

Toward Citizen-Centered Digital Government: Design Principles Guided Legacy System Renewal in A Swedish Municipality

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Abstract

Transformation towards a digital government imposes significant demands on the capabilities of legacy infrastructure. We closely followed a Swedish municipality that designed and implemented a solution to improve the building permit application process with an aim to improve citizen service. We developed six design principles (DPs): availability, timeliness, actionability, transparency, personalization, and generalizability. These DPs guide the solution design and provide a seamless application experience for citizens and business owners. We also discuss the reasoning behind the design choices and the implications of the solution. The artifact encompasses understanding citizens' needs, identifying constraints of the legacy systems, formulating design principles, and developing architectural designs. However, addressing the social aspects of legacy systems, such as organizational culture change, necessitates additional steps, and is worth investigation in future studies.

Keywords: Digital government, digital transformation, legacy systems, renewal, design principles.

1. Introduction

Citizens and business owners are putting pressure on public organizations to keep up with technological development and improve digital services. The public sector as an aggregate - as well as the individual public sector organizations - need to heed this call and engage in digital transformation to alter operations and become a digital government (Mergel et al., 2019; Welby and Tan, 2022).

Legacy systems constitute one of the greatest challenges for digital transformation in the public sector (Irani et al., 2022). This challenge caused several European countries to fall behind in realizing their

vision of “digital by default” in public administration (Al-Muwil et al., 2019). The supplier market with focus on the public sector all too often delivers technical obsolete, monolithic, solutions with locked-in data and very limited support for integrations (combined with a lock-in business strategy) (Zhu and Zhou, 2011). Increasingly complex digital infrastructures, burdened by legacy systems, gradually accumulates digital debt obligations, which over time, will increase debt maintenance costs even more, making any further changes in the infrastructure risky and expensive (Rolland et al., 2018). The general lack of IT competence in public organizations leads to an underinvestment in modernization of the public areas digital infrastructure (Swedish National Audit Office, 2019) leaving the public sector with a legacy of technical and digital debt.

In this study we investigate how the Swedish municipality of Sundsvall tackled the legacy systems challenge by developing and following DPs for solution design and implementation. The municipality is running a digitalization programme with the overall goal stated as “*in the municipality of Sundsvall, we use the possibilities of digitization to improve the quality and increase security in the municipal service. By making municipal operations more efficient, we free up time and resources to strengthen democracy, and increase the participation and independence of Sundsvall's residents.*” (A strategy for sustainable digital development, Sundsvall Municipality, 2022). As a part of this the municipality has revamped structurally their systems toward microservice architecture to reduce the impact from the legacy systems and boost its digital transformation efforts. We investigate the following research questions: *What are the challenges in transforming to a digital government with legacy*

systems? How can DPs guide the design with constraints imposed by legacy systems?

2. Literature review

2.1. Digital government

We follow Janowski's (2015) terminology and adopt the umbrella term "digital government", which not only encompasses the use of technology in government operations but also emphasizes digital transformation, citizen engagement, and the principles of open government.

The scope of the digital government changes continuously to reflect how the government tries to find innovative digital solutions in social, economic, and political areas and how it could transform the decision-making process (Weerakkody, et al., 2016). Prior to digital government we saw the e-government era (OECD, 2003), when governments went online and automated internal processes in the belief that administrative efficiency would follow from digitizing operations. The e-government era focused heavily on digitizing and sometimes left public sectors facing internal skills shortages and over-reliant on external suppliers, building an unhealthy vendor lock-in (Welby and Tan, 2022).

Digital government focuses more on re-engineering and re-designing processes and interactions through modern digital best practices (OECD, 2021). Digital government also aims to ensure public services are designed and delivered to cater to the needs of citizens. In practice, there are various barriers to digital government. These include technological barriers such as inadequate infrastructure, lack of interoperability, and limited access to data. Organizational factors such as the absence of a clear strategy, insufficient human resources, limited digital skills, and capacity constraints among managers (Wilson and Mergel, 2022). In this study, we focus on addressing barriers imposed by legacy systems.

2.2. Legacy systems

Legacy systems refer to outdated or obsolete technologies, methodologies, or infrastructure that continue to be used despite the availability of more advanced alternatives. These systems are typically characterized by their age, lack of support, and compatibility issues with newer technologies and, as Holland et al. (1999) mentions, that legacy systems are systems that "*encapsulate the existing business processes, organization structure, culture, and information technology*". As noted by Irani et al. (2022) and Alexandrova and Rapanotti (2020), outdated legacy systems constitute a major challenge for public sector digital transformation. Consequently, they either need to

be replaced or encapsulated, since the cost of maintaining these legacy systems, and security threats they pose multiply with their age.

Technical modernization of legacy systems involves reverse engineering, schema mapping, application development, and translation (Jha et al., 2014; Khadka et al., 2014). Maintaining, accessing, and analyzing data in legacy systems is challenging and time-consuming. When it comes to data migration during legacy systems modernization, data inconsistency, lack of interoperability, and back-compatibility issues are some of the biggest challenges (Jha et al., 2014). Slow and difficult adaptation of new technology, and the lack of interoperability, adds further complications (Buchanan, 2020).

When replacing or encapsulating legacy systems, social inertia needs to be managed - the social system's (people, processes, hierarchies) resistance to change - arising from deviations between the new solutions functions and legacy systems' ingrained operations (Arvidsson et al., 2014). Alexandrova and Rapanotti (2020) also note that the software implemented to replace legacy systems is often developed or configured to largely mimic their features and functionality, making business process improvements difficult. Bakar et al. (2022) argued that the importance of legacy systems means that they cannot be easily discarded, even though it hinders digital transformations in the public sector.

2.3. Design principles

In this study, the design of solutions is guided by DPs. DPs in information systems research refer to the guidelines and general rules that researchers follow when designing and evaluating information systems. These principles aim to ensure that the systems being developed are effective, efficient, and user-friendly, and that they meet the needs and goals of the organizations or individuals using them. Design principles (DPs) capture the knowledge "*...about creating other instances of artifacts that belong to the same class*" (Sein et al., 2011). They are statements that guide or constrain actions (Hevner & Chatterjee, 2010), are prescriptive in nature, constitute the basis for action (Baskerville & Pries-Heje, 2010) and are an appropriate way to communicate findings to both technology-oriented and management-oriented audiences (Hevner et al., 2004).

Chandra Kruse et al. (2016) define that the purpose of DPs is to provide "*knowledge about creating (...)* instances of IT artifacts that belong to the same class". This means that DPs have been "projected" by identifying the class of IT artifacts to which the set of DPs applies (Baskerville and Pries-Heje, 2019). In other words, an IT artifact can be highly specific and may or may not be transferable to other contexts. However, DPs

can be applied and reused in the design of IT artifacts within the same class.

3. Methodology

To investigate the transformation to a digital government with the constraints from legacy systems, we conducted a design science study at Sundsvall municipality in Sweden. We examined a project aiming at digitizing the Building Permits Application process. We studied challenges presented by the legacy Building Permits Application System ByggR and how these challenges were mitigated. ByggR is a system used in a representative organization in the municipality sector. In the analysis, instead of viewing the system as an isolated software object, we examined it in the context of the work processes that it is supposed to support.

We had extensive access to archival documents, reports, pre-studies, and public communication related to the project, which were available under regulations of the Swedish principle of public access to official records. Below is a brief summary of part of the archival documents.

- The pre-study report “Digitization of the building permit process”, including estimated increased customer value and decreased administration efforts for managing the building permit process, and citizens’ perspectives of the building permit application experience. (October 2020).
- The project description “Digitization of the building permit process” was the basis for the decision to start the project (October 2020).
- The project description “Scale up integrations for environmental - and building permit-processes” served as basis for decision to start a project to continue evolving the solution (November 2021)
- Solution descriptions from the project (October 2020 - December 2022), evolved in iterations during the project’s timelines.

In addition to the archival data, we interviewed both the lead project manager and the IT-project manager in the digitalization of the Building Permits Application process. They were key members in the project responsible for the gathering of functional requirements based on the citizens and business owners’ needs, the implementation in operations, and managing the IT development in the project. Both interviews were conducted online, lasting for 64 minutes and 65 minutes respectively. The interviews were recorded with their consents, and transcribed for analysis. The first author also actively participated in the design phase of the project, which involved the development of DPs for the solution.

The findings presented in this study is a retrospective on the design and implementation of a case management solution for register and update building permit applications. As we reflect on the project evolution, the practitioners actually adopted the Design Science Research Method as proposed in Peffers et al. (2007), though the project team at the municipality might not be aware of the DSRM process model. They started with identifying problems, and then defined the objectives of a solution. They also proposed DPs based on justificatory knowledge (Gregor & Hevner, 2013), through examining citizens’ needs and in-depth analysis of legacy systems. The DPs can be reused in contexts of transformation to a digital government, with the constraints of legacy systems. In this way, DPs help to address similar challenges in the digital transformation towards a digital government, though the IT artifacts for different contexts are highly specific (Iivari, 2020). They then designed and implemented the solution, and the solution has been introduced to the department for demonstration, evaluation and finally for use in production. This study enters the DSRM process in the evaluation phase and the current study can be considered as part of the communication phase.

The preparation phase, including information and process modeling, and solution design, spanned from January 2021 to October 2021 after which development started. The first release of integrated e-services to production was made in January 2022 (the first design and evaluation cycle). After a grace-period that lasted to august 2022, more e-services were developed and released in January 2023 (the second design and evaluation cycle). In the section below, we first identify the problem.

4. Problem Analysis

4.1. Analysis of the application process

The following descriptions of the current application process are simplified and focus on the management of the main building permit process on a high level.

The applicant either downloads application forms from a web page, fills them in, and sends the forms as a paper-application by post or the applicant registers the application through an e-service platform. If the applicant sends the application through the e-service platform, a case is registered in the e-service portal and the information is possible to fetch in pdf-format.

Next, an administrator either gets a paper-application or fetches a pdf with the application from the e-service, and at the same time closes the case in the e-service platform. Based on the information in the forms provided by the citizens, the administrator creates a new case in the system ByggR. The administrator also needs

to manually copy data from another system Sokigo FB to get additional information, to complete the case description.

Then the process is driven by the case manager. Case managers usually process the case manually, and if there is any update about the status of the case, the case manager will let the administrator do the update in the system ByggR. If there is any additional information needed for the application, the case manager contacts the applicant either by phone or by e-mail.

Figure 1 illustrates the process. Once the applicant submits the application, he or she is usually left out of the process, and will be notified when additional information is needed, or when the decision is made. The application process takes around ten weeks for a regular building permit application.

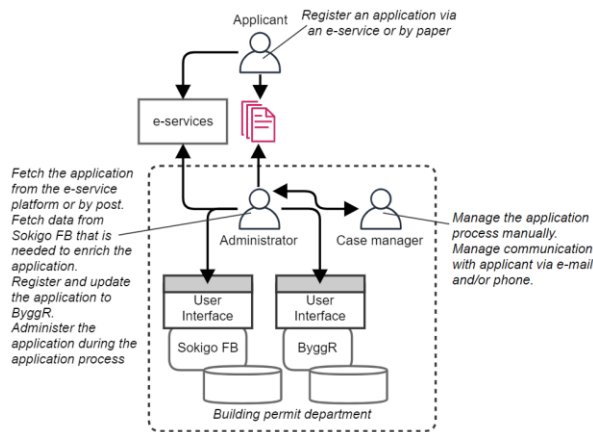


Figure 1. The building permit application process before the solution was implemented.

4.2. Identifying citizens' needs

Digital transformation towards a digital government offers the potential to offer an integrated and coherent user experience of government across channels and spanning across public sector organizations (both across departments within an organization as well as over different public agencies). Unlocking that potential relies on the strategic use of digital tools and data as enablers to rethink, redesign and simplify services on the basis of what the citizens want and needs (Welby and Tan, 2022).

To discover what citizens want, a pre-study was conducted by the municipality before the solution design. The pre-study focused on gathering citizens and business owners' perceptions of the building permit application service, understanding their needs, and thus giving ground for the design. 23 interviews were conducted in the pre-study. Out of the interviewees, 14 were citizens, 7 were business owners, 1 represented a sports association, and 1 represented a housing cooperative. The findings from these interviews were

summarized in the project pre-study report. The quotes below are from the report, unless stated otherwise. The lead project manager took an active role in conducting the interviews and also shared her insights during the interview conducted for this study.

4.2.1. A challenging application process

The laws and regulations that form the foundation of the building permit application process are extensive and complex. Applicants need to take significant preparation before submitting their applications. In a workshop where participants engaged in a discussion about the application process, it was highlighted that citizens begin their application journey well before the municipality's process. For first-time applicants, it can be challenging to know the specific requirements, and the information available on the building department's website is fragmented and incomplete.

"Before the application, where the big job lies, it is mentally hard and difficult. The municipality could be a better support in that whole process. In that way, the municipality could encourage people to build more" (First time applicant).

40% of all applications still require supplementary information to be submitted after the initial application. This indicates that citizens do not receive sufficient information about the application process and are not fully aware of the information required from them.

Citizens also hope the process can be faster, in terms of shorter lead times between application and decision. This aspect is particularly crucial for company applicants. Similar opinions are expressed as needs for "smooth process", and "no additions and hassles".

4.2.2. Lack of transparency and communication

As the e-service platform and the ByggR systems are standalone and do not interact with each other, applicants do not receive any updates from the IT system while their application is in progress. The e-service system only offers functions such as downloading application forms, submitting filled-in forms, and registering a case.

As described previously, an administrator manually moves the case by entering data to the ByggR system from the pdf files fetched from the e-service platform. After moving the case to the ByggR system, the administration sets the status of the case to closed in the e-service platform, though the application is still in process. This process creates confusion.

"In my world, the e-service lured me in and I thought I could follow the case, but in reality it wasn't like that" (First-time applicant).

Citizens also express the need to communicate with municipality staff through channels other than phone

calls. They hope to have the option of being contacted through digital channels as well.

“If I send a question digitally, they don’t answer digitally. Then when I called, they answered. If I send a question digitally, I want an answer digitally” (First-time applicant).

4.2.3. Applicants have varying needs

Applicants for the building permit process have varying levels of knowledge and experience regarding the application process. Some citizens are first-time applicants, but there are also large companies that apply multiple times a year. However, the current application process treats everyone essentially the same. All applicants receive the same information, use the same forms and e-services, and are processed in the same manner. This approach creates obstacles for both new applicants and experienced ones, as illustrated in the quotes below.

“It came as a surprise that it would be so tricky. I realized after a while that this was more complicated than I thought.” (First-time applicant).

“Much in the building permit process is adapted and made for those who cannot. Not adapted for us who can and do it all the time. They know we can do this, so why bother us every time?” (Frequent applicant).

It is evident that different types of applicants have diverse needs, and those needs are not being catered to.

4.2.4. Citizens’ needs for independence and municipality as a partner, not as an authority

In addition to expectations for a smooth and efficient process, applicants also expressed a desire for the municipality to act as a partner rather than an authoritative figure just giving orders. They hope that the municipality can assist them in *“finding solutions together”* and create an environment where *“no one should feel superior or inferior” (Frequent applicant).*

The case managers often perceive themselves as authority figures whose primary responsibility is to ensure compliance with laws and regulations. They view their mission as extremely important. One case manager even believes that every citizen should receive education in school about the laws and the process of building permit application. This perspective, shared by the case manager with the lead project manager, made a profound impression on the project manager.

“(A case manager shared that) the law and how the complete process works about building permits should be a subject in school. Everybody should learn about this because this is so special and this is so important.” (Lead project manager).

The applicants have a completely different viewpoint. For them, this process is seen as a necessary evil, perhaps something that needs to be dealt with only

once in their lifetime. They perceive the case managers as partners who are there to provide assistance throughout the application process.

The authority process must of course be respected, but; *“in order to create development in the city, the municipality must create relationships, not just be an authority exerciser” (Frequent applicant).*

“Of course, the case managers must adhere to laws and regulations, but we can be helped to find possible ways forward” (Frequent applicant).

Citizens also hope to be more independent. They hope to receive tailored guidance from digital channels such as a website, so they can independently prepare the application. However, this is not how their experience currently reflects.

“The manager helped and guided me through the entire process. It felt good with the personal help, it became very clear what I needed to do...”

... But you want to be more independent. You always start there - on the web. I want to be guided easily there - what applies to me” (First time applicant).

4.3. Challenges imposed by the legacy system ByggR

In addition to gathering citizens’ feedback and understanding their needs, we also analyzed the legacy system, specifically the system that supports the building permit application, known as ByggR. ByggR was developed solely from the viewpoint of case managers, which means that citizens and business owners have no opportunities for digital interaction with the system throughout the permit application process. In other words, they are not considered as users of this building permit application system. This lack of user-centric design is quite common for systems designed to support permit applications.

Citizens and business owners are not able to track the progress of their applications digitally, and the system lacks the capability to digitally inform applicants about the results of their applications for all case types.

The access to the data in the system is limited, and the data is also unstructured and of poor quality. This implies a risk that the case management of a citizen's case is not legally secure. There is a risk that the case managers are basing their decisions on inaccurate data, which may result in decisions that are not in line with laws and regulations. Moreover, the fact that the most complete set of data is only accessible from the system’s user interface and the limited access to data leads to the creation of analog processes outside of the system. This reliance on manual processes increases dependence on human resources. While it is possible to retrieve a portion of the data from the system ByggR through integration with the provided Webservice interface, this interface does not provide all the system’s data and

incurs additional expenses. Furthermore, the Webservice interface lacks documentation, and the supplier does not have a well-established lifecycle management process.

The system lacks automation in case management processes, relying entirely on case managers to drive the process. This poses a risk to case management, as rule evaluation is based on individual case managers' knowledge and interpretation of current rules and regulations, rather than being evaluated by an automated rules engine. This high dependency on human resources also creates significant challenges from a case management perspective.

Moreover, the system is monolithic, the data models are specialized for case type building permits, designed from a case management perspective and do not provide any process automation. As a result, it is not possible to create a holistic user experience for citizens, user experiences with a high degree of automation and that span across all municipalities departments of the municipality. From a case management perspective, the highly specific data model and manual driven process for building permit cases restrict case managers to managing only one type of case.

The ByggR system also presents challenges when it comes to integration into the municipality's IT architecture landscape, primarily due to technical limitations rooted in outdated techniques. The lack of integration with the municipality's IT architecture hampers information sharing among different departments within the municipality. Consequently, providing citizens with a comprehensive overview of their interactions with the municipality becomes difficult.

5. Solution

5.1. Design principles

In the previous section, we examined the needs of citizens and identified the issues associated with the legacy system ByggR. As suggested by the literature review, legacy systems encompass both technical and social dimensions. However, for the purpose of this study, our primary focus is on addressing the technical challenges of the system. We acknowledge that altering social aspects, such as the perceptions of case managers regarding their roles, requires a cultural shift within the organization and long-term efforts.

To provide citizens and business owners (users) with a smooth experience and the same interface across different departments' service (aim), solutions shall be designed based on the users' process. In addition, we noted that citizens may apply for different types of permits and interact with different departments in the municipalities. The application processes for these

permits were largely similar to that of the building permit application process and share similar challenges. The aim was to provide a holistic user experience for citizens to interact with the municipality. Therefore, we propose DPs derived from the building permit application scenario and from the municipality level.

The main motivation for the DPs is to enable the possibility to design solutions that meets our citizens increased requirements on digital services in public sector (Mergel et al., 2019), solutions that are designed from the citizens perspective and not based on the internal operational processes which has shown to not encourage the use of the digital services (Mergel et al., 2018). Simply speaking, getting citizens more involved in the process, and providing them a better service. We develop the following DPs.

DP1 Availability: Information should be available to citizens and business owners. As identified in the previous section, citizens hope to get information needed for the application, and be independent. The information shall be able to be fetched and presented from the support systems. The information needs to be accurate, complete and easily comprehensible.

DP2 Timeliness: Provide information to citizens and business owners at the appropriate time to reduce unnecessary delays. It is also important to provide citizens and business owners with the information they need in a timely manner, the information needs to be delivered in line with clearly specified nonfunctional requirements (for instance; "information on status updates of a case shall be sent to the citizen within X minutes"). To provide information at the appropriate time minimize the risk for unnecessary prolonged processes.

DP3 Actionability: Prompt citizens and business owners with the next steps to take during the process to prevent process disruptions. To prompt citizens and business owners with the information on what actions to take, requires a solution that proactively suggests these actions. Prompting the next step of action minimizes the risk that the process breaks.

DP4 Transparency: Citizens and business owners shall be informed about the decision making process. To be transparent to the citizens and business owners with what information is used and what rules are effectuated in authority processes, requires open solutions with open algorithms. Transparency facilitates building trust in the exercise of authority and makes it possible for citizens and business owners to challenge decisions based on hard facts.

DP5 Personalization: The user experience for citizens and business owners should be tailored to meet their specific needs. In order to deliver a user experience that aligns with the knowledge and requirements of citizens and business owners, the design of the user

experience needs to be customized accordingly. By personalizing the user experience based on individual needs, we can enhance user satisfaction and engagement.

DP6 Generalizability: The solution designed for the specific building permit application process shall have the potential to be applied to other permit application processes at the municipality level. The solution shall be generic, in the sense that the solution for the building permit application process can be generalized to other permit application processes. Since, ByggR was difficult to replace, it is important to design the solution with the constraints of the legacy systems in mind.

5.2. Solution design

Guided by DP1 to DP4, the initial step in the digitalization journey for the building permit departments involved two key initiatives. Firstly, the creation of a building permit application guide was implemented to assist applicants throughout their application process, providing guidance and support along their journey. Secondly, the application process itself was digitized, enabling applicants to register, track the status of their cases, and make updates digitally. The cases were seamlessly transferred from the e-service platform via a microservice to the ByggR system, ensuring a smooth transition and integration of the digital application process.

This would provide a higher quality service to our citizens by first guiding the applicants and then digitizing the case registration step in the process. As a result, the data quality of the registered cases in the support systems would improve, and the number of required applicant-completions could be reduced. Automating the case registration in ByggR based on the information entered by citizens in the e-service platform would decrease the amount of manual work required, thereby lowering the workload for the department (and forcing the case managers to work in the system, reducing the amount of administrators).

On a high level, an encapsulation strategy was chosen for practical reasons, despite resulting in a complex system architecture with multiple hidden dependencies that may lead to additional technical debt (Rinta-Kahila et al., 2022). This strategy involved building microservices that integrate with ByggR and providing highly abstracted APIs to create an artificial composable architecture that facilitates business development and responsiveness to business demands. The possibility of implementing a fully automated process support by replacing the ByggR system with a modern process automation solution was discussed for later stages in the department's digitalization journey.

A stand-alone web application was implemented as a guide. In terms of digital case registration, integrating our e-services directly with ByggR WebServices was not an option because it would tightly couple the e-service platform (Open ePlatform) with the ByggR system, which are not considered long-term target solutions in the municipality. This approach is not in line with our goals. By avoiding coupling in the integration between the e-service platform and the systems, we prevent future IT improvements from becoming complex and costly.

Two generic API's, caseManagement and caseStatus, were designed as an abstraction over ByggR, enabling digital case registration and displaying case statuses digitally. The decision to establish two separate APIs, instead of combining everything under caseManagement, was driven by the expectation that case statuses registered in other processes might also be relevant. Therefore, caseStatus was designed from the beginning as a scalable façade capable of accommodating case statuses from multiple sources, i.e., more sources beyond what is covered by caseManagement.

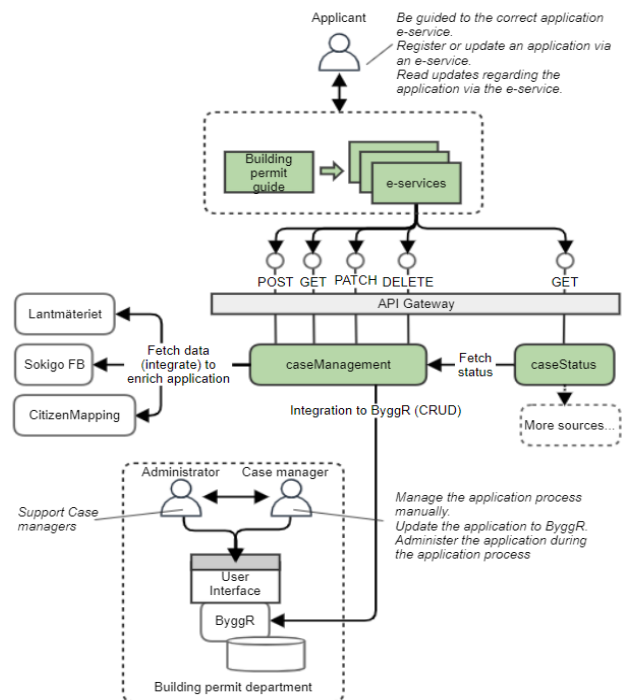


Figure 2. The digitized building permit solution.

Two microservices were developed to implement the API's. For the registration of building permit cases, we enhanced the case by bringing data from our citizen catalog and Lantmäteriet/Sokigo FB, thereby reducing the need for manually copying data from different

systems. The caseManagement microservice then integrates towards ByggR.

After the completion of the projects, an initiative was launched to scale the usage of the solution in the building permit department, with the following goal:

“The assignment includes scaling up the integration of current non-integrated e-services in the departments to the new integrated e-services.” (from the project description “Scale up integrations for environmental- and building permit-processes”).

Continuing the department’s digital transformation journey and replacing the system ByggR with a modern process automation solution was put on hold. Reasons behind this decision will be discussed below.

6. Learnings

In this section, we will discuss the learnings from the project, evaluate the extent to which the solution designed based on the DPs effectively mitigated the problems identified in section 4. When a problem cannot be mitigated, we discuss factors that contribute to it.

From a technical and architectural point of view, when starting a journey like this from scratch, expertise in modularization, APIs and microservices architectures is crucial. Even with these elements in place, one must be prepared to continuously redesign details in solutions and refactor code. The caseManagement integration towards the support system ByggR turned out to be a complex and time-consuming task due to the support systems’ undocumented Webservice with poor design (lacking abstraction), and the ByggR supplier’s unwillingness to provide support in our project.

It would have been better from a technical point of view to replace the existing support systems at the same time with the development of digital case registration. The establishment of caseManagement and caseStatus proved to be beneficial for the e-service development though. Furthermore, the continuous addition of new e-services becomes highly cost-efficient with our solution.

Overall, the DPs were partially followed. Table 1 illustrates how the DPs guided the solution, and how the DPs addressed the problems identified.

Table 1. Connections between problems identified, design principles, and the solution.

Problems Identified	Design Principles	Solution
Lack of transparency and communication	DP1 Availability DP2 Timeliness DP4 Transparency	The information flow improved significantly (DP1 Availability, DP2 Timeliness). Citizens and business owners now have digital access to the current status of the application. As the process still is case manager driven, citizens and business owners have to rely on that the case manager updates the system accordingly
Citizens’ needs for independence	DP3 Actionability	Citizens and business owners are digitally informed about actions that need to be done (DP3 Actionability).
Applicants have varying needs, but the services are not catered	DP5 Personalization	Ideally, we shall allow users to choose their user types, such as first time applicants, frequent applicants, and then cater the application process based on different users types. This is not yet implemented in the current solution due to time constraints and limitations in the Legacy systems.
Similar permit application processes in different departments of the municipalities.	DP6 Generalizability	The solution establishes generic APIs possible to scale to other application types.

The digital transformation part of the project did not move towards completely digitizing the application process. The legacy system ByggR is not replaced with a highly automated solution. The reason for this can partly be attributed to the lack of digital maturity in the organization.

There is also an obvious lack of strength in change management capabilities on the operations side. Digitizing the application process was already challenging, and the case managers showed no interest and even resisted changes to their current way of

working. Upon closer examination, it becomes apparent that as the number of integrated e-services increased, benefiting the citizens, there has been a decrease in the number of administrators within the department. As a result, the case managers are now required to spend more time working independently in the system. This change in workload could influence their perception and appreciation of the system.

To summarize, encapsulating the legacy system ByggR with a solution based on DPs aimed at providing a smooth experience for our citizens and business

owners during the building permit application process was partially successful. Not all obstacles found in the project pre-study insights were mitigated. This was partly due to limitations in the legacy system ByggR and partly because the project did not prioritize the creation of user-specific experiences that adequately considered the respective user groups' prior experiences and needs.

The primary challenge lies in the need for a shift in the case managers' attitude towards their responsibilities and way of working. To effectively address this challenge, it may be necessary to replace the existing legacy solution with a new solution aligned with the DPs. This transition would compel a change in the operations, promoting a more proactive mindset among the case managers.

7. Discussion

7.1. Limitations

The study has some limitations. Firstly, it is important to recognize that there may be additional citizen needs that need to be identified in various digital government contexts beyond the permit application process. The conceptualization of the DPs may vary in different scenarios. However, considering the significance of citizens' information-related needs in digital government, it is worthwhile to test the applicability of the proposed DPs in other digital government settings. Secondly, although the solution introduced based on the DPs has received feedback from case managers and citizens, further rounds of demonstration and evaluation could be conducted. Nonetheless, by implementing the solution based on the DPs, we have effectively demonstrated their effectiveness in achieving the desired outcome. Thirdly, digital government encompasses a broad scope and involves varying levels of citizen engagement. Contexts that involve citizens in strategic decision-making, for instance, require more dynamic interactions with citizens. The DPs proposed in the current context may not be suitable for such scenarios, further research and exploration are needed.

7.2. Theoretical contribution

Firstly, our study contributes to understanding about the challenges in transitioning towards digital government. In the digital government literature, there are studies identifying barriers to digital government (Wilson and Mergel, 2022), defining digital transformation at the public section (Mergel et al., 2019). It is important to specify citizens' needs and the existing problems within the problem space, which, in our case, is the building permit application process in a large municipality. Our analysis reveals that citizens have expectations of a smooth user experience, access

to information even before the application process begins in the system, timely support, and in the meantime to be independent. Our findings echo prior research about "citizens' expectations of governments' ability to deliver high-value, real-time digital services" (Mergel et al., 2019), while we specified the detailed expectation through problem analysis in a permit application context. However, legacy systems present challenges, such as lack of interaction with citizens and difficulties in extracting data from the system.

Secondly, we contribute to design knowledge concerning the digital government design by proposing a set of DPs aimed at enhancing the citizen experience with the permit application process. To the best of our knowledge, there is relatively limited research in the field of Information Systems dedicated to designing solutions for digital governments in the public sector. The DPs are derived from the needs and expectations of citizens and business owners, ensuring that solutions are designed to meet these requirements. Taking an outside-in perspective, our DPs prioritize access to information, process support, and usability for citizens and business users, placing their needs and expectations on an equal footing with those of the case managers. Compared to the generic DPs discussed in the field of user-centered systems design (Gulliksen et al., 2003), the DPs in this study are focused on dealing with the specific challenges in the municipality sector, considering the constraints of the legacy systems.

Thirdly, the DPs not only assist in designing solutions for the building permit application process but can also be applied to tackle similar issues related to citizens' permit applications or other types of applications in the public sector. The DPs help to address comparable challenges in the journey towards digital government transformation, even though the IT artifacts required for each context may vary significantly (Iivari, 2020).

7.3. Practical contribution

Our study has important practical implications for designing new systems and renewing legacy systems in the public sector for digital government purposes. The artifact created, which involves understanding citizens' needs, identifying constraints of the legacy systems, formulating DPs, and developing architectural designs, can be effectively applied across diverse practical contexts. This is especially pertinent as the significance of digital government transcends national boundaries, making it of global importance.

8. References

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