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From Paper to the Cloud – Improving Building Control through E-permitting

Introduction

The construction sector has a major role in economic growth, with the industry's activities affecting nearly every aspect of the economy. It is forecasted that the volume of construction output will grow by 85 percent to $15.5 trillion worldwide by 2030.[1] The integration of advanced technology into the sector is expected to lead to considerably enhanced efficiency, resilience, and adaptability, benefitting not just the construction industry, but the society served by its infrastructure.

Public authorities worldwide are increasingly turning to information management solutions to improve building quality control and to respond more efficiently to the needs of the engineering and construction sector. Modern technology solutions enable building departments and related agencies to streamline and automate their procedures for planning, zoning, and building. They also improve transparency and accountability. Moreover, enhanced information management facilitates record keeping, leading to more efficient use of staff time and less duplication. Other advantages include easy access to building regulations and transparency of fees. From the private sector's point of view, information management solutions improve communication with authorities, the quality of building plan reviews, and customer service.

Electronic permitting has evolved over the years, from basic plan submission via email to sophisticated solutions that include customized software for online submission and automatic building code verification. It also expanded from task-specific systems to more integrated solutions that connect users with all stakeholder agencies and allow a seamless flow of information, making it possible to monitor the various steps of the process.

According to *Doing Business 2020* data, 170 out of 190 surveyed economies have building regulations available online. Ninety-seven economies have information on required documents, pre-approvals and fees in e-format. Online requests for water and sewerage connections are also common. In addition, electronic document management systems are increasingly deployed in many countries.

The features and functionalities of each system, however, vary widely. While some agencies are only capable of front-facing interactions (document submissions), others incorporate more robust capabilities that include personalized web interfaces with features such as interactive checklists, geographical information system (GIS) capabilities and even automated building code compliance functions. Since 2007, 29 economies have implemented reforms to set up or streamline web-based portals for coordinating building permitting processes. In 2014, Morocco first introduced its online permitting platform – CasaUrba –which allowed online submissions. Since then, the platform was further developed to include various features, such as online processing and online notification systems. In 2019, the second version CasaUrba 2.0 streamlined the process and made it possible to apply for and obtain certificates of conformity online.

How can the use of technology and digital features by building authorities and the construction industry make the permitting process more efficient and transparent? This study aims at identifying the gains in transitioning from analog to digital functionalities in building control, and how they translate into more efficiency in construction permitting and increasing transparency.

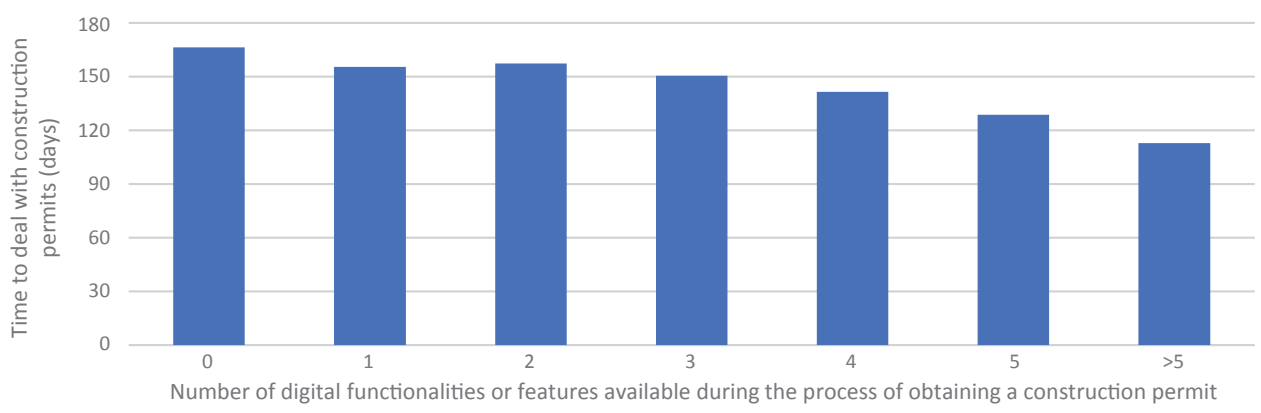
Construction permitting: efficiency gains through digital adoption

Leveraging technology has a significant impact in reducing the time required to deal with construction permits, and many governments have been engaging in reforms aimed at simplifying the permitting process while improving building control. These reforms vary from the implementation of online permitting systems to the use of more efficient formats in presenting building plans and drawings. They also integrate digital functionalities or features during the permitting process and allow for better integration among various public agencies involved in the permitting process.

Availability of digital features

Digital functionalities such as i) online payment, ii) online communication, iii) online notification, iv) online submission, v) auto-code check, vi) auto-generated checklist, vii) integrated GIS, and viii) remote monitoring, all play an important role in reducing processing time. *Doing Business 2020* data show that, on average, it takes 168 days to complete the permitting process with no digital features (i.e. the process is completely manual). This time decreases by 32 percent, to an average of 114 days, when more than 5 digital features are available (figure 1).[2] The availability of effective online communications, both between the private and public sector and

Figure 1. The availability of more digital features during the construction permitting process is associated with less time to deal with construction permits



Source: Doing Business. The digital features measured are: online payment, online communication, online notification, online submission, auto-code check, auto-generated checklist, integrated GIS, and remote monitoring.

within the various public sector agencies, is key in reducing processing time. Faster communication keeps the private sector informed and up to date on the various phases of the review process and allows it to address any issues as soon as they arise. In addition, inter-public agency communication reduces verification time and the burden on the private sector to secure pre-approvals prior to requesting a building permit.

For instance, Kuwait implemented a new e-submission platform in March 2019, which integrated various public agencies such as the Municipality, the Public Authority of Industry, and the Fire Services Directorate.[3] The platform established instant communication channels between the private sector and public agencies. This integration helped streamline the inter-agency communication and made obtaining relevant feedback and clearances during the application review process faster. In fact, the time to obtain plans approval from the Fire Services Directorate decreased from 60 days to 37 days, while the total time to obtain the building permit decreased from 25 days to just 7 days.

Furthermore, the government introduced the GIS system, which includes comprehensive information on land plots, details on electricity grids and the water network. This further simplified the process by eliminating the requirement for a topographical survey, and the need for water and electricity inspections to obtain plans approval.

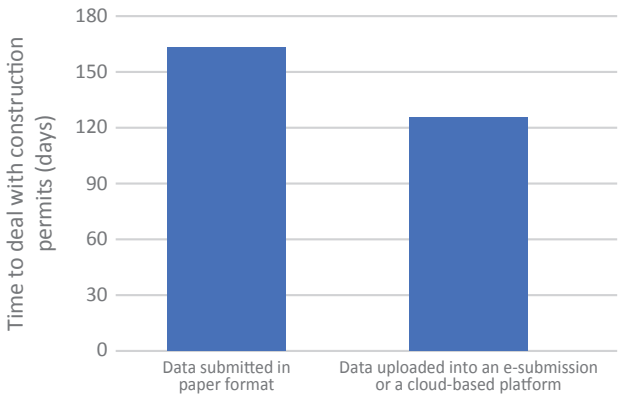
Availability of online payments

Online payments to public agencies involved in the building permitting process is usually one of the first digital functionalities that economies introduce to facilitate fee payments related to the permitting process. It reduces transaction costs and increase efficiency by cutting time and resources allocated to receiving cash payments. Online payments increase transparency and accountability through payment tracking, which reduces the risk of theft and corruption. According to *Doing Business 2020* data, out of 190 surveyed economies, almost 50 percent have online payment options, even if they are not the only payment method. In terms of regional comparisons, Europe and Central Asia is on par with OECD high income economies, where 77 percent of the economies have online payments, followed by the Middle East and North Africa where 53 percent of the economies employ this feature.[4] Sub-Saharan Africa lags behind, with only 25 percent of economies using online payment solutions, often due to lack of infrastructure and broadband access.

Plan submission format

The *Doing Business 2020* data show that the use of e-formats in submitting building permit applications, such as uploading data into an e-submission or cloud-based platform is associated with substantially lower processing times. In economies where building plans and drawings are presented in a 2D paper printed format, the average processing time is 164 days. This average drops by 23 percent, to 126 days, in countries that use electronic systems (figure 2).

Figure 2. More efficient formats in which building plans and drawings are presented are associated with less time to obtain construction permits



Source: Doing Business

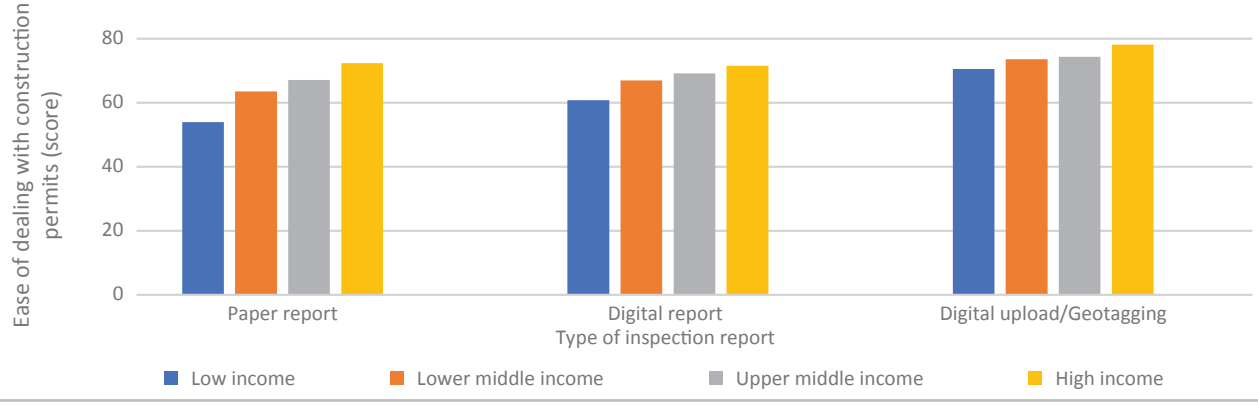
Out of the 190 economies surveyed, only 27 percent have a permitting system that uses e-submissions or cloud-based platforms. OECD high income economies lead with 48 percent implementing efficient submission formats, followed by the Middle East and North Africa with 47 percent of economies.[5] Sub-Saharan Africa falls behind all other regions with only 15 percent of economies using e-platforms.

Many countries were able to streamline their permitting process and reduce time by adopting e-submission solutions. In 2016, Serbia reduced the time to obtain a building permit by 67 percent, from 328 days to 106 days. Similarly, Rwanda implemented its online platform in 2013 and reduced the time to obtain the permit by 28 percent, from 163 days to 117 days.

Leveraging technology in quality control during construction

Beyond good regulations, an effective inspection system is critical for protecting public safety. Without an inspection system in place, there is no mechanism to ensure that buildings comply with proper safety standards, increasing the probability of structural defects. In some cases, the public sector outsources inspections and quality control to the private sector. However, in 132 out of 190 economies, quality control remains the public agency's responsibility. As per *Doing Business 2020* data, economies digitizing quality control processes during construction score higher on the ease of dealing with construction permits. The United Arab Emirates, ranked third in the ease of dealing with construction permits, is increasingly relying on remote monitoring by using cameras and drones to inspect construction sites, reducing the need for on-site inspections. This trend is consistent across all income groups (figure 3).

Figure 3. Across income groups, the average dealing with construction permits score increases with the integration of digital solutions for quality control during construction



Source: Doing Business

Box 1. E-platform for construction permitting – the case of India

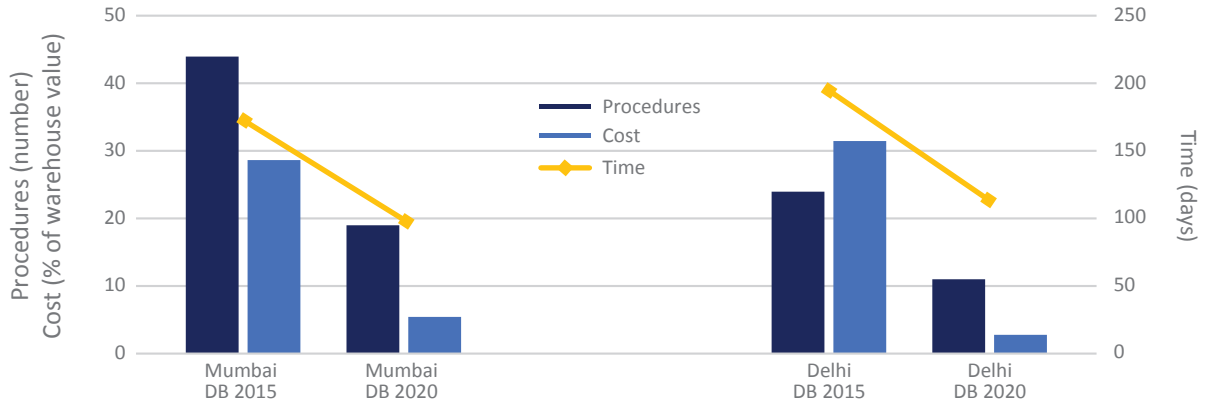
India embarked on an ambitious reform plan to improve the cumbersome and lengthy construction permitting process in Delhi and Mumbai. In the *Doing Business 2015* report, it took 44 procedures in Mumbai and 24 procedures in Delhi to obtain all construction-related permits, and the process lasted 171 and 195 days respectively. Until 2014, the legacy regulatory system in construction was complex, hindering architects with cumbersome obligations.

The first steps in the reform process were quick fixes that included minor process improvements and greater clarity about regulatory requirements for construction permitting. This was followed by a close examination of bottlenecks, which revealed clear shortcomings in the regulatory processes such as need for physical follow-ups/visits to engage with multiple departments, a lack of coordination between departments, ineffective information management, and duplicate clearances.

The municipalities in both cities introduced an online common application form for plan clearance from multiple agencies, which helped streamline the plan approval process and eliminated the need for applicants to approach numerous agencies. The platform also included an online calculator, for building professionals to calculate fees and make payments online. The platforms used AutoDCR software, which reads CAD drawings, mapping them to the development control regulations for approval by municipal corporations and approving authorities. The software is designed to bring greater efficiency and effectiveness in compliance through collaboration between approving authorities.

Changes had to be made to regulations to authorize and accommodate the use of online portals. In 2017, authorities from both cities conducted extensive engagement with stakeholders and end-users to identify challenges in the licensing, permitting, and inspections processes. Engagements took the form of workshops as well as roundtables with architects and frontline staff working in the city departments. Thanks to the architects' perspective, the consultative process identified glitches and bottlenecks that had to be remedied. Beyond plan approvals, the online system was engineered to provide for plinth level inspections as well as occupancy and completion certificates. *Doing Business 2020* acknowledged the success of the platform: obtaining all construction-related permits now takes 11 procedures and 113.5 days in Delhi, and 19 procedures and 98 days in Mumbai.

Figure 4. India (Mumbai and Delhi) reduced the number of procedures, time, and cost to build a warehouse following the introduction of an online portal



Source: Doing Business

The reliance on paper-based inspection is highest in Sub-Saharan Africa, with 85 percent of economies using this type of reports, followed by East Asia and Pacific (72 percent of economies), and Latin America and the Caribbean (59 percent of economies). Paper-based inspection reports are cumbersome, time consuming and can be very costly when modifications are required and are not communicated in time. Digitizing the quality control process – prior to, during, and after construction – reduces approval time and minimizes errors. This is largely due to enabling automatic verification of building code compliance and taking advantage of automatically generated inspection checklists. China, for example, undertook digitalization of the quality control process along with the implementation of an e-platform. These measures decreased, by 76 percent, the time to obtain the certificate of conformity after the final inspection report was submitted.

Policies to accelerate technology adoption and diffusion

Policymakers play an important role in promoting digitalization of construction by introducing relevant regulations, standards, mandates, and by approving the use of digital systems. Increasingly, local authorities are introducing or enhancing their digital platforms for services. E-permitting systems, if properly implemented, are deployed to accelerate the building permitting review and approval process, as well as to facilitate the compliance with building codes and regulations by making information available and more transparent to the private sector. Successful international good practice examples indicate that an incremental implementation approach towards policies and regulations is the best solution.

In the most sophisticated e-permitting systems such as Singapore's CORONET, Hong Kong's BRAVO, and Finland's EVOLTA, automated model checking and digital geospatial data are integrated into the platform, enabling complex assessments and simulations for the private sector and public authorities. The United Kingdom is a good example of how the implementation of a national strategy can accelerate technology adoption in the construction industry. A task force was created in May 2011 with the specific mandate to drive the adoption of integrated technology solutions across all government agencies. In 2016, the government further mandated all centrally-procured construction projects to use a similar approach.[6]

In South Korea, the Public Procurement Service made the use of 3-D modeling and integrated construction databases compulsory for all public sector projects with a value of over $50 million. Local governments, however, need to consider the enabling factors that must be in place before they embark on digitalization and eliminate analog procedures. For example, digital signatures and data security solutions must be adopted in order to replace manual and paper-based processes. Since construction plans, customer data, and personal information are proprietary and valuable assets, the construction sector has to deal with issues of data confidentiality

Table 1. Examples of national roadmaps and strategies for building sector digitalization

Country	Name of Initiative	Year Introduced
Singapore	Building Information Modeling Roadmap	2010
Hong Kong SAR, China	Roadmap for Building Information Modeling Implementation	2014
Finland	Strategy of the Infrastructure Industry Group	2015
Germany	Digital Building Platform	2015
United States	General Services Administration Building Information Modeling Guide	2015
Malaysia	Construction Industry Transformation Plan	2016
South Korea	Building Information Modeling Guide	2016
United Kingdom	Government Construction Strategy (BIM Level 2)	2016
Brazil	National Strategy for Building Information Modeling Dissemination (BIM-BR)	2017
France	Plan for the Digital Transition in the Building Industry	2017
Kazakhstan	Digital transformation of Kazakhstan's construction industry (KazSRICA)	2017
Vietnam	National Building Information Modeling Plan	2017

and liability. Therefore, the digital interface needs to meet precise data privacy and security standards before it can be fully implemented.[7] Governments should also ensure that electronic permitting systems do not duplicate work or add unnecessary complexities. Outdated and burdensome building permitting regimes should not be simply digitized but need to be reengineered before they can be moved online.

An increasing number of governments are taking serious steps to accelerate the digitalization of construction permitting and promote the use of collaborative software. As part of the Gulf Cooperation Council's vision 2030, countries such as Saudi Arabia, the United Arab Emirates, Qatar, Kuwait and Bahrain are undertaking significant reforms in the construction sector. Bahrain recently launched the "Benayat" online platform, which streamlined the permitting process by integrating zoning and regulation information, made available for free through the GIS interactive map. The process was further simplified when the requirement to obtain a road level certificate for asphalted roads was removed. Finally, to increase efficiency while maintaining high standards for quality control, the government took advantage of the well-established private sector, allowing licensed engineering firms to review construction permit applications on behalf of the public authorities. Another example comes from Saudi Arabia, where a new building code was adopted in June 2018, updating the construction regulations as well as the fire and safety requirements. In addition, a new online platform – Baladi – helped increase transparency, allowing the applicant to see the review progress on their applications, and streamline the permitting process, making it easier and faster.

Governments must also consider that for a platform to be adopted, all users of the system must receive appropriate training and have the opportunity to provide feedback to progressively improve and enhance functionality. Qatar's Ministry of Municipality and Environment, for example, only made its online building permitting system mandatory after two years of testing and piloting, in which the government reached out to the private sector through consultations and training workshops. Certain features, such as online payments, digital inspection reporting and electronic notifications, are usually first steps in the process of digitalization of the permitting process. Once these features are widely adopted, governments can begin to invest in enhancing and adding functionalities such as remote monitoring, automated compliance checking and geographical information system features, incrementally enhancing the capabilities of their platforms.

Conclusion

As the construction sector becomes increasingly data-intensive, the ability to manually handle hundreds of submissions and to coordinate among stakeholders becomes harder without appropriate data management solutions. Local governments across the world are facing a surge in building permitting applications under tight budgets and limited manpower. Keeping up with technology advancements is crucial for public agencies dealing with construction permitting, in order to optimize the use of scarce resources as well as to maintain transparency and efficiency.

In turn, construction companies depend on efficient and quality building permitting services from local governments in order to deliver their projects on time and within the allocated budget. They rely on building control authorities for guidance to navigate the complex building regulations and compliance requirements which are evolving at a fast pace.

The *Doing Business 2020* study finds strong evidence that digitalization and automation of building permitting interactions lead to significant efficiency improvements. The data collected show that even controlling for income levels as shown in Figure 3, digitalization and online collaboration lead to faster, more transparent and less costly building permitting.

The study captures an increasing number of reforms that indicate the beginning of a digital transformation trend for the industry. Over two dozen economies ranging from Brazil to Vietnam to Kazakhstan have recently introduced national strategies or roadmaps to accelerate the digitalization of construction permitting and to promote the use of collaborative software (table 1). Local governments would benefit from closely examining these experiences and extracting best practices as they undertake digital construction permitting initiatives of their own.

NOTES

This case study was written by Kamal Chakaroun, Lodovico Onofri, Enrique Orellana, Jayashree Srinivasan, and Farrukh Umarov.

1 Global Construction Perspectives and Oxford Economics, 2015.
2 All relationships presented in this study are statistically significant at the 1 percent level after controlling for log income per capita.
3 https://www.doingbusiness.org/en/reforms/overview/economy/kuwait
4 Availability of online payment feature: In Latin America and Caribbean 44 percent of economies employ this feature, followed by East Asia and Pacific at 42 percent and South Asia at 38 percent.
5 Efficient plan submission formats: In Europe and Central Asia 35 percent of economies implement efficient submission formats, followed by South Asia at 25 percent, East Asia and Pacific at 20 percent and Latin American and Caribbean at 19 percent.
6 BIM Industry Working Group, 2011.
7 For example, the British Standards Institution (BSI) has developed the "Specification for security-minded information modelling, digital built environments and smart asset management – PAS 1192-5" in order for stakeholders to guard against cybersecurity breaches and to avoid misuse, loss, unintentional disclosure or theft of information

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