Capabilities and Challenges of Mobile Computing in Construction Industry

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Abstract

Mobile computing refers to a set of technologies, devices, and services that enable the wireless transmission of data, voice, and video. Despite its advantages in the construction industry, many users lack a clear understanding of its functions and potential applications. As a result, mobile computing is often underutilized, typically limited to simple tasks. This underutilization contributes to various issues such as slow site management, limited access to data and information, and increased human error. The objective of this study is to evaluate the capabilities and challenges of mobile computing in the construction industry, with the goal of enhancing convenience and efficiency. Primary data were collected via a survey questionnaire distributed to targeted respondents in Kuala Lumpur and Selangor. Data analysis was conducted using the Relative Importance Index (RII) and a one-sample t-test. The findings indicate that improved project management is the most significant capability of mobile computing, while the high cost of technology and software presents the most critical challenge to its implementation.

Keywords

Mobile computing, capabilities, challenges.

Introduction

Since the early 1990s, the introduction and development of mobile computing have gained widespread recognition due to its ability to realize the vision of "information at your fingertips—anywhere, anytime" (Mahadev, 2010). Mobile computing encompasses technologies, devices, and services that support the wireless transmission of data, voice, and video.

According to Rebolj and Menzel (2004), mobile computing comprises three main components: mobile computers, wireless networks, and mobile applications. Mobile computers—such as laptops, smartphones, tablets, and PDAs—are designed with portability in mind, allowing users to operate both indoors and outdoors. Wireless networks, including Wireless Wide Area Network (WWAN), Wireless Local Area Network (WLAN), and Wireless Personal Area Network (WPAN), provide the necessary connectivity. Mobile applications, meanwhile, enable users from

various roles within the construction industry to perform their tasks more efficiently and conveniently.

This study focuses on the three core capabilities of mobile computing in the construction industry: portability, connectivity, and mobile applications. Portability is a key characteristic that enables users to access and transmit data from virtually any location using compact and lightweight devices (Margaret, 2010). Wireless connectivity facilitates communication and data transmission—such as audio, video, and file sharing—among team members on-site and off-site. Furthermore, network connectivity allows users to access mobile applications for purposes such as document viewing, data recording, design review, photography, and more (Jesper, 2010).

Anoop and Taylor (2015) found that limited use of mobile computing on construction sites leads to several issues, including communication delays, poor site management, and difficulty accessing project information. Workers unfamiliar with mobile devices often struggle to stay connected with their offices while working at remote locations. In emergency situations, they may face challenges in alerting project stakeholders about sudden changes or events (Sandra, 2018).

Furthermore, without mobile computing tools, project managers may experience delays in coordinating materials, labor, and equipment across multiple project sites. This inefficiency hampers project timelines. Conversely, mobile applications designed for construction management help streamline tracking and oversight, reducing the risk of delays (Sandra, 2018; Anumba & Wang, 2012).

Workers on-site also face difficulties in accessing real-time project data without mobile technology. During site visits, tasks such as monitoring progress or verifying designs become cumbersome without mobile computing tools (Andy, 2019). In contrast, mobile devices allow real-time access to updated drawings and progress tracking apps, thanks to WLAN and Wi-Fi connectivity (James, 2019).

Human error is another concern in project execution. Errors at any organizational level can lead to costly defects or failures. Mobile devices reduce this risk by supporting accurate digital recording and documentation of tasks such as meeting minutes and project updates, thus minimizing reliance on memory (Andrew, 2010).

Research Objectives

1. To determine the significant capabilities of mobile computing in the construction industry.
2. To identify the challenges in implementing mobile computing within the construction sector.

Capabilities of Mobile Computing in the Construction Industry

Time and Cost Reduction

One of the primary benefits of mobile computing in the construction industry is the reduction of both time and capital costs. Mobile computing enables paperless operations, such as recording meetings and exchanging information digitally. Chitu et al. (2002) emphasized that mobile computing not only facilitates paperless work but also offers more affordable solutions compared to full-powered desktop computers. Moreover, mobile computing enhances convenience by allowing workers to access and transfer data from multiple locations, thereby reducing the need for travel and saving time (Bowden, 2005).

Predictability and Quick Decision-Making

Mobile computing also improves predictability and enables faster decision-making. It allows users to access accurate and up-to-date information quickly via the internet. With real-time data sharing capabilities, workers and project stakeholders can exchange information anytime and anywhere, which supports timely decision-making by project leaders (Sattineni & Taylor, 2015).

Better Project Management

Through mobile applications and software, project managers can monitor tasks assigned to workers, helping to ensure that the project stays on schedule. These tools also aid in resource management by improving the accuracy of equipment tracking, facilitating instant repair requests, and ensuring precise management of materials (Pauline, 2019).

Increased Productivity

Improving productivity is a key objective in the construction industry (Abdel & Vogl, 2011). The use of mobile computing allows workers to access mobile applications for documentation, photography, project planning, and real-time information retrieval. These capabilities enhance reporting and workflow management, reduce the likelihood of errors, and ultimately increase overall productivity (Sitalakshmi & Pak, 2009).

Challenges of Applying Mobile Computing in the Construction Industry

Based on a review of secondary literature, several challenges hinder the widespread adoption of mobile computing in construction:
1. Security Issues – Concerns about data breaches and unauthorized access to sensitive information.
2. High Costs of Technology and Software – Initial investment in devices, software licenses, and infrastructure can be substantial.
3. Lack of Qualified Professionals and Need for Additional Training – Effective use of mobile computing requires skilled personnel and ongoing training.
4. Technical Issues – Problems such as poor internet connectivity, system compatibility, and software glitches may disrupt usage.

Research Methodology

Secondary data were collected from journal articles, books, industry reports, online newsletters, and official websites. Meanwhile, a quantitative approach was adopted to evaluate construction team members' perceptions regarding the capabilities and challenges of applying mobile computing in the construction industry. A structured questionnaire was distributed via email to 91 construction firms in Kuala Lumpur and Selangor. A total of 35 responses were received, resulting in a response rate of 38.46%. The collected data were analyzed using two statistical tools: the Relative Importance Index (RII) and the one-sample t-test.

Data Analysis

Objective 1: To determine the significant capabilities of Mobile Computing.

Table 1. RII and Rank Based on Overall Data

Capabilities of Mobile Computing	1 (Least Important)	2 (Not Important)	3 (Important)	4 (Most Important)	RII	Rank
Time and cost reduction	4	15	7	9	0.650	2
Predictability and quick decision-making	7	6	17	4	0.632	4
Better project management	12	3	5	14	0.654	1
Increased productivity	9	9	4	12	0.640	3

Objective 2: To identify the challenges of applying Mobile Computing in the Construction Industry.

Table 2. T-value Based on Overall Data

Challenges	T-value	Standard error of difference	Critical t-value	DF (Degree of freedom)
Cost of technologies	5.2030	0.176	2.441	34
Security issues	4.4429	0.193	2.441	34
Qualified professional and additional training	4.4429	0.193	2.441	34
Technical issues	3.1787	0.189	2.441	34

Conclusions

In conclusion, the most significant capability of mobile computing in the construction industry is improved project management, as identified by the highest RII ranking. Meanwhile, findings from the one-sample t-test reveal that the cost of technology and software is the most critical challenge in adopting mobile computing within the current construction environment. To fully harness the

benefits of mobile computing, such as increased productivity and efficiency, further promotion and integration of its capabilities in the construction workflow are essential.

Acknowledgements

References

Andrew, A. (2010). Human error in the management of building projects. *Journal of Construction Management and Economics, 16*(3), 339–349.

Anoop, S., & Taylor, S. (2015). Implementation of mobile devices on jobsites in the construction industry. *Procedia Engineering, 123*, 488–495.

Chen, Y., & Kamara, J. M. (2005). The use of mobile computing in construction information management. *Journal of Association of Researchers in Construction Management, 1*, 581–590.

Daniel, R., Magdi, A., & Nenad, C. B. (2002). Mobile computing in construction. In *Conference Proceedings – Distributing Knowledge in Building*.

Deepak, G., & Pradeep, B. S. (2012). Challenging issues and limitations of mobile computing. *COMPUSOFT: An International Journal of Advanced Computer Technology, 3*(2), 177–181.

Farag, H. G., Khalim, A. R., & Amiruddin, B. I. (2012). Application and efficacy of information technology in construction industry. *Scientific Research and Essays, 7*(38), 3223–3242.

Fellipe, S. M., Julio, A. C. C., & Fernando, A. R. S. (2018). Secondary data in research – Uses and opportunities. *Revista Ibero-Americana de Estratégia, 17*(4), 1–4.

Hema, K. (2017). Applications and benefits of mobile computing. *International Journal of Scientific & Engineering Research, 8*(5), 2229–5518.

Irrma, D. M., Aripin, A., Emma, M., & Zulhabri, I. (2019). Factors influencing the implementation of technologies behind Industry 4.0 in the Malaysian construction industry. *MATEC Web of Conferences, 266*, 01006.

Larry, G. W. (2016). Mobile computing device threats, vulnerabilities and risk are ubiquitous. *ISACA Journal, 4*, 1–5.

Naveen, K., & Soniya, V. (2017). Security issues and solutions in mobile computing. *International Journal of Scientific & Engineering Research, 8*(5), 2229–5518.

Rahul, B. M., & Amol, B. B. (2013). Challenges of mobile computing: An overview. *International Journal of Advanced Research in Computer and Communication Engineering, 2*(8), 3109–3114.

Salman, A. (2015). Impact of mobile tools and technologies on jobsite operations. In *Proceedings of the 51st ASC Annual International Conference*.

Yuan, C., & Kamara, J. M. (2008). Using mobile computing for construction site information management. *Engineering, Construction and Architectural Management, 15*(1), 7–20.

Yuan, C., & Kamara, J. M. (2011). A framework for using mobile computing for information management on construction sites. *Automation in Construction, 20*, 776–788.