

Priorities and KPIs in the evaluation of digital building permit processes from different stakeholder perspectives

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ABSTRACT: This study explores the complexities of building permitting processes and the prioritization of key performance indicators (KPIs) from diverse stakeholder perspectives across countries. An initial list of KPIs was developed from in-depth interviews with field professionals. To validate this list and capture various stakeholder views, a quantitative survey was conducted among industry professionals, public authorities, and policymakers. Results reveal significant disparities in priorities, both internationally and within countries. The findings emphasize the need to tailor solutions to specific contexts and stakeholder requirements, rejecting a one-size-fits-all approach. By moving away from the notion of a mythical best practice, the research advocates for a pragmatic approach that acknowledges the multifaceted nature of building permitting processes. This is essential for addressing the evolving needs of stakeholders globally, contributing to a nuanced understanding of building permitting complexity and the importance of accommodating diverse perspectives in developing effective solutions.

1 INTRODUCTION

Building permitting, characterized by its inherent multidisciplinary nature, involvement of diverse stakeholders, and compliance with numerous regulations, presents a complex challenge (Noardo et al. 2022, Fauth et al. 2024, Amor and Dimyadi 2021). The digitalization of building permits holds promise for streamlining processes, increasing efficiency, and enhancing transparency (Ullah 2022, Ataide, Braholli & Siegele 2023). However, the pursuit for a universal best practice case remains elusive due to the absence of a global standard and the reliance on key performance indicators (KPIs) such as corruption vulnerability, decision robustness, and various other factors identified in previous work (Fauth, Bloch & Soibelman 2024).

This study delves into the intricacies of building permitting by examining priorities from the perspectives of different stakeholders. Contrary to the pursuit of a singular best practice case, our study emphasizes the significance of individual preferences, acknowledging the diverse purposes and priorities inherent in various building permit systems.

The importance of this work is in providing a comprehensive understanding of how different stakeholders prioritize various aspects of the permitting process. By capturing and analyzing these perspectives,

the study aims to highlight the need for flexible, context-sensitive approaches rather than striving for a one-size-fits-all solution. This insight is crucial for developing effective digital solutions that can adapt to the diverse environments and stakeholder expectations across different countries.

To investigate the complexities, a quantitative survey was conducted among industry professionals, public authorities, and policymakers. Experts were meticulously selected based on their roles, expertise, and experience, ensuring a nuanced understanding of the subject matter. The survey, enriched with diverse questions, aimed to rank priorities based on predefined KPIs. Additionally, individual comments from participants were collected and analyzed.

The results reveal substantial disparities in priorities not only across countries and roles in the permitting process. Stakeholder perspectives significantly influence these variations, highlighting the need to tailor solutions to the specific contexts and requirements of different entities. Our study demonstrates that a one-size-fits-all approach to building permitting is inadequate and may lead to suboptimal outcomes.

This research advances the discourse on building permitting complexity by shedding light on stakeholder perspectives and cross-country variances. By acknowledging and accommodating individual preferences, we move away from the pursuit of a mythical best practice case and towards a more pragmatic

understanding that accounts for the multifaceted nature of building permitting processes.

This nuanced approach is vital for developing effective (digital) solutions that align with the diverse needs of stakeholders and contribute to the ongoing evolution of building permitting practices globally.

The remainder of this paper is structured as follows: Section 2 describes the previous work in the field, including the previously developed framework for building permit process modelling and the extension of that framework with the process analysis and comparative evaluation methodology. Section 3 provides insights on the research methodology, and Section 4 introduces the results followed by a discussion section in Section 5. Summary and conclusions are presented in Section 6.

2 PREVIOUS WORK

2.1 Framework for building permit process mapping

In previous work, the authors developed framework for building permit process modelling contains three key components: processes, stakeholders, and business rules. This framework considers the hierarchical steps in the process and how stakeholders influence it, and the business rules outline specific requirements and options for action. Data collection for implementing this framework consists of in-depth

interviews with different stakeholders. Once data on building permit processes are collected and analysed, they can be modelled using this framework. The results of the framework are detailed and process maps with a standardize representation which provides a consistent basis for comparison, enabling other researchers to replicate models for their respective countries. It is crucial to use a consistent framework when modelling processes to ensure fair comparisons between different processes (Fauth & Soibelman 2022).

2.2 Process analysis and comparative evaluation of building permit processes PACE-BP

Modelling and mapping the building permit processes in different countries using the same framework, presents a unique opportunity for global comparison. However, in order to compare the processes in a systematic and objective manner, it is necessary to define the parameters upon which the processes can be compared. Furthermore, it is necessary to define the parameters upon which each individual process can be evaluated. As part of the PACE-BP workflow described in Fauth, Bloch & Soibelman (2024) and illustrated in Figure 1, 10 evaluation parameters were defined based on the interviews conducted for process modelling in different countries. The list of parameters was finalized based on reviewing the literature on the subject as well, but unfortunately the

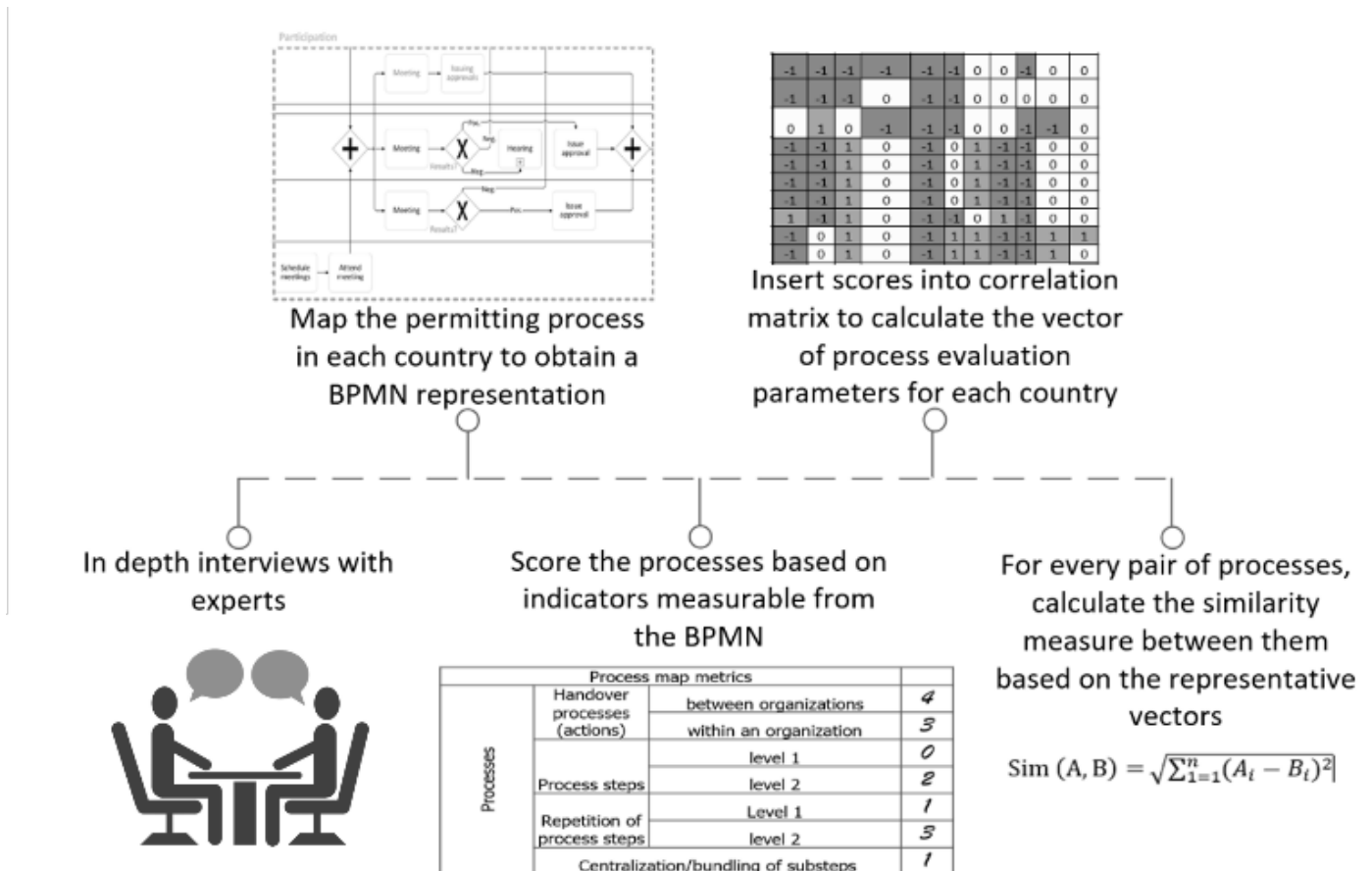


Figure 1 PACE-BP methodology.

literature on the subject is scarce. The PACE-BP workflow relies on measurable indicators that are visible and can be counted directly in the process maps. The core of the workflow is the correlation matrix that defines the affect each such measurable indicator has on each of the evaluation parameters. The calculated scores of the evaluation parameters provide a measure for assessing each individual process. Stringing all the 10 evaluation parameters together presents a representative vector for each process, which provides an opportunity for a mathematical comparison between processes simply by calculating the Euclidian distance between the vectors.

To ensure that the proposed approach is reliable and indeed expresses the priorities of the involved stakeholders, further research is needed to validate the list of evaluation parameters. Since the main source for the initial list was interviews conducted for process modelling, the interviewees were not directly asked about the evaluation parameters, but rather the list is a collection of what surfaced during the interviews. In addition, since most of the interviewees were authorities' representatives, further validation of these parameters is needed. Hence, the objective of this work is to validate the initial list of evaluation parameters, and to capture the different points of view of stakeholders in the field.

3 RESEARCH METHODOLOGY

As explained in the previous section, the initial list of KPIs was identified through interviews with industry experts supported by an extensive literature review. The interviews aimed to fulfill the framework for building permit process modeling and did not explicitly focus on identifying KPIs. However, during these conversations, certain parameters surfaced repeatedly as significant points of concern and interest among the interviewees. These recurring themes were noted and later formed the basis of our KPI list. The repeated mention of these parameters across numerous interviews underscored their importance and relevance to various stakeholders in the building permitting process.

To validate the list of evaluation parameters, a survey was used. Important to note that we do not aim for quantitative validation per se, the aim was to collect a high quality set of responses. Namely, the survey was not open to the public. Instead, specific stakeholders with experience in the field were approached and asked to complete the questionnaire. As a result, we obtained 20 responses from experienced professionals in the field. As illustrated in Figure 2, 30% of the respondents have over 20 years of experience in the field, and another 30% have between 6-20 years of experience. Only one respondent is relatively unexperienced with only one year of experience. In addition, as illustrated in Figure

3, the responses are representative of various roles in the building permit domain, from municipal offices, to architects, legal firms, consulting firms, software developers, construction companies, etc.

The participants were asked to answer two main questions. First, they were given the definitions for each individual term in the initial list of evaluation parameters (presented in Table 1) and were asked to score the individual parameters on a scale of 0 to 5, where 0 signifies 'not important at all' and 5 signifies 'very important.' These parameters should reflect what is important to the participant in evaluating a building permit process. The second question, the participants were asked to arrange the parameters based on their relative importance, 1 - being the most important in the participant's opinion and 10 - being the least important. This structure of survey aimed to compare the responses once they consider individual evaluation parameters, vs. a situation where they have to consider all evaluation parameters together.

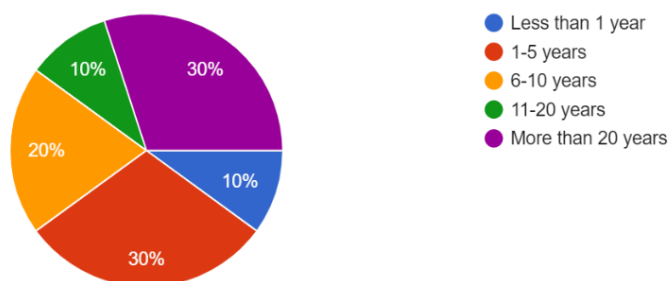


Figure 2 Work experience of the participants.

This was added after we realized that there are many tradeoffs within the evaluation parameters. For example, usually, processes that allow flexibility suffer from significant time consumption. However, the priorities are not clear. What is more important, time consumption or flexibility? We assume that different stakeholders will have different points of view and also different opinions.

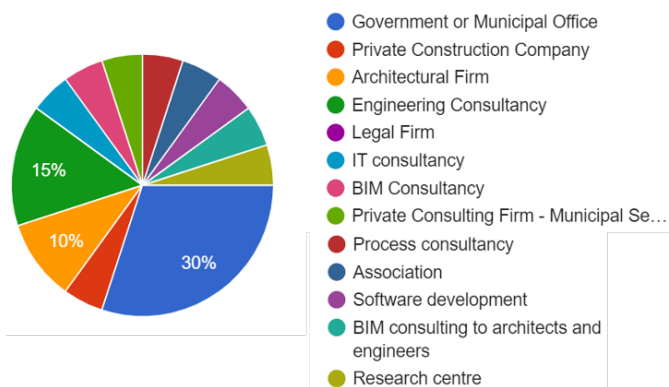


Figure 3 Current role of participants in the permitting process.

Table 1 Initial list of evaluation parameters

Parameter	Abb.	Definition
Time consumption	TC	Time needed to process an application, from submission to issuance of a decision.
Data and Information loss	DIL	The intentional or unintentional destruction or distortion of information, caused by people, processes or systems.
Resource consumption	RC	The consumption of all resources required for process completion, such as human resources, computer resources, etc.
Coordination efforts	CE	A clear definition of how, by whom and when the various functions must be performed to allow their integration with the overall process in order to assure a unity of efforts.
Transparency	T	Visible process execution with a clear insight for all involved parties into the process (who does what and when, how a decision is made, etc..).
Decision robustness	DR	Decisions made in a clear, objective, and systematic manner.
Corruption vulnerability	CV	Integration of informal practices into the process, or lack of enforcement of the relevant laws and regulation for incentives.
Flexibility	F	The ability to utilize deviations, undefined terms and unregulated aspects from the laws and regulations.
Citizen friendliness	CF	Simplification of authority's operations by open communication and service providing.
Societal and political impact	SPI	Sustainable and safe city development with maximum value for taxpayer's money.

4 RESULTS

4.1 Analyses results according to rank and ordering of the parameters

The following describes results for each parameter in regards to ranking (first question) and order (second question):

Time Consumption: In the assessment, time consumption emerged as most crucial for 50% of participants (see Figure 5), with 45% still considering it important or somewhat important. None of the participants ranked it as unimportant. However, when ordered among all parameters, only 6 out of 20 participants maintained time consumption as their primary concern, with 3 participants (15%) considering it the least or very less important.

Data and Information Loss: Data and information loss were deemed most important or very important by 85% of participants, with 11 out of 20 participants (55%) reflecting this in their rankings in terms of the order.

The remaining rankings exhibited a more dispersed distribution among the scores.

Resource Consumption: In the ranking, all participants rated resource consumption between important and most important, albeit less significant than time consumption. However, the order displayed a diverse distribution, with scores ranging from most important to almost least important, each endorsed by one to three participants.

Coordination Efforts: Evaluation of coordination efforts varied between most important (40%), important (35%), and somewhat important (25%). The order reflected a similar trend, with 25% still considering it most important, while the remaining scores were dispersed among the participants.

Transparency: In the ranking, transparency received 55% for most important and 40% for important, with only one participant considering it

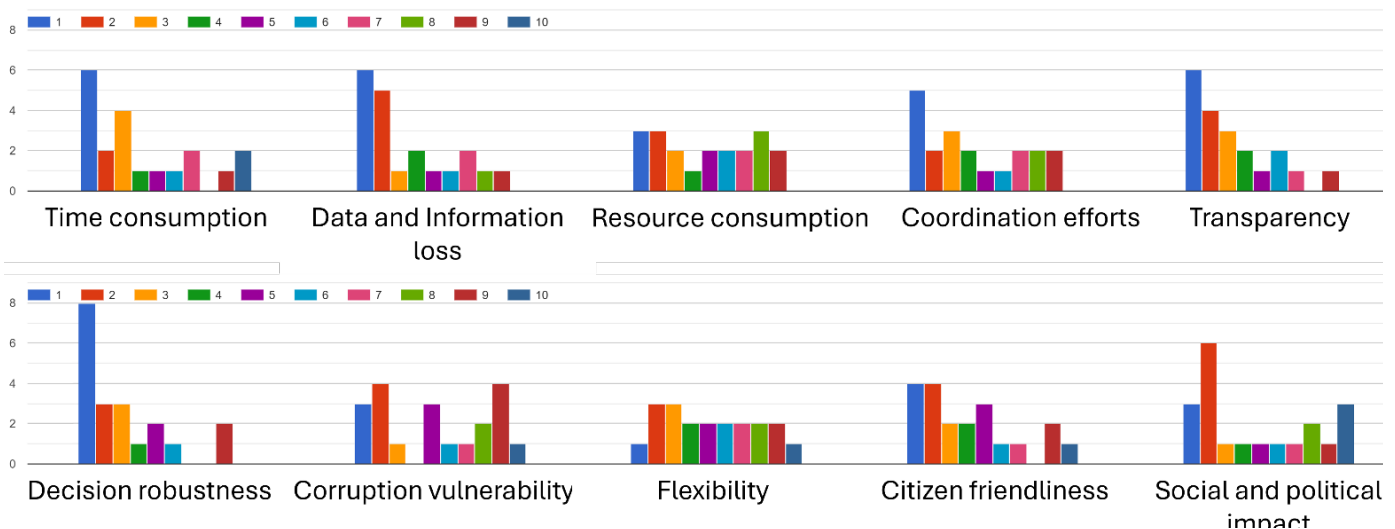


Figure 4 Evaluation results of ordering the parameters.

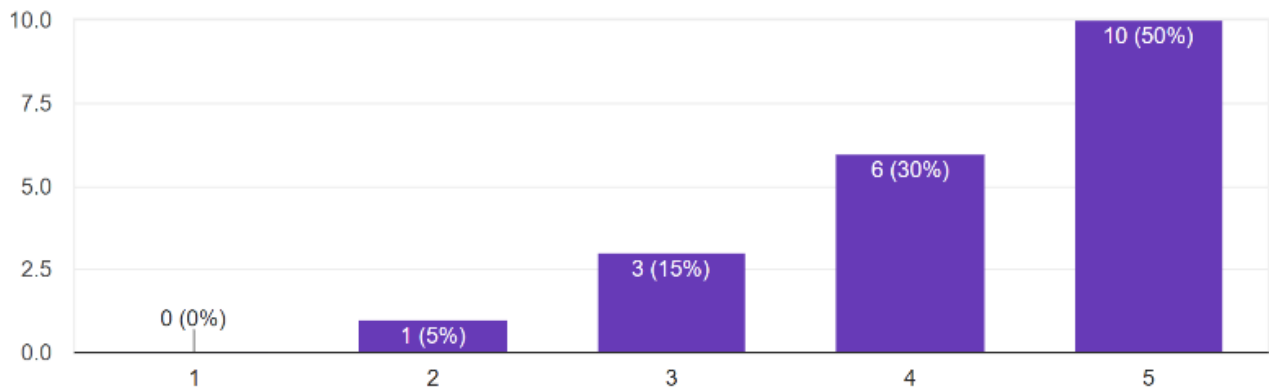


Figure 5 Evaluation results for individual score of "Time consumption".

somewhat important. However, its importance decreased in the order, with only ten participants ranking it in the top two stages, while the remainder exhibited a dispersed distribution.

Decision Robustness: Participants ranked decision robustness highest for most important (60%), followed by 35% for important and 5% for somewhat important. However, in the order, while it retained the highest score, only eight participants (40%) endorsed it as such. Six more participants ranked it second or third, while only two participants considered it less important. Furthermore, decision robustness was ranked on the first place of importance when ordering the terms by most of the participants.

Corruption Vulnerability: Corruption vulnerability was predominantly regarded as most important or important (70% total), with 30% split between somewhat important and not important. The order revealed a diverse distribution, with nearly every score chosen by at least one participant, with the second and ninth place garnering the most participants.

Flexibility: In the ranking, flexibility was primarily seen as important or somewhat important (75%), with 15% considering it most important and 5% each for less and not important. The order showed an equal distribution among ranks, with each rank endorsed by 2 participants except for the first and tenth ranks (1 each) and second and third ranks (3 each).

Citizen Friendliness: Participants rated citizen friendliness as very important in 50% of cases, with the rest distributed among important, somewhat important, and less important (20% or 15% each). When ordered, four participants each placed the first and second positions, while eight participants ordered between third and fifth place. The remaining five participants were distributed among positions six through ten.

Societal and Political Impact: In the ranking, 75% of participants considered societal and political impact very important or important, with 25% viewing it as somewhat important (20%) or less important (5%). However, the order revealed a more dispersed distribution.

Overall, the diversity of opinions among participants regarding various criteria suggests a nuanced perspective influenced by multiple factors.

4.2 Analysis results based on the profession

Additionally, the responses were analyzed based on the profession of the respondents in the building permit process in order to shed light into the differences in the points of view of the different stakeholders. To examine the diversity of opinions amongst each profession, we transformed the scale of the ordering responses by reversing the values (10 becomes 1, 9 becomes 2 and so on), to make the rank scale and the order scale comparable. We then looked at the average values of responses grouped by profession of the respondents. The results are illustrated in Figures 6, 7 and 8, where architectural firms are marked with the number 1, BIM consultants – number 2, Engineering consultants – number 3, professional from government or municipal offices – number 4, other participants – number 5 and professionals from other consulting firms – number 6.

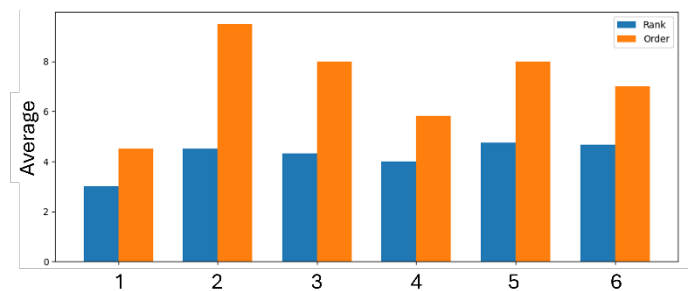


Figure 6 Time consumption - Average rank and order by profession.

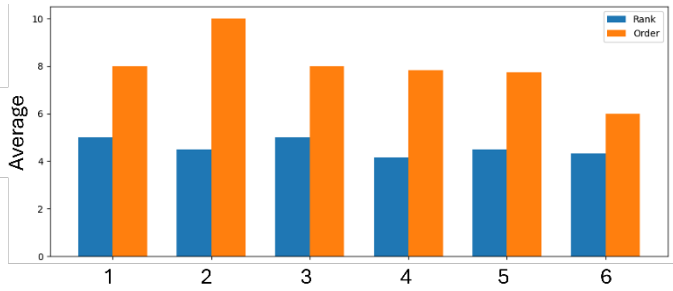


Figure 7 Transparency - Average rank and order by profession.

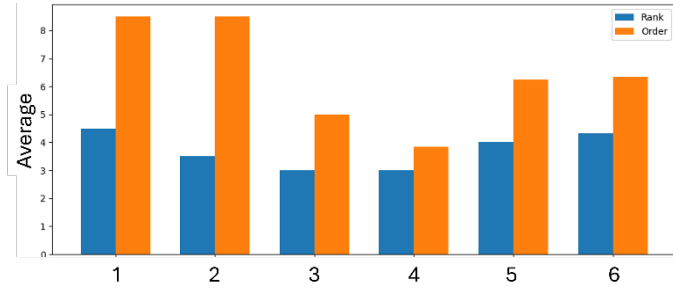


Figure 8 Flexibility - Average rank and order by profession.

We can see from the plots that there are many disagreements amongst the groups. For example, in Figure 6, we see the grouped average responses for time consumption, where individual average ranks are in blue and the average order in orange. Clearly architectural firms do not consider time consumption as the number 1 priority, and it is consistent when ranking individual terms and when ordering them by importance. There is somewhat an agreement amongst all stakeholders about the importance of transparency in the process as can be seen from Figure 7, where we can also see consistency in the individual ranking and the ordering.

It is also interesting to see that Flexibility is considered of very high importance amongst architects and BIM consultants, but less important amongst government and municipal offices. For the other stakeholders we can see average results (illustrated in Figure 8).

5 DISCUSSION

The results reveal substantial disparities in priorities not only across countries but also within municipalities at the same country. Stakeholder perspectives significantly influence these variations, highlighting the need to tailor solutions to the specific contexts and requirements of different entities. Our study demonstrates that a one-size-fits-all approach to building permitting is inadequate and may lead to suboptimal outcomes.

The results shed light on the complex nature of building permitting processes, emphasizing the need for tailored approaches for global comparison that account for diverse stakeholder perspectives and

contextual aspects. While it may appear obvious that specialized solutions outperform general ones, much of the existing work in the field strives for standardization and universal solutions. Furthermore, in practice we often see attempts to adopt practices from our colleges across the globe, but we don't pay enough attention to the need to customize these solutions to fit them to the local environment and needs. One example is the integration of building control companies into the Israeli permit process, adopting the practice from the UK (Fauth, Bloch & Soibelman 2023). Although the benefits seem straightforward, implementation results did not rise to the expectations (State comptroller (2021).

The building permit process is highly complex, with inefficiencies often stemming from the varied needs of stakeholders and local circumstances. To truly understand these processes, we must consider why they have developed in their current form. This study represents a first step towards addressing that gap. The varying interpretations and weighting of KPIs highlight the subjective nature of assessing process effectiveness and efficiency. For instance, while one stakeholder may prioritize time consumption as a measure of efficiency, another may emphasize transparency and decision robustness to ensure procedural fairness and integrity. This diversity of perspectives underscores the need for comprehensive approaches that consider a broad range of KPIs and adapt to evolving stakeholder needs and expectations.

The acquired knowledge contributes to a nuanced understanding of the (digital) solutions required for specific circumstances. Importantly, the study underscores that a comprehensive approach must consider the diversity of perspectives and priorities, reinforcing the awareness that building permitting solutions should be tailored rather than universally applied.

For the digitalization of building permit processes, it is essential to recognize that a one-size-fits-all approach to digitalization is inadequate, as the diverse perspectives and requirements of stakeholders must be carefully considered.

Examining existing research, there is a common assumption that adaptations will broaden the scope of research findings in building permitting. Moreover, many initiatives seek a universal solution that may not align with the specific needs and expectations. Our study highlights the limitations of adopting pre-existing solutions that may not adequately address the unique demands of individual contexts.

Despite its contributions, this study has several limitations that warrant consideration. Firstly, the survey sample may not fully represent the entire spectrum of stakeholders involved in building permitting processes, potentially introducing sampling bias. Moreover, the findings may lack generalizability beyond the specific demographics and contexts covered in the study, limiting their applicability to broader populations or regions. For example, the lower

importance of time in our findings reflects the perspectives of the stakeholders we surveyed, who may not fully appreciate the massive impact of time on the development process that permitting serves. We recognize that this prioritization might differ significantly in other contexts, such as China or Hong Kong, where time efficiency is often critical. Additionally, the subjective nature of survey responses and the pre-defined set of KPIs may not capture all relevant factors or considerations that stakeholders prioritize in practice. Cultural differences across countries or regions may also influence the interpretation and comparability of survey responses. Furthermore, the study's reliance on a single data collection method and its snapshot approach may overlook temporal dynamics and evolving stakeholder perspectives over time. Acknowledging these limitations is crucial for interpreting the study's findings and identifying avenues for future research and improvement in methodology.

6 SUMMARY AND CONCLUSIONS

In conclusion, this research advances the discourse on building permitting complexity by shedding light on stakeholder perspectives and cross-country variances. By acknowledging and accommodating individual preferences, we move away from the pursuit of a mythical best practice case and towards a more pragmatic understanding that accounts for the multifaceted nature of building permitting processes. This nuanced approach is vital for developing effective (digital) solutions that align with the diverse needs of stakeholders and contribute to the ongoing evolution of building permitting practices globally.

This research provides an analysis of stakeholder priorities and highlights the significant variations across both countries and roles. Furthermore, this study sets the stage for future research aimed at exploring the dynamic interplay between regulatory environments, stakeholder expectations, and technological advancements in building permitting. Moving forward, the development of effective (digital) solutions for building permitting must prioritize not only efficiency, but also transparency, and flexibility. This entails engaging stakeholders in the co-design and implementation of permit systems, leveraging technology to foster a culture of continuous improvement and innovation.

Besides gaining empirical evidence from practice, this study is a preliminary step towards developing a comprehensive theoretical framework and classification system that explains the relationships between stakeholder types, their environments, and their priority settings. Further work will involve deeper analysis of individual evaluation parameters and their interrelations, requiring a larger dataset. This expanded dataset would enable exploration of regional

differences, the impact of regulatory changes, and the role of emerging technologies like artificial intelligence and blockchain in enhancing building permit systems. Statistical analyses, including correlation and regression, could be employed to identify patterns and correlations between stakeholder types and their KPI prioritizations. This will provide a more concrete basis for our conclusions and enhance understanding of how stakeholder perspectives influence priorities, contributing to more tailored and effective digital solutions for building permitting processes.

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