadmap. The questions focus on how well these components align with your building permit process and the digital maturity of your municipality. Feedback will help determine how well the tool addresses your needs, aids in achieving CHEK benchmarks, and provides actionable insights for improvement in the building permit process.

6. On a scale of 1-5, how relevant was the process mapping template to your municipality's Building Permit process?

1. Very Relevant – The template closely matched our process, requiring little to no modifications.
2. Relevant – Mostly aligned with our process, with only minor adjustments needed.
3. Neutral – Somewhat relevant, but required significant customization to fit our needs.
4. Not Very Relevant – Did not align well with our process and required major modifications.
5. Not Relevant at All – The template was not applicable to our process.

*

1	2	3	4	5

7. On a scale of 1-5, how well did the tool address your needs for mapping your building permit process?

1. Very Well – Fully met our needs, providing clear structure and valuable insights.
2. Well – Mostly met our needs, with only minor adjustments or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete mapping.
4. Not Very Well – Did not fully address our needs, missing key aspects of the process.
5. Not at All – Did not meet our needs and was not useful for mapping our building permit process.

*

1	2	3	4	5

8. On a scale of 1-5, how easy was it to complete your process map using the provided template and editing tools?

1. Very Difficult – I had a lot of trouble completing the process map with the tools provided.
2. Difficult – It was somewhat challenging to complete the process map, and I encountered several issues.
3. Neutral – The process map was easy to complete, but I faced some minor difficulties.
4. Easy – I found it straightforward to complete the process map using the provided template and tools.
5. Very Easy – The process map was quick and easy to complete with the provided template and tools.

*

1	2	3	4	5

9. What aspects of the tool were most helpful for mapping your process, and what improvements would make it more effective for mapping your building permit process? *

The initial map did not take into account the description given, having even placed stages that were not mentioned, which led to it having to be extensively changed

10. Were the steps to start a new project and finish the process map clearly defined? *

- (●) Yes
- ( ) No

11. If no, what was missing?

12. On a scale of 1-5, how well did the tool address your needs for assessing digital maturity?

1. Very Well – Fully met our needs, providing clear insights and valuable assessments.
2. Well – Mostly met our needs, with only minor gaps or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete assessment.
4. Not Very Well – Did not fully address our needs, missing key aspects of digital maturity assessment.
5. Not at All – Did not meet our needs and was not useful for assessing digital maturity.

*

1	2	3	4	5

13. On a scale of 1 to 5, how well do the results of the digital maturity assessment (Technology, Process, Organisation, Information) match your building permit process?

1. Not at all – The maturity assessment does not match the maturity of our actual process in any way.
2. Slightly – The assessment partially aligns but has significant discrepancies.
3. Moderately – The assessment is somewhat accurate but needs adjustments to fully match the actual maturity of our process.
4. Mostly – The assessment is mostly aligned, with only minor gaps.
5. Completely – The assessment fully reflects the maturity of our building permit process. *

1	2	3	4	5

14. If the maturity assessment did not fully match, please explain which aspects of the maturity of **Technology**, **Process**, **Organisation**, or **Information** did not align with the maturity of your actual process.

15. On a scale of 1 to 5, how clear and easy to understand did you find the CHEK roadmap generated by the CHEK Virtual Assistant (VA)?

1. Very Clear – The roadmap was very easy to understand and follow.
2. Clear – The roadmap was mostly clear, with minor areas needing clarification.
3. Neutral – Some parts of the roadmap were clear, but others were harder to follow.
4. Confusing – The roadmap was difficult to understand, and some parts were unclear.
5. Very Confusing – The roadmap was very unclear, making it hard to understand and follow. *

1	2	3	4	5

16. What aspects of the roadmap were difficult to understand, and how can it be improved to make it clearer? *

it seam overall confusing

17. On a scale of 1 to 5, how useful do you find the CHEK roadmap in supporting your municipality's path to digitalize the building permit process and reach CHEK benchmarks?

1 Not Useful at All – The roadmap does not provide any value in our digitalization efforts.
2 Slightly Useful – The roadmap offers limited support but could be more relevant.
3 Moderately Useful – The roadmap is somewhat helpful, though additional resources may be needed.
4 Very Useful – The roadmap is quite helpful and provides clear guidance for reaching the CHEK benchmarks.
5 Extremely Useful – The roadmap is very valuable and directly supports our efforts to achieve the CHEK benchmarks. *

1	2	3	4	5

18. What specific elements of the roadmap would be most helpful for your municipality in achieving the CHEK benchmarks, and what additional features would enhance its usefulness? *

the problem is that the roadmap is based on as-s map and the maturity model, but the as-is map does not reflect the real complexity of the entire process as well as of all the stakeholders within the company, they are just generic guidelines, so it is difficult to apply the roadmap as presented

Interaction with the CHEK Virtual Assistant

This section assesses the effectiveness and relevance of the virtual assistant (VA) throughout your interaction with the tool. It explores how helpful, clear, and relevant the chatbot's prompts, feedback, and questions were in guiding you through the process. Your responses will provide valuable insights into the chatbot's ability to support users in achieving their goals, ensuring that the tool's interactions align with user needs and contribute to a positive experience. By understanding the interaction with the VA, we can improve the overall user experience and refine its ability to assist with future tasks.

19. Were the interactions and questions from the virtual assistant (VA) **helpful and relevant** to your process? *

- ○ Yes, the interactions and questions were very helpful and directly relevant to my process.
- ◉ No, the interactions and questions were not helpful or relevant to my process.
- ○ Other

20. How **clear and understandable** were the questions posed by the virtual assistant (VA)? *

- ◉ Very clear and understandable
- ○ Somewhat clear, but could be improved
- ○ Not clear or understandable
- ○ Not sure / I did not engage enough to judge
- ○ Other

21. Did the virtual assistant (VA) guide you through the process in a way that made sense? *

- ○ Yes, the guidance was clear and logical throughout.
- ○ Yes, but sometimes the guidance was unclear or confusing.
- ○ No, the guidance was difficult to follow or inconsistent.
- ○ Not sure / I did not engage enough with the assistant to judge.
- ◉ no, it only asked questions sometimes with no reasono

22. How would you rate the overall effectiveness of the virtual assistant (VA) in helping you map your building permit process? *

- ○ Very effective
- ○ Somewhat effective
- ◉ Not effective
- ○ Not sure
- ○ Other

23. Did you feel that the virtual assistant (VA) asked the right questions at the right time during the process mapping? *

- ○ Yes, the questions were well-timed and appropriate.
- ◉ Sometimes, the timing or relevance of the questions could have been improved.
- ○ No, the questions were poorly timed or not appropriate.
- ○ Not sure
- ○ Other

24. On a scale of 1 to 5, how would you rate the responsiveness of the VA during the process mapping?

1 Very Poor – The VA was very slow or unresponsive throughout the process.
2 Poor – The VA had noticeable delays in responses.
3 Neutral – The VA was somewhat responsive, with occasional delays.
4 Good – The VA responded quickly with only minor delays.
5 Excellent – The VA was very responsive and prompt throughout the process.
*

1	2	3	4	5

25. Did the VA's prompts and feedback help you understand what actions to take? *

- ○ Yes
- ◉ No

26. What suggestions do you have to improve the CHEK VA's interaction with the user?

I don't understand why to detail the whole process if the AS-IS map provided is always the same and did not take into account what was described.
after the map was finished the assintant didn t recomend any changes, only asked questions anda sometimes purposed another text that didn-t aplied

Likability & future use

This section explores your satisfaction with the overall experience of using the CHEK Virtual Assistant (VA) tool and your likelihood of recommending it to other municipalities. It evaluates your willingness to continue using the tool for future process evaluations and assesses its potential value for other municipalities. Your feedback helps identify areas of strength and areas for improvement, ensuring that the tool continues to meet the needs of users like yourself. This section also provides insight into the tool's overall appeal and its potential role in future digitalization efforts.

27. On a scale of 1-5, how likely are you to use the CHEK VA tool for future process evaluations?

1. Not Likely at All – We would not consider using the tool for future evaluations.
2. Slightly Likely – We may use the tool in some cases, but not regularly.
3. Moderately Likely – We are somewhat likely to use the tool for future evaluations.
4. Very Likely – We would likely use the tool regularly for future evaluations.
5. Extremely Likely – We would definitely use the tool for all future process evaluations.

*

1	2	3	4	5

28. If you answered "Not Likely at All" (1), we would appreciate your feedback to understand whether this reflects a reluctance to use this specific tool or any tool of this kind. Was this due to challenges you faced with the tool's usability, or do you feel that tools like this do not align with your municipality's needs for process evaluations? Please provide any insights or additional reasons that influenced your response.

- ○ No Need for Such Tools – We do not foresee a need for this type of tool in our process evaluations.
- ◉ Usability Challenges – The tool's difficulty or complexity made it less likely for us to use it.
- ○ Other

29. If you selected **"Other Reasons"**, please kindly specify them here.

A tool that is able to analyze a process and suggest improvements would be very useful, as well as being able to give a roadmap for implementation

30. On a scale of 1 to 5, how likely are you to recommend this tool to another municipality?

1. Not Likely at All – I would not recommend this tool to another municipality.
2. Slightly Likely – I might consider recommending it to another municipality in certain circumstances.
3. Moderately Likely – I would be somewhat likely to recommend it to another municipality.
4. Very Likely – I would likely recommend it to another municipality.
5. Extremely Likely – I would definitely recommend this tool to another municipality.

*

1	2	3	4	5

31. On a scale of 1 to 5, how satisfied are you with the overall experience of using the CHEK VA tool?

1. Very Dissatisfied – I was very dissatisfied with the tool's overall experience.
2. Dissatisfied – I was somewhat dissatisfied with the tool's overall experience.
3. Neutral – I had a neutral experience with the tool, neither satisfied nor dissatisfied.
4. Satisfied – I was satisfied with the tool's overall experience.
5. Very Satisfied – I was very satisfied with the tool's overall experience.

*

1	2	3	4	5

Overall feedback & satisfaction

This section gathers feedback on the user's overall experience with the tool, aiming to assess their level of satisfaction and identify areas for improvement. The responses will help evaluate how well the tool met the user's needs and expectations, as well as highlight the most valuable aspects of the tool. Additionally, open-ended questions will capture suggestions for enhancements, providing insights into potential improvements to ensure the tool is more effective and user-friendly in the future. This feedback is crucial for refining the tool and enhancing the overall user experience.

32. On a scale from 1 to 5, how satisfied are you with your overall experience using the CHEK Virtual Assistant?

1. Very Dissatisfied
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very Satisfied

*

1	2	3	4	5

33. What aspects of the VA did you find most valuable or useful? *

roadmap and the maturity

34. What improvements or changes would you suggest to enhance the overall user experience and provided content? *

the descrition that is given in the begning should be able to be translated to the as-is map

35. Please add here any other comments or suggestions you might have regarding your experience with the CHEK VA.

Clarity of instructions

This section focuses on evaluating the clarity and effectiveness of the document guide provided before using the tool. It aims to assess how well the guide helped users understand how to navigate and use the tool effectively. The responses will offer insights into whether the instructions were clear, easy to follow, and sufficient to prepare users for the tool's functionalities. By identifying areas that may require further clarification, this section helps improve the guide, ensuring that users can confidently start using the tool with minimal confusion.

36. On a scale from 1 to 5, how clear and easy to follow were the instructions provided in the guide document?

1. Very Unclear and Difficult – The instructions were very unclear and hard to follow.
2. Unclear and Difficult – The instructions were somewhat unclear and challenging to follow.
3. Neutral – The instructions were okay, but could have been clearer or easier to follow.
4. Clear and Easy to Follow – The instructions were clear and mostly easy to follow.
5. Very Clear and Easy to Follow – The instructions were very clear, well-organized, and easy to follow without any confusion. *

1	2	3	4	5

37. If the instructions were not clear, where did you feel the need for more guidance or clarification?

View results

Respondent

3 Anonymous

30:14
Time to complete

Usability, navigation and layout

This section assesses the ease of use and clarity of the CHEK Virtual Assistant (VA) interface and tutorial. Participants will provide feedback on navigation, intuitiveness, and the effectiveness of instructions. The insights gathered will help identify areas for improvement to enhance the user experience.

1. On a scale of 1-5, how would you rate the overall ease of navigating the CHEK VA interface?

1 Very Easy – Navigation is intuitive and effortless; all features are easy to find and use without assistance.
2 Easy – Navigation is mostly straightforward, with minor challenges that do not significantly impact usability.
3 Neutral – Navigation is somewhat clear, but some features require effort to locate or understand.
4 Difficult – Navigation is confusing, requiring guidance or repeated attempts to find and use features effectively.
5 Very Difficult – Navigation is frustrating and unclear, making it hard to complete tasks without extensive help.
*

1	2	3	4	5

2. What specific aspects of the interface made navigation easy or difficult for you? Please share any suggestions for improvement.
*

mooving - pan- zooming - zoom extent-undo- select andediting

3. On a scale of 1-5, how intuitive was the layout of the tool (e.g., locating the project tabs, BPMN editor, and message bar)?

1 Very Unintuitive – The layout was confusing, and I had difficulty finding key features.
2 Unintuitive – The layout was somewhat confusing, and I had trouble locating some features.
3 Neutral – The layout was okay, but I had to spend some time locating features.
4 Intuitive – The layout was generally easy to understand, and I could locate features without difficulty.
5 Very Intuitive – The layout was clear and well-organized, making it easy to locate all features right away.
*

1	2	3	4	5

4. Did you experience any difficulties finding or using any of the features? *

- (●) Yes
- ( ) No
- ( ) Other

5. If yes, please explain.

introducing text - talking with the AI

Relevance & Content

This section assesses the relevance of the CHEK Virtual Assistant (VA) tool in supporting your municipality's digitalization efforts. It covers the applicability of the process mapping template, the digital maturity assessment, and the generated CHEK roadmap. The questions focus on how well these components align with your building permit process and the digital maturity of your municipality. Feedback will help determine how well the tool addresses your needs, aids in achieving CHEK benchmarks, and provides actionable insights for improvement in the building permit process.

6. On a scale of 1-5, how relevant was the process mapping template to your municipality's Building Permit process?

1. Very Relevant – The template closely matched our process, requiring little to no modifications.
2. Relevant – Mostly aligned with our process, with only minor adjustments needed.
3. Neutral – Somewhat relevant, but required significant customization to fit our needs.
4. Not Very Relevant – Did not align well with our process and required major modifications.
5. Not Relevant at All – The template was not applicable to our process.

*

1	2	3	4	5

7. On a scale of 1-5, how well did the tool address your needs for mapping your building permit process?

1. Very Well – Fully met our needs, providing clear structure and valuable insights.
2. Well – Mostly met our needs, with only minor adjustments or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete mapping.
4. Not Very Well – Did not fully address our needs, missing key aspects of the process.
5. Not at All – Did not meet our needs and was not useful for mapping our building permit process.

*

1	2	3	4	5

8. On a scale of 1-5, how easy was it to complete your process map using the provided template and editing tools?

1. Very Difficult – I had a lot of trouble completing the process map with the tools provided.
2. Difficult – It was somewhat challenging to complete the process map, and I encountered several issues.
3. Neutral – The process map was easy to complete, but I faced some minor difficulties.
4. Easy – I found it straightforward to complete the process map using the provided template and tools.
5. Very Easy – The process map was quick and easy to complete with the provided template and tools.

*

1	2	3	4	5

9. What aspects of the tool were most helpful for mapping your process, and what improvements would make it more effective for mapping your building permit process? *

Graphically is ok but the AI doesn't understand the business, so to speak.

10. Were the steps to start a new project and finish the process map clearly defined? *

- (●) Yes
- ( ) No

11. If no, what was missing?

12. On a scale of 1-5, how well did the tool address your needs for assessing digital maturity?

1. Very Well – Fully met our needs, providing clear insights and valuable assessments.
2. Well – Mostly met our needs, with only minor gaps or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete assessment.
4. Not Very Well – Did not fully address our needs, missing key aspects of digital maturity assessment.
5. Not at All – Did not meet our needs and was not useful for assessing digital maturity.

*

1	2	3	4	5

13. On a scale of 1 to 5, how well do the results of the digital maturity assessment (Technology, Process, Organisation, Information) match your building permit process?

1. Not at all – The maturity assessment does not match the maturity of our actual process in any way.
2. Slightly – The assessment partially aligns but has significant discrepancies.
3. Moderately – The assessment is somewhat accurate but needs adjustments to fully match the actual maturity of our process.
4. Mostly – The assessment is mostly aligned, with only minor gaps.
5. Completely – The assessment fully reflects the maturity of our building permit process. *

1	2	3	4	5

14. If the maturity assessment did not fully match, please explain which aspects of the maturity of **Technology**, **Process**, **Organisation**, or **Information** did not align with the maturity of your actual process.

It is not clear how the results correspond to what was inquired. too generic.

15. On a scale of 1 to 5, how clear and easy to understand did you find the CHEK roadmap generated by the CHEK Virtual Assistant (VA)?

1. Very Clear – The roadmap was very easy to understand and follow.
2. Clear – The roadmap was mostly clear, with minor areas needing clarification.
3. Neutral – Some parts of the roadmap were clear, but others were harder to follow.
4. Confusing – The roadmap was difficult to understand, and some parts were unclear.
5. Very Confusing – The roadmap was very unclear, making it hard to understand and follow. *

1	2	3	4	5

16. What aspects of the roadmap were difficult to understand, and how can it be improved to make it clearer? *

It is not clear how the results correspond to what was inquired. too generic. There is no knowledge of the state of the art of the municipality. What is the rigor of the roadmap?

17. On a scale of 1 to 5, how useful do you find the CHEK roadmap in supporting your municipality's path to digitalize the building permit process and reach CHEK benchmarks?

1 Not Useful at All – The roadmap does not provide any value in our digitalization efforts.
2 Slightly Useful – The roadmap offers limited support but could be more relevant.
3 Moderately Useful – The roadmap is somewhat helpful, though additional resources may be needed.
4 Very Useful – The roadmap is quite helpful and provides clear guidance for reaching the CHEK benchmarks.
5 Extremely Useful – The roadmap is very valuable and directly supports our efforts to achieve the CHEK benchmarks. *

1	2	3	4	5

18. What specific elements of the roadmap would be most helpful for your municipality in achieving the CHEK benchmarks, and what additional features would enhance its usefulness? *

greater knowledge of the Dbp process is necessary

Interaction with the CHEK Virtual Assistant

This section assesses the effectiveness and relevance of the virtual assistant (VA) throughout your interaction with the tool. It explores how helpful, clear, and relevant the chatbot's prompts, feedback, and questions were in guiding you through the process. Your responses will provide valuable insights into the chatbot's ability to support users in achieving their goals, ensuring that the tool's interactions align with user needs and contribute to a positive experience. By understanding the interaction with the VA, we can improve the overall user experience and refine its ability to assist with future tasks.

19. Were the interactions and questions from the virtual assistant (VA) **helpful and relevant** to your process? *

- ○ Yes, the interactions and questions were very helpful and directly relevant to my process.
- ◉ No, the interactions and questions were not helpful or relevant to my process.
- ○ Other

20. How **clear and understandable** were the questions posed by the virtual assistant (VA)? *

- ○ Very clear and understandable
- ◉ Somewhat clear, but could be improved
- ○ Not clear or understandable
- ○ Not sure / I did not engage enough to judge
- ○ Other

21. Did the virtual assistant (VA) guide you through the process in a way that made sense? *

- ○ Yes, the guidance was clear and logical throughout.
- ○ Yes, but sometimes the guidance was unclear or confusing.
- ◉ No, the guidance was difficult to follow or inconsistent.
- ○ Not sure / I did not engage enough with the assistant to judge.
- ○ Other

22. How would you rate the overall effectiveness of the virtual assistant (VA) in helping you map your building permit process? *

- ○ Very effective
- ○ Somewhat effective
- ◉ Not effective
- ○ Not sure
- ○ Other

23. Did you feel that the virtual assistant (VA) asked the right questions at the right time during the process mapping? *

- ○ Yes, the questions were well-timed and appropriate.
- ○ Sometimes, the timing or relevance of the questions could have been improved.
- ◉ No, the questions were poorly timed or not appropriate.
- ○ Not sure
- ○ Other

24. On a scale of 1 to 5, how would you rate the responsiveness of the VA during the process mapping?

1. Very Poor – The VA was very slow or unresponsive throughout the process.
2. Poor – The VA had noticeable delays in responses.
3. Neutral – The VA was somewhat responsive, with occasional delays.
4. Good – The VA responded quickly with only minor delays.
5. Excellent – The VA was very responsive and prompt throughout the process.

*

1	2	3	4	5

25. Did the VA's prompts and feedback help you understand what actions to take? *

- ○ Yes
- ◉ No

26. What suggestions do you have to improve the CHEK VA's interaction with the user?

We recognise and appreciate the great potential and benefits of this tool. However, the testing process should be more rigorous to ensure greater accuracy.

Summary:

The process mapping created two years ago should have been uploaded to the AI.

WP1 should have completed the second part of the "as-process" exercise. This was not done. After mapping the "type" licensing process, it is necessary to detail what happens at each stage/moment, the step-by-step flow, as this is what the AI asks us and it does not know what it is talking about. One thing is the flow, another is the stages and what happens within them.

Currently, the AI tool has bugs and is difficult to use. It contains incorrect information, does not know what it is talking about, and cannot formulate questions correctly. It does not understand the business, so to speak.

After this study, the AI can learn. From there, we could start testing and have a licensing flow design closer to the reality of the municipality, and the results could be more accurate and interesting.

In conclusion, more tests should be conducted, with greater knowledge of the process, to ensure more accuracy in the data presented and collected. The tool has incredible potential.

Likability & future use

This section explores your satisfaction with the overall experience of using the CHEK Virtual Assistant (VA) tool and your likelihood of recommending it to other municipalities. It evaluates your willingness to continue using the tool for future process evaluations and assesses its potential value for other municipalities. Your feedback helps identify areas of strength and areas for improvement, ensuring that the tool continues to meet the needs of users like yourself. This section also provides insight into the tool's overall appeal and its potential role in future digitalization efforts.

27. On a scale of 1-5, how likely are you to use the CHEK VA tool for future process evaluations?

1. Not Likely at All – We would not consider using the tool for future evaluations.
2. Slightly Likely – We may use the tool in some cases, but not regularly.
3. Moderately Likely – We are somewhat likely to use the tool for future evaluations.
4. Very Likely – We would likely use the tool regularly for future evaluations.
5. Extremely Likely – We would definitely use the tool for all future process evaluations.

*

1	2	3	4	5

28. If you answered "Not Likely at All" (1), we would appreciate your feedback to understand whether this reflects a reluctance to use this specific tool or any tool of this kind. Was this due to challenges you faced with the tool's usability, or do you feel that tools like this do not align with your municipality's needs for process evaluations? Please provide any insights or additional reasons that influenced your response.

- ○ No Need for Such Tools – We do not foresee a need for this type of tool in our process evaluations.
- ○ Usability Challenges – The tool's difficulty or complexity made it less likely for us to use it.
- ○ Other

29. If you selected **"Other Reasons"**, please kindly specify them here.

30. On a scale of 1 to 5, how likely are you to recommend this tool to another municipality?

1. Not Likely at All – I would not recommend this tool to another municipality.
2. Slightly Likely – I might consider recommending it to another municipality in certain circumstances.
3. Moderately Likely – I would be somewhat likely to recommend it to another municipality.
4. Very Likely – I would likely recommend it to another municipality.
5. Extremely Likely – I would definitely recommend this tool to another municipality.

*

1	2	3	4	5

31. On a scale of 1 to 5, how satisfied are you with the overall experience of using the CHEK VA tool?

1. Very Dissatisfied – I was very dissatisfied with the tool's overall experience.
2. Dissatisfied – I was somewhat dissatisfied with the tool's overall experience.
3. Neutral – I had a neutral experience with the tool, neither satisfied nor dissatisfied.
4. Satisfied – I was satisfied with the tool's overall experience.
5. Very Satisfied – I was very satisfied with the tool's overall experience.

*

1	2	3	4	5

Overall feedback & satisfaction

This section gathers feedback on the user's overall experience with the tool, aiming to assess their level of satisfaction and identify areas for improvement. The responses will help evaluate how well the tool met the user's needs and expectations, as well as highlight the most valuable aspects of the tool. Additionally, open-ended questions will capture suggestions for enhancements, providing insights into potential improvements to ensure the tool is more effective and user-friendly in the future. This feedback is crucial for refining the tool and enhancing the overall user experience.

32. On a scale from 1 to 5, how satisfied are you with your overall experience using the CHEK Virtual Assistant?

1. Very Dissatisfied
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very Satisfied

*

1	2	3	4	5

33. What aspects of the VA did you find most valuable or useful? *

We recognise and appreciate the great potential and benefits of this tool. However, the testing process should be more rigorous to ensure greater accuracy.

Summary:

The process mapping created two years ago should have been uploaded to the AI.

WP1 should have completed the second part of the "as-process" exercise. This was not done. After mapping the "type" licensing process, it is necessary to detail what happens at each stage/moment, the step-by-step flow, as this is what the AI asks us and it does not know what it is talking about. One thing is the flow, another is the stages and what happens within them.

Currently, the AI tool has bugs and is difficult to use. It contains incorrect information, does not know what it is talking about, and cannot formulate questions correctly. It does not understand the business, so to speak.

After this study, the AI can learn. From there, we could start testing and have a licensing flow design closer to the reality of the municipality, and the results could be more accurate and interesting.

In conclusion, more tests should be conducted, with greater knowledge of the process, to ensure more accuracy in the data presented and collected.

34. What improvements or changes would you suggest to enhance the overall user experience and provided content? *

We recognise and appreciate the great potential and benefits of this tool. However, the testing process should be more rigorous to ensure greater accuracy.

Summary:

The process mapping created two years ago should have been uploaded to the AI.

WP1 should have completed the second part of the "as-process" exercise. This was not done. After mapping the "type" licensing process, it is necessary to detail what happens at each stage/moment, the step-by-step flow, as this is what the AI asks us and it does not know what it is talking about. One thing is the flow, another is the stages and what happens within them.

Currently, the AI tool has bugs and is difficult to use. It contains incorrect information, does not know what it is talking about, and cannot formulate questions correctly. It does not understand the business, so to speak.

After this study, the AI can learn. From there, we could start testing and have a licensing flow design closer to the reality of the municipality, and the results could be more accurate and interesting.

In conclusion, more tests should be conducted, with greater knowledge of the process, to ensure more accuracy in the data presented and collected.

35. Please add here any other comments or suggestions you might have regarding your experience with the CHEK VA.

We recognise and appreciate the great potential and benefits of this tool. However, the testing process should be more rigorous to ensure greater accuracy.

Summary:

The process mapping created two years ago should have been uploaded to the AI.

WP1 should have completed the second part of the "as-process" exercise. This was not done. After mapping the "type" licensing process, it is necessary to detail what happens at each stage/moment, the step-by-step flow, as this is what the AI asks us and it does not know what it is talking about. One thing is the flow, another is the stages and what happens within them.

Currently, the AI tool has bugs and is difficult to use. It contains incorrect information, does not know what it is talking about, and cannot formulate questions correctly. It does not understand the business, so to speak.

After this study, the AI can learn. From there, we could start testing and have a licensing flow design closer to the reality of the municipality, and the results could be more accurate and interesting.

In conclusion, more tests should be conducted, with greater knowledge of the process, to ensure more accuracy in the data presented and collected.

Clarity of instructions

This section focuses on evaluating the clarity and effectiveness of the document guide provided before using the tool. It aims to assess how well the guide helped users understand how to navigate and use the tool effectively. The responses will offer insights into whether the instructions were clear, easy to follow, and sufficient to prepare users for the tool's functionalities. By identifying areas that may require further clarification, this section helps improve the guide, ensuring that users can confidently start using the tool with minimal confusion.

36. On a scale from 1 to 5, how clear and easy to follow were the instructions provided in the guide document?

1. Very Unclear and Difficult – The instructions were very unclear and hard to follow.
2. Unclear and Difficult – The instructions were somewhat unclear and challenging to follow.
3. Neutral – The instructions were okay, but could have been clearer or easier to follow.
4. Clear and Easy to Follow – The instructions were clear and mostly easy to follow.
5. Very Clear and Easy to Follow – The instructions were very clear, well-organized, and easy to follow without any confusion. *

1	2	3	4	5

37. If the instructions were not clear, where did you feel the need for more guidance or clarification?

the use off the tool features

View results

Respondent

4 Anonymous

143:06
Time to complete

Usability, navigation and layout

This section assesses the ease of use and clarity of the CHEK Virtual Assistant (VA) interface and tutorial. Participants will provide feedback on navigation, intuitiveness, and the effectiveness of instructions. The insights gathered will help identify areas for improvement to enhance the user experience.

1. On a scale of 1-5, how would you rate the overall ease of navigating the CHEK VA interface?

1 Very Easy – Navigation is intuitive and effortless; all features are easy to find and use without assistance.
2 Easy – Navigation is mostly straightforward, with minor challenges that do not significantly impact usability.
3 Neutral – Navigation is somewhat clear, but some features require effort to locate or understand.
4 Difficult – Navigation is confusing, requiring guidance or repeated attempts to find and use features effectively.
5 Very Difficult – Navigation is frustrating and unclear, making it hard to complete tasks without extensive help.
*

1	2	3	4	5

2. What specific aspects of the interface made navigation easy or difficult for you? Please share any suggestions for improvement.
*

Some primary guide at the beggining would help - what steps I should do, why there is a process map and when I should expect questions from the chat.

3. On a scale of 1-5, how intuitive was the layout of the tool (e.g., locating the project tabs, BPMN editor, and message bar)?

1 Very Unintuitive – The layout was confusing, and I had difficulty finding key features.
2 Unintuitive – The layout was somewhat confusing, and I had trouble locating some features.
3 Neutral – The layout was okay, but I had to spend some time locating features.
4 Intuitive – The layout was generally easy to understand, and I could locate features without difficulty.
5 Very Intuitive – The layout was clear and well-organized, making it easy to locate all features right away.
*

1	2	3	4	5

4. Did you experience any difficulties finding or using any of the features? *

- (●) Yes
- ( ) No
- ( ) Other

5. If yes, please explain.

There is no explanation on which feature is used for which action. I'm not expierenced with making process schemas, so it would help to have some explanation of icons and their usage.

Relevance & Content

This section assesses the relevance of the CHEK Virtual Assistant (VA) tool in supporting your municipality's digitalization efforts. It covers the applicability of the process mapping template, the digital maturity assessment, and the generated CHEK roadmap. The questions focus on how well these components align with your building permit process and the digital maturity of your municipality. Feedback will help determine how well the tool addresses your needs, aids in achieving CHEK benchmarks, and provides actionable insights for improvement in the building permit process.

6. On a scale of 1-5, how relevant was the process mapping template to your municipality's Building Permit process?

1. Very Relevant – The template closely matched our process, requiring little to no modifications.
2. Relevant – Mostly aligned with our process, with only minor adjustments needed.
3. Neutral – Somewhat relevant, but required significant customization to fit our needs.
4. Not Very Relevant – Did not align well with our process and required major modifications.
5. Not Relevant at All – The template was not applicable to our process.

*

1	2	3	4	5

7. On a scale of 1-5, how well did the tool address your needs for mapping your building permit process?

1. Very Well – Fully met our needs, providing clear structure and valuable insights.
2. Well – Mostly met our needs, with only minor adjustments or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete mapping.
4. Not Very Well – Did not fully address our needs, missing key aspects of the process.
5. Not at All – Did not meet our needs and was not useful for mapping our building permit process.

*

1	2	3	4	5

8. On a scale of 1-5, how easy was it to complete your process map using the provided template and editing tools?

1. Very Difficult – I had a lot of trouble completing the process map with the tools provided.
2. Difficult – It was somewhat challenging to complete the process map, and I encountered several issues.
3. Neutral – The process map was easy to complete, but I faced some minor difficulties.
4. Easy – I found it straightforward to complete the process map using the provided template and tools.
5. Very Easy – The process map was quick and easy to complete with the provided template and tools.

*

1	2	3	4	5

9. What aspects of the tool were most helpful for mapping your process, and what improvements would make it more effective for mapping your building permit process? *

It would be helpfull, if the virtual assistent will ask more questions about missing things (for example if I didn't fill in any time criteria for the steps or I didn't put any step for public, it could ask, if it isn't mistake).

10. Were the steps to start a new project and finish the process map clearly defined? *

- ( ) Yes
- (•) No

11. If no, what was missing?

Clear information about how to proceed after finishing the schema.

12. On a scale of 1-5, how well did the tool address your needs for assessing digital maturity?

1. Very Well – Fully met our needs, providing clear insights and valuable assessments.
2. Well – Mostly met our needs, with only minor gaps or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete assessment.
4. Not Very Well – Did not fully address our needs, missing key aspects of digital maturity assessment.
5. Not at All – Did not meet our needs and was not useful for assessing digital maturity.

*

1	2	3	4	5

13. On a scale of 1 to 5, how well do the results of the digital maturity assessment (Technology, Process, Organisation, Information) match your building permit process?

1. Not at all – The maturity assessment does not match the maturity of our actual process in any way.
2. Slightly – The assessment partially aligns but has significant discrepancies.
3. Moderately – The assessment is somewhat accurate but needs adjustments to fully match the actual maturity of our process.
4. Mostly – The assessment is mostly aligned, with only minor gaps.
5. Completely – The assessment fully reflects the maturity of our building permit process. *

1	2	3	4	5

14. If the maturity assessment did not fully match, please explain which aspects of the maturity of **Technology**, **Process**, **Organisation**, or **Information** did not align with the maturity of your actual process.

There are points with 'no information" - it would be helpful, if the assistant would ask while preparing the process to these information, if they are part of assessment.

15. On a scale of 1 to 5, how clear and easy to understand did you find the CHEK roadmap generated by the CHEK Virtual Assistant (VA)?

1. Very Clear – The roadmap was very easy to understand and follow.
2. Clear – The roadmap was mostly clear, with minor areas needing clarification.
3. Neutral – Some parts of the roadmap were clear, but others were harder to follow.
4. Confusing – The roadmap was difficult to understand, and some parts were unclear.
5. Very Confusing – The roadmap was very unclear, making it hard to understand and follow. *

1	2	3	4	5

16. What aspects of the roadmap were difficult to understand, and how can it be improved to make it clearer? *

I don't know what is the goal of this process and what are the dependencies.

17. On a scale of 1 to 5, how useful do you find the CHEK roadmap in supporting your municipality's path to digitalize the building permit process and reach CHEK benchmarks?

1 Not Useful at All – The roadmap does not provide any value in our digitalization efforts.
2 Slightly Useful – The roadmap offers limited support but could be more relevant.
3 Moderately Useful – The roadmap is somewhat helpful, though additional resources may be needed.
4 Very Useful – The roadmap is quite helpful and provides clear guidance for reaching the CHEK benchmarks.
5 Extremely Useful – The roadmap is very valuable and directly supports our efforts to achieve the CHEK benchmarks. *

1	2	3	4	5

18. What specific elements of the roadmap would be most helpful for your municipality in achieving the CHEK benchmarks, and what additional features would enhance its usefulness? *

Some explanation of meaning of the roadmap.

Interaction with the CHEK Virtual Assistant

This section assesses the effectiveness and relevance of the virtual assistant (VA) throughout your interaction with the tool. It explores how helpful, clear, and relevant the chatbot's prompts, feedback, and questions were in guiding you through the process. Your responses will provide valuable insights into the chatbot's ability to support users in achieving their goals, ensuring that the tool's interactions align with user needs and contribute to a positive experience. By understanding the interaction with the VA, we can improve the overall user experience and refine its ability to assist with future tasks.

19. Were the interactions and questions from the virtual assistant (VA) **helpful and relevant** to your process? *

- (●) Yes, the interactions and questions were very helpful and directly relevant to my process.
- ( ) No, the interactions and questions were not helpful or relevant to my process.
- ( ) Other

20. How **clear and understandable** were the questions posed by the virtual assistant (VA)? *

- ( ) Very clear and understandable
- ( ) Somewhat clear, but could be improved
- ( ) Not clear or understandable
- ( ) Not sure / I did not engage enough to judge
- (●) Virtual assistent always ask almost the same question, which was very general. It would help to have more concrete questions.

21. Did the virtual assistant (VA) guide you through the process in a way that made sense? *

- ( ) Yes, the guidance was clear and logical throughout.
- ( ) Yes, but sometimes the guidance was unclear or confusing.
- ( ) No, the guidance was difficult to follow or inconsistent.
- ( ) Not sure / I did not engage enough with the assistant to judge.
- (•) It asks question only when changing the text. I let there sometimes steps and texts from the example.

22. How would you rate the overall effectiveness of the virtual assistant (VA) in helping you map your building permit process? *

- ( ) Very effective
- (•) Somewhat effective
- ( ) Not effective
- ( ) Not sure
- ( ) Other

23. Did you feel that the virtual assistant (VA) asked the right questions at the right time during the process mapping? *

- ( ) Yes, the questions were well-timed and appropriate.
- ( ) Sometimes, the timing or relevance of the questions could have been improved.
- ( ) No, the questions were poorly timed or not appropriate.
- ( ) Not sure
- (•) In maturity model it skips foreward and backward, so I was sometimes lost where exactly in the process we are.

24. On a scale of 1 to 5, how would you rate the responsiveness of the VA during the process mapping?

1. Very Poor – The VA was very slow or unresponsive throughout the process.
2. Poor – The VA had noticeable delays in responses.
3. Neutral – The VA was somewhat responsive, with occasional delays.
4. Good – The VA responded quickly with only minor delays.
5. Excellent – The VA was very responsive and prompt throughout the process.

*

1	2	3	4	5

25. Did the VA's prompts and feedback help you understand what actions to take? *

- ( ) Yes
- (•) No

26. What suggestions do you have to improve the CHEK VA's interaction with the user?

Likability & future use

This section explores your satisfaction with the overall experience of using the CHEK Virtual Assistant (VA) tool and your likelihood of recommending it to other municipalities. It evaluates your willingness to continue using the tool for future process evaluations and assesses its potential value for other municipalities. Your feedback helps identify areas of strength and areas for improvement, ensuring that the tool continues to meet the needs of users like yourself. This section also provides insight into the tool's overall appeal and its potential role in future digitalization efforts.

27. On a scale of 1-5, how likely are you to use the CHEK VA tool for future process evaluations?

1 Not Likely at All – We would not consider using the tool for future evaluations.
2 Slightly Likely – We may use the tool in some cases, but not regularly.
3 Moderately Likely – We are somewhat likely to use the tool for future evaluations.
4 Very Likely – We would likely use the tool regularly for future evaluations.
5 Extremely Likely – We would definitely use the tool for all future process evaluations.
*

1	2	3	4	5

28. If you answered "Not Likely at All" (1), we would appreciate your feedback to understand whether this reflects a reluctance to use this specific tool or any tool of this kind. Was this due to challenges you faced with the tool's usability, or do you feel that tools like this do not align with your municipality's needs for process evaluations? Please provide any insights or additional reasons that influenced your response.

- ○ No Need for Such Tools – We do not foresee a need for this type of tool in our process evaluations.
- ○ Usability Challenges – The tool's difficulty or complexity made it less likely for us to use it.
- ◉ Both

29. If you selected **"Other Reasons"**, please kindly specify them here.

30. On a scale of 1 to 5, how likely are you to recommend this tool to another municipality?

1 Not Likely at All – I would not recommend this tool to another municipality.
2 Slightly Likely – I might consider recommending it to another municipality in certain circumstances.
3 Moderately Likely – I would be somewhat likely to recommend it to another municipality.
4 Very Likely – I would likely recommend it to another municipality.
5 Extremely Likely – I would definitely recommend this tool to another municipality.
*

1	2	3	4	5

31. On a scale of 1 to 5, how satisfied are you with the overall experience of using the CHEK VA tool?

1. Very Dissatisfied – I was very dissatisfied with the tool's overall experience.
2. Dissatisfied – I was somewhat dissatisfied with the tool's overall experience.
3. Neutral – I had a neutral experience with the tool, neither satisfied nor dissatisfied.
4. Satisfied – I was satisfied with the tool's overall experience.
5. Very Satisfied – I was very satisfied with the tool's overall experience.

*

1	2	3	4	5

Overall feedback & satisfaction

This section gathers feedback on the user's overall experience with the tool, aiming to assess their level of satisfaction and identify areas for improvement. The responses will help evaluate how well the tool met the user's needs and expectations, as well as highlight the most valuable aspects of the tool. Additionally, open-ended questions will capture suggestions for enhancements, providing insights into potential improvements to ensure the tool is more effective and user-friendly in the future. This feedback is crucial for refining the tool and enhancing the overall user experience.

32. On a scale from 1 to 5, how satisfied are you with your overall experience using the CHEK Virtual Assistant?

1. Very Dissatisfied
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very Satisfied

*

1	2	3	4	5

33. What aspects of the VA did you find most valuable or useful? *

Asking questions about the process, but the questions were mostly very general.

34. What improvements or changes would you suggest to enhance the overall user experience and provided content? *

VA should ask more concrete questions and also ask for missing information, which are necessary for assessment and reports.

35. Please add here any other comments or suggestions you might have regarding your experience with the CHEK VA.

Clarity of instructions

This section focuses on evaluating the clarity and effectiveness of the document guide provided before using the tool. It aims to assess how well the guide helped users understand how to navigate and use the tool effectively. The responses will offer insights into whether the instructions were clear, easy to follow, and sufficient to prepare users for the tool's functionalities. By identifying areas that may require further clarification, this section helps improve the guide, ensuring that users can confidently start using the tool with minimal confusion.

36. On a scale from 1 to 5, how clear and easy to follow were the instructions provided in the guide document?

1. Very Unclear and Difficult – The instructions were very unclear and hard to follow.
2. Unclear and Difficult – The instructions were somewhat unclear and challenging to follow.
3. Neutral – The instructions were okay, but could have been clearer or easier to follow.
4. Clear and Easy to Follow – The instructions were clear and mostly easy to follow.
5. Very Clear and Easy to Follow – The instructions were very clear, well-organized, and easy to follow without any confusion. *

1	2	3	4	5

37. If the instructions were not clear, where did you feel the need for more guidance or clarification?

To make a proper process map, I would need to understand more the tools and icons.

View results

Respondent

5 Anonymous

23:08
Time to complete

Usability, navigation and layout

This section assesses the ease of use and clarity of the CHEK Virtual Assistant (VA) interface and tutorial. Participants will provide feedback on navigation, intuitiveness, and the effectiveness of instructions. The insights gathered will help identify areas for improvement to enhance the user experience.

1. On a scale of 1-5, how would you rate the overall ease of navigating the CHEK VA interface?

1 Very Easy – Navigation is intuitive and effortless; all features are easy to find and use without assistance.
2 Easy – Navigation is mostly straightforward, with minor challenges that do not significantly impact usability.
3 Neutral – Navigation is somewhat clear, but some features require effort to locate or understand.
4 Difficult – Navigation is confusing, requiring guidance or repeated attempts to find and use features effectively.
5 Very Difficult – Navigation is frustrating and unclear, making it hard to complete tasks without extensive help.
*

1	2	3	4	5

2. What specific aspects of the interface made navigation easy or difficult for you? Please share any suggestions for improvement.
*

Zoom is difficult and the fact that if you cancel by mistake something is not possible to annull the command

3. On a scale of 1-5, how intuitive was the layout of the tool (e.g., locating the project tabs, BPMN editor, and message bar)?

1 Very Unintuitive – The layout was confusing, and I had difficulty finding key features.
2 Unintuitive – The layout was somewhat confusing, and I had trouble locating some features.
3 Neutral – The layout was okay, but I had to spend some time locating features.
4 Intuitive – The layout was generally easy to understand, and I could locate features without difficulty.
5 Very Intuitive – The layout was clear and well-organized, making it easy to locate all features right away.
*

1	2	3	4	5

4. Did you experience any difficulties finding or using any of the features? *

- (●) Yes
- ( ) No
- ( ) Other

5. If yes, please explain.

I notice that is not possible to copy the elements (for example when some phasis is ripetitive)

Relevance & Content

This section assesses the relevance of the CHEK Virtual Assistant (VA) tool in supporting your municipality's digitalization efforts. It covers the applicability of the process mapping template, the digital maturity assessment, and the generated CHEK roadmap. The questions focus on how well these components align with your building permit process and the digital maturity of your municipality. Feedback will help determine how well the tool addresses your needs, aids in achieving CHEK benchmarks, and provides actionable insights for improvement in the building permit process.

6. On a scale of 1-5, how relevant was the process mapping template to your municipality's Building Permit process?

1. Very Relevant – The template closely matched our process, requiring little to no modifications.
2. Relevant – Mostly aligned with our process, with only minor adjustments needed.
3. Neutral – Somewhat relevant, but required significant customization to fit our needs.
4. Not Very Relevant – Did not align well with our process and required major modifications.
5. Not Relevant at All – The template was not applicable to our process.

*

1	2	3	4	5

7. On a scale of 1-5, how well did the tool address your needs for mapping your building permit process?

1. Very Well – Fully met our needs, providing clear structure and valuable insights.
2. Well – Mostly met our needs, with only minor adjustments or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete mapping.
4. Not Very Well – Did not fully address our needs, missing key aspects of the process.
5. Not at All – Did not meet our needs and was not useful for mapping our building permit process.

*

1	2	3	4	5

8. On a scale of 1-5, how easy was it to complete your process map using the provided template and editing tools?

1. Very Difficult – I had a lot of trouble completing the process map with the tools provided.
2. Difficult – It was somewhat challenging to complete the process map, and I encountered several issues.
3. Neutral – The process map was easy to complete, but I faced some minor difficulties.
4. Easy – I found it straightforward to complete the process map using the provided template and tools.
5. Very Easy – The process map was quick and easy to complete with the provided template and tools.

*

1	2	3	4	5

9. What aspects of the tool were most helpful for mapping your process, and what improvements would make it more effective for mapping your building permit process? *

the template that the tool give at the beginning was very helpful to adjust to our needs

10. Were the steps to start a new project and finish the process map clearly defined? *

- (●) Yes
- ( ) No

11. If no, what was missing?

12. On a scale of 1-5, how well did the tool address your needs for assessing digital maturity?

1. Very Well – Fully met our needs, providing clear insights and valuable assessments.
2. Well – Mostly met our needs, with only minor gaps or improvements needed.
3. Neutral – Somewhat useful, but required additional effort or external tools for a complete assessment.
4. Not Very Well – Did not fully address our needs, missing key aspects of digital maturity assessment.
5. Not at All – Did not meet our needs and was not useful for assessing digital maturity.

*

1	2	3	4	5

13. On a scale of 1 to 5, how well do the results of the digital maturity assessment (Technology, Process, Organisation, Information) match your building permit process?

1. Not at all – The maturity assessment does not match the maturity of our actual process in any way.
2. Slightly – The assessment partially aligns but has significant discrepancies.
3. Moderately – The assessment is somewhat accurate but needs adjustments to fully match the actual maturity of our process.
4. Mostly – The assessment is mostly aligned, with only minor gaps.
5. Completely – The assessment fully reflects the maturity of our building permit process. *

1	2	3	4	5

14. If the maturity assessment did not fully match, please explain which aspects of the maturity of **Technology**, **Process**, **Organisation**, or **Information** did not align with the maturity of your actual process.

15. On a scale of 1 to 5, how clear and easy to understand did you find the CHEK roadmap generated by the CHEK Virtual Assistant (VA)?

1. Very Clear – The roadmap was very easy to understand and follow.
2. Clear – The roadmap was mostly clear, with minor areas needing clarification.
3. Neutral – Some parts of the roadmap were clear, but others were harder to follow.
4. Confusing – The roadmap was difficult to understand, and some parts were unclear.
5. Very Confusing – The roadmap was very unclear, making it hard to understand and follow. *

1	2	3	4	5

16. What aspects of the roadmap were difficult to understand, and how can it be improved to make it clearer? *

The steps are a lot and probably is difficult to focus on and translate in a municipality program; maybe is useful to create groups of action to be followed in a administative way (not only technical)

17. On a scale of 1 to 5, how useful do you find the CHEK roadmap in supporting your municipality's path to digitalize the building permit process and reach CHEK benchmarks?

1 Not Useful at All – The roadmap does not provide any value in our digitalization efforts.
2 Slightly Useful – The roadmap offers limited support but could be more relevant.
3 Moderately Useful – The roadmap is somewhat helpful, though additional resources may be needed.
4 Very Useful – The roadmap is quite helpful and provides clear guidance for reaching the CHEK benchmarks.
5 Extremely Useful – The roadmap is very valuable and directly supports our efforts to achieve the CHEK benchmarks. *

1	2	3	4	5

18. What specific elements of the roadmap would be most helpful for your municipality in achieving the CHEK benchmarks, and what additional features would enhance its usefulness? *

tha action are useful but they need to be elaborated more and put into an administative action plan

Interaction with the CHEK Virtual Assistant

This section assesses the effectiveness and relevance of the virtual assistant (VA) throughout your interaction with the tool. It explores how helpful, clear, and relevant the chatbot's prompts, feedback, and questions were in guiding you through the process. Your responses will provide valuable insights into the chatbot's ability to support users in achieving their goals, ensuring that the tool's interactions align with user needs and contribute to a positive experience. By understanding the interaction with the VA, we can improve the overall user experience and refine its ability to assist with future tasks.

19. Were the interactions and questions from the virtual assistant (VA) **helpful and relevant** to your process? *

- (●) Yes, the interactions and questions were very helpful and directly relevant to my process.
- ( ) No, the interactions and questions were not helpful or relevant to my process.
- ( ) Other

20. How **clear and understandable** were the questions posed by the virtual assistant (VA)? *

- (●) Very clear and understandable
- ( ) Somewhat clear, but could be improved
- ( ) Not clear or understandable
- ( ) Not sure / I did not engage enough to judge
- ( ) Other

21. Did the virtual assistant (VA) guide you through the process in a way that made sense? *

- (●) Yes, the guidance was clear and logical throughout.
- ( ) Yes, but sometimes the guidance was unclear or confusing.
- ( ) No, the guidance was difficult to follow or inconsistent.
- ( ) Not sure / I did not engage enough with the assistant to judge.
- ( ) Other

22. How would you rate the overall effectiveness of the virtual assistant (VA) in helping you map your building permit process? *

- (●) Very effective
- ( ) Somewhat effective
- ( ) Not effective
- ( ) Not sure
- ( ) Other

23. Did you feel that the virtual assistant (VA) asked the right questions at the right time during the process mapping? *

- ( ) Yes, the questions were well-timed and appropriate.
- (●) Sometimes, the timing or relevance of the questions could have been improved.
- ( ) No, the questions were poorly timed or not appropriate.
- ( ) Not sure
- ( ) Other

24. On a scale of 1 to 5, how would you rate the responsiveness of the VA during the process mapping?

1. Very Poor – The VA was very slow or unresponsive throughout the process.
2. Poor – The VA had noticeable delays in responses.
3. Neutral – The VA was somewhat responsive, with occasional delays.
4. Good – The VA responded quickly with only minor delays.
5. Excellent – The VA was very responsive and prompt throughout the process.

*

1	2	3	4	5

25. Did the VA's prompts and feedback help you understand what actions to take? *

- (●) Yes
- ( ) No

26. What suggestions do you have to improve the CHEK VA's interaction with the user?

I suggest to define some acronime (like Responsible of the process = ROP (rup in italian)) in order to interact and write less time the same concept if are clear in the environment

Likability & future use

This section explores your satisfaction with the overall experience of using the CHEK Virtual Assistant (VA) tool and your likelihood of recommending it to other municipalities. It evaluates your willingness to continue using the tool for future process evaluations and assesses its potential value for other municipalities. Your feedback helps identify areas of strength and areas for improvement, ensuring that the tool continues to meet the needs of users like yourself. This section also provides insight into the tool's overall appeal and its potential role in future digitalization efforts.

27. On a scale of 1-5, how likely are you to use the CHEK VA tool for future process evaluations?

1 Not Likely at All – We would not consider using the tool for future evaluations.
2 Slightly Likely – We may use the tool in some cases, but not regularly.
3 Moderately Likely – We are somewhat likely to use the tool for future evaluations.
4 Very Likely – We would likely use the tool regularly for future evaluations.
5 Extremely Likely – We would definitely use the tool for all future process evaluations.
*

1	2	3	4	5

28. If you answered "Not Likely at All" (1), we would appreciate your feedback to understand whether this reflects a reluctance to use this specific tool or any tool of this kind. Was this due to challenges you faced with the tool's usability, or do you feel that tools like this do not align with your municipality's needs for process evaluations? Please provide any insights or additional reasons that influenced your response.

- ○ No Need for Such Tools – We do not foresee a need for this type of tool in our process evaluations.
- ○ Usability Challenges – The tool's difficulty or complexity made it less likely for us to use it.
- ○ Other

29. If you selected **"Other Reasons"**, please kindly specify them here.

30. On a scale of 1 to 5, how likely are you to recommend this tool to another municipality?

1 Not Likely at All – I would not recommend this tool to another municipality.
2 Slightly Likely – I might consider recommending it to another municipality in certain circumstances.
3 Moderately Likely – I would be somewhat likely to recommend it to another municipality.
4 Very Likely – I would likely recommend it to another municipality.
5 Extremely Likely – I would definitely recommend this tool to another municipality.
*

1	2	3	4	5

31. On a scale of 1 to 5, how satisfied are you with the overall experience of using the CHEK VA tool?

1. Very Dissatisfied – I was very dissatisfied with the tool's overall experience.
2. Dissatisfied – I was somewhat dissatisfied with the tool's overall experience.
3. Neutral – I had a neutral experience with the tool, neither satisfied nor dissatisfied.
4. Satisfied – I was satisfied with the tool's overall experience.
5. Very Satisfied – I was very satisfied with the tool's overall experience.

*

1	2	3	4	5

Overall feedback & satisfaction

This section gathers feedback on the user's overall experience with the tool, aiming to assess their level of satisfaction and identify areas for improvement. The responses will help evaluate how well the tool met the user's needs and expectations, as well as highlight the most valuable aspects of the tool. Additionally, open-ended questions will capture suggestions for enhancements, providing insights into potential improvements to ensure the tool is more effective and user-friendly in the future. This feedback is crucial for refining the tool and enhancing the overall user experience.

32. On a scale from 1 to 5, how satisfied are you with your overall experience using the CHEK Virtual Assistant?

1. Very Dissatisfied
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very Satisfied

*

1	2	3	4	5

33. What aspects of the VA did you find most valuable or useful? *

the fact that led to better understand the phasis that we run automatically

34. What improvements or changes would you suggest to enhance the overall user experience and provided content? *

probably in the future it will be important to introduce a timeline (that for italian law is important)

35. Please add here any other comments or suggestions you might have regarding your experience with the CHEK VA.

Clarity of instructions

This section focuses on evaluating the clarity and effectiveness of the document guide provided before using the tool. It aims to assess how well the guide helped users understand how to navigate and use the tool effectively. The responses will offer insights into whether the instructions were clear, easy to follow, and sufficient to prepare users for the tool's functionalities. By identifying areas that may require further clarification, this section helps improve the guide, ensuring that users can confidently start using the tool with minimal confusion.

36. On a scale from 1 to 5, how clear and easy to follow were the instructions provided in the guide document?

1. Very Unclear and Difficult – The instructions were very unclear and hard to follow.
2. Unclear and Difficult – The instructions were somewhat unclear and challenging to follow.
3. Neutral – The instructions were okay, but could have been clearer or easier to follow.
4. Clear and Easy to Follow – The instructions were clear and mostly easy to follow.
5. Very Clear and Easy to Follow – The instructions were very clear, well-organized, and easy to follow without any confusion. *

1	2	3	4	5

37. If the instructions were not clear, where did you feel the need for more guidance or clarification?