

## Mobile Application for Sustainable Construction Management

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**Abstract**—The construction industry is an information-based industry the progression of which requires the most effective and efficient tools in management, more specifically in managing the information flow between project team members. These tools become essential to a project management team dealing with the complexity and changing needs in the construction industries. Advances in information and communication technologies (ICT), especially mobile phones, offer an alternative way to overcome the limitations on effective collaboration in construction projects. A review of previous research, case studies and technology reports shows how mobile information technology has the potential to provide improvements in construction communication and information collaboration. This review paper specifically discusses the implications of mobile information systems in sustainable project management. The findings show that there is a high potential for improving sustainability construction projects, the effects on construction resources and the potential impact of improving sustainable project management in construction industries.

**Keywords**—Project management, information system, sustainable project management, mobile information system, Construction management.

### I. INTRODUCTION

In recent years, construction projects have grown larger and played a key role in the development of a country. As projects have become larger, technical complexity has become greater, client demands have increased, government regulations have grown considerably and the public desire for an improved lifestyle quality has increased. Such large and complicated projects require a project management team with strong and intelligent strategies. The most significant aspect in a construction project is the interrelations among the involved parties and communication methods that can improve those relations [1]. Poor communication means that the potential for disaster in managing and developing the projects is significantly increased.

The growth of mobile communications and social networks in recent years has transformed the way in which people and organisations communicate and interact. It has revolutionised the ways in which information is exchanged and viewed in the construction industry [2]. The construction industry has greatly benefited from the advances in mobile communication technologies, which include wireless technologies [3], mobile computing and mobile devices. These technologies have also increased the speed of information

flow and collaboration [4], enhanced the efficiency and effectiveness of information communication [5] and reduced the cost of information transfer.

Researchers [6] have shown that Information Communication Technology (ICT) and mobile computing can enhance project information management in the construction industry and offer a pathway to improved performance and strategic competitiveness. The research efforts of Abdullah and Thai [7] on the use of mobile applications in Malaysian construction have suggested that such applications will standardize the ways of managing defects, improve quality, increase the productivity of inspectors and help to produce accurate photographic records.

This paper is organised in four main sections. Section one introduces the paper. Section two is an introduction to project management and sustainability. Section three discusses mobile information systems and their role in project management. The final section sets out the efficiencies that a mobile project management information system can bring to sustainable project management.

### II. PROJECT MANAGEMENT AND SUSTAINABILITY

Project management is the application of knowledge, skills, tools and techniques to project activities to meet the project requirements [8]. In construction management, the attempts to fulfil the planned objectives within the specific requirements and constraints become the main priority. Through optimum use of resources and appropriate planning and control systems, sustainable construction management is achievable. Therefore, project management is an important and essential part of the process of construction development. This growth in the acceptance of project management concepts has rapidly increased over time as resources have become limited. The application of project management concepts is an essential tool for planning, organizing, managing and controlling work, which leads to better performance and increased productivity [9].

In Malaysia, the rapid growth of construction industries demands efficient tools and techniques in managing and controlling the projects in order to achieve specific goals. Today's companies, governments and non-profit organizations are recognizing that to be successful, they need to be conversant with the use of modern and efficient project management techniques. We would

strongly suggest that to remain competitive, they need to have a highly skilled project management team with good technology know-how.

Current issues requiring serious consideration in the construction industry are not only the efficiency and effectiveness of project management, but those surrounding environmental sustainability. In today's environmentally conscious world, project management teams with a full understanding of sustainability and its critical role in planning and developing a project are required. Problems often occur regarding physical resources when project members do not fully understand the application of sustainable practices in the process of manufacturing and construction [10].

Sustainable development is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [11]. Since then, the influence of the concept has increased rapidly and it features more and more often as a core element in the policy documents of government and international agencies [11]. Pressure is increasing in the construction industry in order to incorporate sustainability as a major objective into the decision-making process. Hence, managing a project becomes more complex. The critical factors in designing, planning and developing a project need to be more focused on sustaining and protecting natural and human resources. Therefore, the opportunity given by the rapid development in advanced technology should be taken as an advantage. Mobile information systems and cloud computing offer solutions to the delivery of fast and real-time information and services in project management. They will increase the effectiveness of collaboration and the reliability of the information whilst reducing information delays.

### III. MOBILE INFORMATION SYSTEMS IN CONSTRUCTION PROJECT MANAGEMENT

The definitions of ‘mobility’ differ over time and people. According to Hjelm, “laptops are not mobile”, where to him the criteria of true mobility are the capability of the computer to be used fluently without disrupting the current activity of his user [12]. Terms ‘mobile information technology’ or ‘mobile work’ more likely refer to a portable office in which normal working equipment is used somewhere else rather than in a conventional office environment [13].

Mobility has been known as a new computational revolution where new and advanced technology does not bind working to a specific time or place but allows work to be undertaken in reasonable situations and at times that offer the greatest advantages in seeking increasing profits. For example, meeting clients and attending exhibitions or conferences can be managed on the way to work or from a remote location. Thus, changes in working habits are closely related to the changes of working environment [14].

In project management, mobility supports the project team members and helps in building their professional, and social, communications. This gives a direct access to their task, typically involving retrieving information, contacting colleagues, participating in meetings and managing documents. The adoption of mobile phones with computing technology made new ways of working possible in many project management teams. Table 1 shows the selected web-based project management software and applications that support mobility. These software applications are an extra tool and technology that makes managing a project become easier and much more effective, especially in managing the project resources and collaboration within the project team.

Table 1: The Web-based Mobile Applications for Construction Management. (adopted from PMcampus Blog, PMI 2011).

Mobile software/ Apps	Features						
	Track Goals	Collaboration	Plan	Finance	Equipment	Schedule	Document sharing
Desk Away	x	x	x	x	x	x	x
Microsoft office 365 for Project management	x	x	x	x	x	x	x
Outpost		x	x		x	x	
Nozbe	x	x	x			x	x
Cisco WebEx Meeting Center		x	x	x		x	x
Box.net	x	x	x		x	x	
Project schedule	x	x	x	x		x	x
Documents to Go		x	x	x	x	x	x
Project manager for Blackberry	x	x	x	x		x	

Web based application       Mobile application

### IV. MOBILE INFORMATION SYSTEMS FOR SUSTAINABLE CONSTRUCTION MANAGEMENT

Most organizations are aware of sustainability and realise that it should be a part of their strategy. The integration of sustainability should be implemented in the concepts and methodologies that the organization is using. Practical tools are needed to align business methodologies with the principles of sustainable development, which systematically include sustainability within the evaluation process [15]. Sustainability has become increasingly important for many organizations so models and tools that integrate sustainability in project management need to be developed. The Sustainable Project Management

Star developed by [16] shows the relationship between sustainability and project management.

According to [17], to successfully integrate sustainability into the project management process, all the five factors (Social, Economic, Environmental, Time and Quality) need to be balanced. The economic factor also covers the aspect of cost since there is a great similarity in these two factors. Based on the 'triple bottom line' (TBL) concepts developed by Elkington in 1997 [17], the success and health of an organisation can be measured not only by the economic figures but also by the influence of social and environmental factors.

The main advantages of using this system, besides the efficient and fluent flow of information throughout the entire developing process, include the contribution to the healthy environment. In the conventional management process, the project manager has to be in a specific place to obtain the latest information or to attend a meeting with a client, contractor or other colleagues. This requires some form of transportation which contributes to increasing air pollution caused by the vehicle exhaust gases. This system certainly affects the project managers' and organisations' ability to comply with the concept of sustainability.

There is strong evidence from the extensive research conducted worldwide that air pollution has an adverse effect on health. The effects range from mild respiratory irritation to lung cancer and cardiovascular disease. In developing nations, where air quality is frequently poor, the link between air pollution and health is often obvious [18]. The data from the World Bank in [19] shows that the CO<sub>2</sub> emissions are increasing in Malaysia. Therefore, taking positive action to reduce the use of transportation and therefore to reduce carbon dioxide emissions is critical.

## V. CONCLUSION

Mobile information systems are able to help control our environment resources. Mobile information systems provide services and document-storage systems that enable all the team members to locate and retrieve details and documents about the project using their mobile technologies without having to open and search for a bundle of paper in a messy filing system in the conventional way.

The idea of adopting mobile information systems in the management strategy should begin in the early stage of the process such as when the concepts of the project are decided. Therefore, throughout the development process, this system will become an essential tool that makes managing a project much more efficient. Case studies will be conducted in future to calculate the carbon offset from a project team when managing a construction project.

## ACKNOWLEDGMENT

This work was financially supported by UTM Razak School of Engineering and Advanced Technology,

Universiti Teknologi Malaysia, under research grant 4B012.

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