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THE USE OF ICT PLATFORMS TO PROMOTE KNOWLEDGE EXCHANGE IN PROJECT-BASED ORGANISATIONS

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ABSTRACT

This study aims to investigate the use of information and communication technology (ICT) to support knowledge exchange in project-based organisations. The primary ICT tool investigated in this research is WhatsApp, a messaging application that has been widely used since its introduction. An ethnographic case study method was utilised to analyse qualitative data collected from interviews and focus group discussions. Three projects in an Indonesian university with a duration ranging from 8 months to 2 years were examined as object of investigations. Broadly, the findings show that ICT tools are generally useful in supporting knowledge exchange, which ultimately positively affects project performance. The project teams relied on WhatsApp for the success of the projects. Although face-to-face meetings were rare, team communication was highly intensive, supported by WhatsApp. In addition, managers are encouraged to promote knowledge exchange between team members. Through knowledge exchange, there will be knowledge development, which facilitates the invention of new techniques and methods for promoting project success. The most prominent findings are presented using direct quotations to provide first hand insight from the field. At the end of the paper, recommendations regarding what project managers should do during and after the project has been completed are presented. The recommendations are classified based on the knowledge management life cycle, representing a structured method to manage knowledge in project-based organisations.

KEY WORDS

knowledge exchange, project management, knowledge management, information technology, project-based organisation

JEL CLASSIFICATION

M11, M15

1. INTRODUCTION

Projects create temporary systems in which knowledge creations occur (Boh, 2007). The created knowledge is stored as 'lessons learned' within a project management office, so that it can be

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retrieved at any time if required (Project Management Institute, 2013). Projects are interrelated works that are intertwined and interrelated; these are difficult to operate successfully if the project team is not well organised (Crawford, 2002). Members of the project team interact, create and share knowledge, which is valuable to stakeholders in organisations.

When the field of project management was in its early stages, knowledge management was not a popular topic in the field. In that era, project management typically dealt with the 'hard' side of assignments, related to physical activities. However, in recent years, with the increase in project complexity, the soft side of project management has gained popularity, specifically management of skills, teams, information and knowledge (Ziek & Anderson, 2009).

Project-based organisation is utilised by organizations to meet challenge of dynamic business environment (Boh, 2007). In project-based organisations, which are typically matrix types, each project is assigned to a team. As a subset of an organisation, the team binds together people with different skill sets, knowledge and expertise in an attempt to achieve a shared goal (Hoegl *et al.*, 2004). Due to differences in background, team members should have cross-cultural understanding, and thus be able to communicate effectively. Interacting with people with diverse backgrounds is a critical skill if one is to succeed in this field (Ziek & Anderson, 2009).

Communication is the foundation of knowledge-sharing; without communication, knowledge exchange will never occur. Communication using ICT platforms requires different skills to conventional face-to-face meetings. There is a common belief that use of ICT leads to more efficient communication between people. However, empirical evidence suggests that use of ICT does not always lead to the effective knowledge exchange. A typical problem encountered by project teams is difficulty in developing a common understanding among members. Common understanding is important, as the foundation of collective efforts (Bartsch *et al.*, 2013) and communication skills bridge the knowledge gap as well as create common understanding.

Other factors affecting knowledge exchange include culture and trust. An open culture increases the willingness of people to share and exchange knowledge. People who are highly concerned with privacy tend to be less willing to share knowledge. Meanwhile, trust is also strongly related with risk; individuals who want to exchange their knowledge should consider what return they will receive, and what risk is associated with the exchange (Pemsel & Wiewiora, 2013).

Maintaining a database of knowledge can support knowledge exchange between members of a project-based organisation. Nevertheless, organisations experience difficulties regarding how to develop a database within which to accumulate knowledge gleaned from past projects. Such knowledge is unique, valid in certain circumstances only and could easily become obsolete; consequently, managing knowledge using databases and documents that can be easily accessed is not an easy task. Almeida and Soares (2014) suggest that organisations develop a mechanism to make knowledge exchange easier, such as promoting the use of ICT tools or providing direct channels of communication.

During project execution, a type of social system is formed between the project team members. Knowledge that is created through this social system will be dispersed when the project has completed; therefore a large amount tacit knowledge created during the project will no longer be relevant. The knowledge is typically embedded within individual team members, not within the project team. Therefore, if an organisation intends to reassemble the tacit knowledge created during project execution, the manager should reunite the individuals who formed the social system of previous projects.

There is very little empirical evidence regarding how to use ICT to support effective knowledge creation, transfer and sharing (Kruger & Johnson, 2010). Although the empirical evidence is limited, there is consistent empirical evidence supporting the relationship between improved project team performance and knowledge exchange (Table 1). However, the use of specific tools – i.e. the messaging application WhatsApp – to support knowledge exchange in a project team environment has never been investigated.

Table 1 Previous studies on knowledge exchange and project performance

No.	Topics	Author
1.	The significance of information management to support projects	Johannessen and Olsen (2011)
2.	Information and communication technologies in project teams	Shachaf (2008)
3.	Knowledge transfer across projects, within organisations	Back and Moreau (2011)
4.	Knowledge-sharing in project-based organisations to overcome informational limbo	Almeida and Soares (2014)
5.	Knowledge management with the support of information technology in uncertain environments	Mehta <i>et al.</i> (2014)
6.	Knowledge management practices in project management with the support of information technology	Yang <i>et al.</i> (2012)
7.	The benefit of using a project information system to support decision-making in a multi-project environment	Caniëls and Bakens (2012)
8.	Creating and sharing of tacit knowledge in a project environment	Koskinen <i>et al.</i> (2003)

The use of WhatsApp has proliferated in many different fields, such as education (Alabdulkareem, 2015; van Rooyen, 2015), research (Stefanidis *et al.*, 2015), surgery (Petruzzi & De Benedittis, 2015; Jonhston *et al.*, 2015) and other medical-related fields (Drake *et al.*, 2015; Watson *et al.*, 2015). Although many studies have investigated the use of WhatsApp in a number of fields, its use in the area project management is under-researched, specifically there is a lack of empirical evidence regarding the use of WhatsApp for knowledge exchange in a project management environment. Thus, an investigation of the use of WhatsApp in project management will contribute knowledge in this field. In recognition of this research gap, it is timely and relevant to investigate the use of WhatsApp in supporting knowledge exchange in project-based organisations. This combination represents the novel contribution of this paper, in that it is the first time the use of WhatsApp to support knowledge exchange in a project management context has been examined.

From the discussion above, it is clear that the relationship between knowledge exchange, project management and instant messaging applications needs to be better understood. To address this identified research gap, this study will attempt to conduct a deep and comprehensive analysis of how knowledge exchange supported by messaging applications can promote the success of projects and at the same time fulfill the needs of the project team. The objectives of this study can be broken into the following points:

1. What are the benefits and challenges of using WhatsApp in project management?
2. How do managers could utilise WhatsApp to support knowledge exchange in project project based-organisation?

2. THEORETICAL BACKGROUND

2.1. The use of WhatsApp as an ICT platform

Among a number of existing instant messenger services, WhatsApp is the most popular (Winkler, 2013). Since its introduction in 2009, WhatsApp has quickly gained in popularity. As of 2009, more than two thirds of populations possess mobile phones. This represents a very large market for producers of application software. In 2014, the number of WhatsApp users has reached over 500 million worldwide, who share 700 million pictures and 1,000 million videos daily (Acton & Koum, 2014).

For professional purposes, the use of WhatsApp to support teamwork has largely been devoted to medical teams and learning. Johnston *et al.* (2015) demonstrate how WhatsApp can support communication between members of surgical teams. Also in the surgical field, Stefandis *et al.* (2015) examine its use from a different angle, investigating how the technology could support research collaboration in the surgical field involving a number of institutions. Giardano *et al.* (2015) report that the application can support paramedics in analysing surgical cases and come to agreement without the need to meet face to face.

Like medicine, in the field of education a number of studies have been carried out regarding the use of WhatsApp. Ahad and Lim (2014) report that the application is viewed as convenient by the younger generation. For this reason, its use for supporting learning purposes is strongly recommended. The researchers suggest using the application as 'all-in-one' mobile communication tool for sharing information pertaining to study materials.

Van Rooyen (2015) demonstrates how mobile phones equipped with a messaging application can enhance the quality of teaching and learning in distance-based education. The application can bridge the gap of interconnectedness between lecturers and students in developing countries. Developing countries, which typically lack of internet access, benefit greatly from using mobile phones. Alabdulkareem (2015) reveals that messaging applications enhance the educational experience in Saudi Arabia, and students and instructors confirm this. Further, the researcher suggests training to make better use of the technology, so as to improve the quality of education. In addition, many users enjoy using the messaging application, which contributes to its popularity; however, one of the negative consequences of this is that many users become 'addicted' to it (Sultan, 2014).

Yang *et al.* (2012) classifies ICT applications into two groups: basic and advanced. Using this classification, WhatsApp can be categorised as an advanced ICT application, as it supports collaborations, allows video conferences, and is accessed via a smart phone, the function of which is similar to that of a personal digital assistant. According to Yang *et al.*, these are all the characteristics of advanced ICT tools. It is these characteristics that enable WhatsApp to support knowledge exchange in project management in a variety of ways.

2.2. ICT platforms and knowledge exchange

Knowledge management is based on the premise that the most valuable resource is the knowledge embedded in employees. Due to its importance, many scholars have investigated the benefit of knowledge management (Yang *et al.*, 2012; Shachaf, 2008; Almeida & Soares, 2014). Nevertheless, in practice, it is difficult to find managers who use a formal and structured method of knowledge management. One explanation for this phenomenon is the intangible nature of knowledge management. Thus, in order to enable the exchange of this valuable resource in an efficient way, project managers should promote ICT facilitated communication.

Mickan and Rodger (2000) point out that members of the project team need to give and receive information regularly to ensure that everyone remains up to date with the latest information. As a messaging application, WhatsApp has been extensively used to support communication in daily life. Therefore, it will most likely support communication in a project management environment too. The instant delivery facilitated by messaging application technology enables a reduction of the time lag between sending and receiving a message.

Other digital communication tools offer facilities for communication but they have drawbacks. For example, e-mail is a widely used communication tools; however, it has some disadvantages. It is not a synchronous media, so people will not necessarily notice quickly when a new message is received. Consequently, the recipient may not respond as soon as expected (Juarez-Ramirez *et al.*, 2013). From the perspective of project management, which requires speedy information flows, e-mail is less responsive compared to chatting applications.

Begel *et al.* (2010) present an analysis of how the technology changes the way that individuals communicate and collaborate. As the technology affects the way they collaborate, it ultimately affects team performance. Similarly, Chiocchio (2007) finds that electronic messages enhance coordination between team members, emphasising the importance of social media in supporting teamwork and collaboration.

When knowledge is created, it is embedded in the individual creator as well as the organisation in which they work; it can be 'stored' in a document that can be retrieved by other people. Learning takes place during the knowledge creation, but the retrieval of knowledge only provides the instant results of the stored knowledge. As such, the individuals who retrieve the knowledge will most likely have a lower level of understanding in comparison with the creator. Nevertheless, the individuals who retrieve it could have a better understanding if they combine the new knowledge with their existing knowledge. Thus, a knowledge synthetic process could occur from combination of the retrieved knowledge from the database and the existing knowledge possessed by the users.

Knowledge exchange between individuals in a project team could create social knowledge. Social knowledge is different from individual knowledge (Nahapiet & Ghoshal, 1998); the former represents the shared knowledge of the team members, whereas the latter is possessed only by certain individuals (Chang & Chuang, 2011). In a project environment, the benefit of social knowledge is much greater; thus, managers should develop a bridge in their project team so that individual knowledge becomes social knowledge.

The challenge in knowledge exchange lies in how to acquire knowledge and match it against the need to promote efficient information use (Karim & Hussein, 2008). Detlor (2010) outlines more comprehensively the importance of knowledge management in ensuring that the required information is complete, of sufficient quality, and is available in the right format.

ICT platforms are proliferating across project-based organisations, and support project executions in order to help them run efficiently and effectively, and the advancement of technology means that they are affordable for most people. This progress is positive, as it means a large amount of knowledge is being created and shared; however, it also creates challenges, since a significant amount of messy and chaotic knowledge is also spread within project-based organisations (Detlor, 2010).

In line with the increase in ICT facilitated communication, there has been a growing trend of project failure (Lynn & Reilly, 2000). One of the reasons for this could be that, despite the advantages of technology in supporting knowledge exchange, this is a less important factor than the users

themselves. It is the behaviour of users that determines how knowledge is organised, managed, distributed and shared (Barreau, 2008), and which ultimately affect the performance of the project.

2.3. Knowledge exchange and project performance

A project is an endeavour comprising of professionals undertaking temporary work with the purpose of creating unique products, services or results (Project Management Institute, 2013). A project involves a process of satisfying the needs of stakeholders through complex problem-solving processes. It consists of a set of collective activities pursuant to the development of common understandings. To achieve success in a project, knowledge must be created and should then be disseminated widely. The dissemination is intended to maintain the common interpretation of how to undertake the tasks and what the output of the tasks are (Jackson & Klobas, 2008). Projects have the following characteristics: high interdependence of different knowledge and skill sets, complexity and unpredictability of problems, as well as constraints in terms of budget, time and output specifications (Project Management Institute, 2013). Due to the above features, project-based organisations require a different approach to traditional organisation, particularly in regard to knowledge management.

Prencipe and Tell (2001) discuss how knowledge created in a project can be transferred across and within an organisation. The learning process for creating knowledge occurs at different levels within a project-based organisation. Here, it is important to stress that the created knowledge should be accumulated as well so that it can be accessed by subsequent projects, and therefore, knowledge exchange can occur, in order to avoid repeating past mistakes and wasting resources (Pemsel & Wiewiora, 2013). However, it appears that utilising accumulated knowledge from past projects is not an easy task, due to the uniqueness and finite nature of project tasks (Bartsch *et al.*, 2013).

Many scholars distinguish between knowledge and information, although the two concepts are interrelated. Knowledge is much broader than information, as the former also covers a logical understanding of the context that can help an organisation to complete an assignment or solve a problem (Gunnlaugsdottir, 2003). On the other hand, information is less meaningful than knowledge, and must be assigned meaning. Information is only data that is interpreted within a particular context. However, for the purpose of this paper, as recommended by Almeida and Soares (2014), knowledge and information are considered to be synonymous.

There is no doubt that ICT platforms support effective knowledge management (Rooke *et al.*, 2010), which in turn, leads to improved project performance. Many studies have shown that knowledge management is a critical success factor in project performance, including those by Adenfelt (2010), Liu *et al.* (2004), and Carrillo *et al.* (2006). Although the importance of knowledge management to project performance is generally strongly supported, some studies have yielded slightly different results. For instance, Yang *et al.* (2012) reveals that knowledge management does not directly affect performance; instead, it mediates the relationship between information technology and project performance in terms of cost, scheduling, quality and safety.

There are at least three scholars who outline knowledge management life cycles. Choo (1991) proposed six processes of managing information: (1) identification, (2) acquisition, (3) organisation and storage, (4) design, (5) distribution, and (6) use. Wilson (2005) categorises the cycle from creating to using knowledge into the following phases: (1) acquisition, (2) organisation, (3) storing, (4) retrieval, (5) access/lending, and (5) dissemination. Detlor (2010) also proposes six processes of managing knowledge: (1) creation, (2) acquisition, (3) organisation, (4) storage, (5) distribution, and (6) use. There is some difference between the cycles proposed by the three authors above; nevertheless, there is strong agreement that the main challenge is how to acquire the necessary knowledge, and how to use it to the benefit of the organisation.

3. METHODS

3.1. Case study

This research used a case study method, as suggested by Yin (2009) and Eisenhardt (1989). The researcher was immersed himself in the cases using the ethnographic approach. To analyse the data accumulated via WhatsApp, the content analysis method was used. Content analysis is a data analysis method in which researchers attempt to identify specific words or phrases that are relevant to the subject under investigation. Content analysis is well suited to research with a deductive element, where the researchers propose a list of specific words at the outset (Easterby-Smith *et al.*, 2012).

3.2. The Projects

A number of projects were running at the university where this study was undertaken, in which the researcher works. The university can be considered a project-based organisation, as there are many activities taking place that are assigned to specific teams for certain purposes, with a specific allocated time period and well-defined scope (Project Management Institute, 2013). For the purpose of this study, three projects were selected as objects of the investigation. The cases were selected as they were considered to be the most active project teams, and require intensive knowledge exchange between team members. The investigator was involved in all of the project teams, in one as the project leader for an international event organised by the university, and in the two other projects as a team member. As many as 86 people were involved in the three projects investigated in this study. The durations of the projects ranged from 8 months to 2 years, depending on the scope of the projects.

Table 2 Description of the projects in this study

No.	Description of the project team	Project A: international conference	Project B: Accreditation of master program team	Project C: Accreditation of an academic journal
1.	Number of project team member	26	16	14
2.	Duration of working period	24 months	18 months	8 months

As can be seen on Table 2 above, Project A had the longest working period. It also required more intensive communication between team members as the team interacted with participants of conference consisting of roughly 500 participants. In addition to this, each division of the project team set up different WhatsApp groups to discuss specific issues they were experiencing. There were as many as four WhatsApp were set up by different project teams to discuss specific issues they had.

The fact above is different from two other project teams – i.e. Project B and C – that require one WhatsApp group only. This can be understood because the two projects were mostly dealt with documents preparation. The two teams had limited interaction with customers over the course of the projects. The customers of the projects were government accreditation board, which would meet the project team at the end of the project period. However, the project team should be well prepared a large amount documents and materials in advance before they had meetings the accreditation board members.

The patterns of communication between the three project team are different as well. The first project team, Project A, require extremely intensive communication a few days just before the conference was held. The communications were between project team members with participants of the conference as the customers. At this period, knowledge exchanges were not as intensive as at the beginning of project team formations. During the initiation stage of the project until a few days before the conference, the communications were mainly between the project team members. This was the period where the knowledge exchange occurred. On the other hand, a few days just before the conference, the purpose of the communication was serving the participants of the conference, not for sharing and exchanging knowledge. Meanwhile, the workloads of other two project team's – i.e. Project B and C – were relatively stable over the course of the project period.

In terms of the project team composition, the teams were dominated by managerial level individuals, such as heads of departments, vice heads of departments, and the dean and vice dean of the faculty. Because of their roles, it was extremely difficult to have face-to-face meetings around the same table, due to their extremely high workloads. For these reasons, there is a significant need for more structured project planning processes and communication. To ensure that communication is effective, the project teams which are investigated in this study agreed the following rules:

- Each team would set-up at least one WhatsApp group to enable knowledge exchange between the project team members.
- There should be clear direction regarding who would be responsible for what.
- All members should regularly post information on WhatsApp to update the rest of the team regarding what they have done, or if there had been any deviation from the planned activities.
- For one of the projects, every morning the project leaders would post a message on WhatsApp summarising what had been achieved so far. This summary would contain a list of activities classified as urgent and needed to be completed that day, and an agenda for the coming days.

The communications continue to run regardless of day and time, although not during working days. This indicates that the team continues to work during the day and night time.

4. ANALYSIS AND RESULTS: BENEFITS AND CHALLENGES OF USING ICT

As mentioned in Section 3.1 Case Study, the researcher utilised content analysis to analyse messages posted in the four groups. To this end, the WhatsApp messages were downloaded and imported into Microsoft Word. Then, NVivo software was used to analyse the data.

According to the analysis, there is absolute agreement among the project team members that WhatsApp is an affordable and easy technology to used, and represents a 'perfect' and complete package to support communication in project management. Nevertheless, using WhatsApp as a primary tool of communication is not without challenges. For example, one of the project team members commented: *"It is time consuming to write message on WhatsApp, particularly those that require long explanations. If we meet face to face, I can explain in seconds, but when using WhatsApp, it is not that easy"*.

Another team member described the challenges with using the application as follows: *"There is a lot of important knowledge that I am supposed to know. Team members do not understand what others need; they should report something that seems important to others, but from their point of view it is not important (so they do not post it on WhatsApp). This causes miscommunication between us."* However, opinions concerning the use of the tool are split, as another project member expressed a more positive view: *"We are all busy people who do not have sufficient time to talk*

about technical and operational things. Just say it in a few words on WhatsApp, and other people will understand what you mean”.

There is common agreement between the team members that knowledge exchange can occur in various situations: in a formal meeting, conversations during lunch, or other informal occasions. However, these methods of knowledge exchange require people to meet face by face, and consequently are relatively rare. Relying on direct meetings between people can hinder the progress of projects, as some decisions need to be made quickly. WhatsApp can help to solve this problem; as one team member described, *“I do not need to make appointments, schedule meetings, or pick up the phone. I can just send message on WhatsApp and I'll get a response. I do not mind waiting, as I don't want to put pressure on others”.*

Using WhatsApp as a communication platform requires all project team members to actively participate in virtual team meetings. This ensures that information asymmetry can be avoided - minor missing information can prove catastrophic for the team. For example, in the course of the study there was an instance of miscommunication, when one of the team members did not attend the meeting, and then did something different from what had been agreed during the meeting, thinking that better results could be achieved, causing a minor disagreement.

Another important point to consider when using WhatsApp is project review and evaluation. Relying on WhatsApp as the primary communication platform makes reviewing process more difficult; the only way to do this is through reporting, but the opportunity for further discussion via WhatsApp is limited. Reporting projects typically require details clarification that is difficult to do via WhatsApp. Face-to-face group meetings are strongly recommended in this case.

Interviews with subjects revealed that the responsiveness of WhatsApp is considered by some to be a ‘double-edged sword’. WhatsApp does not guarantee instant replies, unlike a phone call; accordingly, it is less suitable for those requiring a quick reply. Despite being less responsive in this regard, it is beneficial for those who require some time to think before responding to enquiries. Other members could also share their opinions, which could improve the quality of other responses. The benefit escalates when the response is shared in the group and is useful for all project team members.

Culture is often an issues in project work (Liu *et al.*, 2015), particularly in relation to the power distance between the manager and lower level employees. In Indonesia, where power distance is high (Hofstede *et al.*, 1990), lower level staff experience difficulties communicating with higher level management. These problems escalate when the staff attempt to express negative viewpoints, such as disagreement, criticism or complaint. One member of project team described: *“Using WhatsApp, I find it easier to provide knowledge that my manager might be unaware but I have expertise in. The situation is different when I meet him face to face” (Interviewee 1).* They continued, *“I think he likes it this way too. At least, he does not feel embarrassed in front of me”.*

Knowledge exchange supported by WhatsApp is not always easy, but it is still useful. Knowledge of technical skills is not difficult to transfer, but the *transfer process* is complicated if one is relying on WhatsApp alone. In traditional knowledge exchange, the transferee and the receiver meet face by face, but scheduling a meeting for both parties is difficult. WhatsApp facilitates this by enables users to suggest or link to guidelines; one team member commented, *“Explaining how to do technical things, such as using MS Project, is not efficient over WhatsApp. I prefer to provide my peers with a link to a YouTube video, website or other resource that they can refer to”.* Copying and pasting a resource link via WhatsApp is practical for the recipient of the knowledge, as they can simply click on the website address to be redirected to the resource.

Retrieving knowledge from past projects is also not easy. Tacit knowledge is often embedded in people who were involved in past projects, with no supporting documentation. In the organisation within which the project was undertaken, documenting past knowledge is extremely rare, and is typically dispersed across different people who have been involved in the project. Quite often, new projects use entirely new people, who have never been involved in similar or relevant projects. For example, in one of the projects under investigation, there was a lack of knowledge regarding how to organise the opening ceremony for an international conference. None of the team members possessed any knowledge on this matter. The solution to this issue was to invite a guest who had the relevant knowledge to the project team WhatsApp group; the invited person shared their knowledge and answered questions. Their participation in the group was temporary, as they were not a project team member. In this way, WhatsApp is able to support team members in extending their knowledge networks beyond just the project team.

Culture plays a significant role in successful project management (Liu *et al.*, 2015). It is important to emphasise here that the use of WhatsApp in a project team is strongly supported in a culture that appreciates collectivism (Hofstede *et al.*, 1990). On some occasions, the messages from people supporting the team were simply copied and pasted into the WhatsApp group. The author of the original message did not complain, although the person who forwarded the message did not acknowledge the original author, and acted as if they had written the message themselves. In addition, there are minimal privacy issues; something considered private in other, particularly Western cultures, is considered suitable for sharing with the public in Indonesian culture.

Table 3 Recommendations during knowledge management life cycle

Phases of knowledge management	Strategies during project execution	Recommendation after project execution
Creation	<ul style="list-style-type: none"> • Intensify the use of WhatsApp to maximise knowledge exchange • Identify what type of knowledge is needed and how to acquire that knowledge • Create a contact list in anticipation of knowledge that might be needed • Broaden the network beyond the group members to acquire the knowledge necessary for the project 	<ul style="list-style-type: none"> • Categorise and embed the created knowledge into a database • Create a profile for people who have been involved in the project, along with their expertise • Document lessons learned, parties involved in the projects and who has expertise in what area • Archival of communication logbook that can be assessed by other project teams. The archive should be integrated with a centralised database so that it can be assessed by other members of the organisation.
Acquisition	<ul style="list-style-type: none"> • Maximise the use of the ICT platform, as it enables members of the project team to share and exchange knowledge in an efficient and easy way • Identify potential knowledge needed for the project 	<ul style="list-style-type: none"> • Identification and documentation of lessons learned from the project
Organisation	<ul style="list-style-type: none"> • Identify existing databases that are relevant to the project 	<ul style="list-style-type: none"> • Categorise the knowledge in a way that is easy to access by members

	<ul style="list-style-type: none"> • Update existing databases with the newly created knowledge • Develop a database of expertise – i.e. database regarding who has done what 	of the organisation.
Distribution	<ul style="list-style-type: none"> • Disseminate the knowledge to ensure the completion of projects 	<ul style="list-style-type: none"> • Share information regarding the databases that are created for the projects • Create contact information for the team members and list the specific skills that they have

This study corroborates the findings of previous studies that conclude that communication supported with ICT tools can potentially create ‘social loafing’ (Aggarwal & O’Brien, 2008), where members of the team rely on help from others and put less effort into their roles. This is facilitated by the ability to ask questions and obtain instant answers using WhatsApp, which might be an efficient strategy for the requester, but for the overall group it is less efficient. The members who share knowledge could have used the time spent responding to do something more productive for the project.

In agreement with previous studies, this study shows that the use of ICT tools generally has a positive impact on knowledge exchange. Nevertheless, it seems that no previous study has attempted to address the interplay between ICT tools, knowledge exchange and project performance. The present research has successfully addressed this gap in the literature.

Knowledge is typically embedded in different people and places, meaning it is not readily available for use. This knowledge is of value to higher education institutions; however, due to the dispersed location of the knowledge, members of a project team should make efforts to obtain that knowledge, which is not always an easy task (Nonaka, 1991).

Based on the analysis above, the strategies that can be adopted by project managers within project-based organisations are summarised and presented in Table 3. The strategies presented in the table are organised according to the knowledge management life cycle proposed by Detlor (2010), with some modification. The table also provides the answers to research question two, set out at the beginning of this paper.

5. DISCUSSION

The adoption and use of WhatsApp has successfully promoted communication between members of the project teams. It is an efficient and economical tool that is superior to other existing devices, such as pager systems or conventional telephones. The movement of the ‘real world’ toward digital life has encouraged dialogue between people with different backgrounds; technology such as WhatsApp has made this dialogue even easier, as it avoids conflict that might arise if the dialogue is carried out face to face (Budden *et al.*, 2011). In addition, it helps to break down hierarchical barriers between people in different levels of organisational structure.

Knowledge management as part of project management should not only focus on managing the information needed for or produced in the current project, but also on creating and disseminating it, as it might be relevant to subsequent projects (Fong, 2003). When the project has been completed, the new tacit knowledge should be disseminated across different people within the organisation.

WhatsApp, as a messaging application, facilitates the exchange of knowledge, which can be dispersed among different people within an organisation. This is particularly useful when the individuals in possession of the knowledge are not involved in the project team; they can simply be contacted and temporarily included in the WhatsApp group for the project, in order to share their knowledge and experiences.

The findings of this study support and extend the results of previous studies. For instance, Almeida and Soares (2014) demonstrate that knowledge exchange mechanisms offer opportunities to improve the following cycles: *information management* → *knowledge exchange* → *organisational learning*. This study finds similarity that WhatsApp can benefit information management and knowledge. However, this study comes to a slightly different conclusion in terms of the final output of the knowledge exchange. In this study, the final benefit knowledge exchange is improved team performance. Thus, the pattern of how ICT tools can support team performance follows the sequence of: *use of ICT platform* → *information management* → *knowledge exchange* → *project team performance* → *project success*.

This study demonstrates that ICT supported communication assists knowledge exchange in higher education institutions. This finding complements those of previous studies, suggesting that knowledge management has a mediating effect on the relationship between ICT and project performance (Adenfelt, 2010). The possession of advanced communication tools does not necessarily guarantee the success of knowledge exchange. The technology must be used in a particular way so that all concerned parties can benefit from it (Carrillo *et al.*, 2004).

Yang *et al.* (2012) highlights the importance of storing knowledge so that it can be accessed by the members of the organisation participating in different projects. Using this method, knowledge loss can be avoided. Storing knowledge is part of knowledge management, and is critical for knowledge exchange. This study found that the organisation deliberately did not develop a database of previous knowledge. One of the reasons behind this decision was the high cost of developing such a database. In addition, there is uncertainty regarding what type of knowledge will be needed in the future. Developing a knowledge database, the benefit of which can be questioned, may incur unnecessary expenses. However, WhatsApp offers a solution. This study demonstrates that WhatsApp aids knowledge transfer, although the source of knowledge does not need to be included in the project team. The inclusion of external parties in the virtual WhatsApp team group could overcome the problem of database absence.

A wide variety of knowledge types can be shared via WhatsApp. In general, knowledge is more easily shared via face to face conversation (Almeida & Soares, 2014) rather than using WhatsApp, as it takes more time for people to type a message on the small keypad of a smartphone than to say it out loud. On the other hand, for the knowledge requester, this study shows that it is very easy to request new information using WhatsApp. This leads to an unbalanced condition between those who share knowledge and those who request it.

In addition, knowledge exchange is easier in social and informal interactions (Almeida & Soares, 2014). Here, WhatsApp offers both advantages and disadvantages. It is advantageous in the sense that it can narrow the power gap between the senior and junior team members. Conversations between people with different levels of seniority can occur more frequently via WhatsApp. On the other hand, it can be disadvantageous, because there is some knowledge distortion when using WhatsApp as a tool for knowledge exchange. The quality of knowledge that can be shared via this platform is not as high as in direct conversation (Almeida & Soares, 2014).

The findings of this study corroborate those of previous studies in that knowledge exchange, which is part of knowledge management, is found to be a key determinant of team performance, as well as

successful collaboration (Kotlarsky & Oshri, 2005; Yang *et al.*, 2012). The exchange creates uniformity of knowledge among the members of project teams, which makes the progress of the project more efficient. The findings further provide evidence that knowledge exchanges between members of an organisation could result in the creation of new knowledge, methods and techniques. In this way, Yang *et al.* (2012) argue that the role of knowledge in this phenomena is as a catalyst for innovation and creation.

6. CONCLUSION

This study examines three related disciplines: project management, knowledge management and information technology. This is the first study of its kind that investigates the use of WhatsApp to support knowledge exchange in a higher education institution. WhatsApp can be viewed as a knowledge-sharing tool capable of alleviating the negative effects of bureaucratic knowledge practices within higher education institutions. Knowledge should be adapted according to specific project characteristics, rather than attempting to develop 'best practice' knowledge that is expected to work well under various circumstances (Sage *et al.*, 2010).

Higher education institutions can be viewed as knowledge intensive organisations; they produce an abundance of knowledge in their operations, causing challenges in managing it. In a research and training intensive organisation, knowledge is viewed as an asset, and, if it is not well managed, it will be lost and wasted. In order to successfully manage knowledge, higher education institutions should update their knowledge management practices.

In order to achieve a proposed goal through team coordination, certain requirements must be met. Coordination is categorised as being successful when the following criteria are met: (a) there is routine communication between team members; (b) there is an even distribution of communication between team members; (c) there is a sense of collectiveness and a clear idea of what should be done by who; (d) the team rely on a track record regarding what has been done in the past. The way in which WhatsApp can be used to promote project team performance is summarised in the following points:

- When using WhatsApp, the team should sacrifice a certain amount of time to type messages, as part of good time management. In some cases, members of a committee must devote time, from a matter of seconds to up to 20 minutes, to typing messages. A good example of this found in the case study was a message posted by one of the project team leaders, who posted a long message every morning, up to 500 words, containing the latest updates and necessary knowledge for the progress of the project. To type such a message on a smart phone keyboard took the team member around 15 minutes; however this time can be compensated for by the removal of the need for a meeting, though the team was still updated with the latest information, enabling them to work remotely. If only all members of committee organise a face-to-face meeting, it would take longer as there is a need for meeting preparation as well as time spent for trip to the meeting venue. In this team, the task of the project manager was to ensure that all team members were working in harmony, so that the common goal could be achieved. In this sense, the role of project manager is similar to that of the leader of an orchestra at a music concert, who is the key person in assembling specific instrument players so that harmonic music is created.
- The use of technology to support communication in project management should take cultural factors into account. The use of the messaging application to some extent successfully enabled people to express their ideas in a clear way, and to some degree reduced the chance of conflict. In the Indonesian culture, people tend to express ideas, particularly those regarding sensitive issues, using implicit terms. However, when using WhatsApp, one has to express his idea in a clear and concise way because there is limited

opportunity to express it in comparison to a direct conversation. For this reason, comments must be written in a more explicit way, in order to avoid misunderstandings.

- Similar to the previous point, expressing compliments is also difficult. The local Indonesian culture is generally shy about expressing compliments in a straightforward way in face-to-face conversations. However, this proved very easy to do via WhatsApp, where team members did not hesitate to compliment members of the group, creating a positive atmosphere overall among the group members.

In addition to the contribution mentioned above, this study identifies several opportunities for future investigations. First, this study did not use any metrics to measure the effectiveness of WhatsApp as an application to support project management. Future research could therefore make use various metrics, such as quantitative metrics, qualitative metrics and return-on-investment, as suggested by Turner (2010). Second, future studies could analyse in greater detail the time lag between posting an enquiry or question on the group, and receiving a response from the other members. The time lag reflects the effectiveness of the communication, as the closer the time gap, the quicker the information spreads throughout the members of the group.

Future research should also consider using WhatsApp to support larger projects with higher degrees of uncertainty. Larger sized projects are more likely to have greater difficulty with managing knowledge-exchange. A larger project team is typically associated with more diverse team member backgrounds. Empirical evidence has shown that low uncertainty projects require rigid team management, while high uncertainty projects require less formal and more intensive communication, as well as a flexible management approach (Shenhar, 2001). Previous research carried out by Mehta *et al.* (2014) could be used as a starting point, but further studies are needed to explore how IT could help managers overcome uncertain environments.

REFERENCES

- Acton, B. & Koum, J., 2014. WhatsApp blog. Available at: <http://blog.whatsapp.com> [Accessed February 4, 2016].
- Adenfelt, M., 2010. Exploring the performance of transnational projects: shared knowledge, coordination and communication. *International Journal of Project Management*, 28(6), pp.529–538.
- Aggarwal, P. & O'Brien, C.L., 2008. Social loafing on group projects: structural antecedents and effect on student satisfaction. *Journal of Marketing Education*.
- Ahad, A.D. & Lim, S.M.A., 2014. Convenience or Nuisance?: The “WhatsApp” Dilemma. *Procedia - Social and Behavioral Sciences*, 155(October), pp.189–196.
- Alabdulkareem, S.A., 2015. Exploring the use and the impacts of social media on teaching and learning science in Saudi. *Procedia - Social and Behavioral Sciences*, 182, pp.213–224.
- Almeida, M.V. & Soares, A.L., 2014. Knowledge sharing in project-based organizations: Overcoming the informational limbo. *International Journal of Information Management*, 34, pp.770–779.
- Barreau, D., 2008. The persistence of behavior and form in the organization of personal information. *Journal of the American Society for Information Science and Technology*, 59(2), pp.307–317.
- Bartsch, V., Ebers, M. & Maurer, I., 2013. Learning in project-based organisations: The role of project teams' social capital for overcoming barriers to learning. *International Journal of Project Management*, 31(2), pp.239–251.
- Begel, A., DeLine, R. & Zimmermann, T., 2010. Social media for software engineering2. In *Proc. FSE/SDP workshop on Future of software engineering research FoSER '10*. Santa Fe, New Mexico, USA: ACM New York, pp. 33–37.

- Boh, W.F., 2007. Mechanism for sharing knowledge in project-based organisations. *Information and Organisation*, 17(1), pp.27–58.
- Budden, C.B. et al., 2011. Managing the evolution of a revolution: Marketing implications of Internet media usage among college students. *College Teaching Methods and Styles Journal*, 3(3), p.5–10.
- Caniëls, M.C.J. & Bakens, R.J.J.M., 2012. The effects of Project Management Information Systems on decision making in a multi project environment. *International Journal of Project Management*, 30(2), pp.162–175.
- Carrillo, P. et al., 2004. Knowledge management in UK construction: Strategies, resources and barriers. *Project Management Journal*, 35(1), pp.46–56.
- Carrillo, P.M. et al., 2006. A knowledge transfer framework: the PFI context. *Construction Management and Economics*, 24(10), pp.1045–1056.
- Chang, H.H. & Chuang, S., 2011. Social capital and individual motivations on knowledge sharing: participant involvement as a moderator. *Information & Management*, 48(1), p.9.
- Chiocchio, F., 2007. Project team performance: A study of electronic task and coordination communication. *Project Management Journal*, 38(1), pp.97–109.
- Choo, C.W., 1991. Towards an informational model of organizations. *The Canadian Journal of Information Science*, 16(3), pp.32–62.
- Crawford, L., 2002. Profiling the competent project manager. In *In D. P. Slevine, D. I. Cleland, & J. K. Pinto (Eds.), The frontiers of project management research*. Newtown Square, PA.: Project Management Institute., pp. 151–176.
- Detlor, B., 2010. Information management. *International Journal of Information Management*, 30(2), pp.103–108.
- Drake, T.M. et al., 2015. WhatsApp with patient data transmitted via instant messaging? *The American Journal of Surgery*, 211(1), pp.300–301.
- Easterby-Smith, M., Thorpe, R. & Jackson, P., 2012. *Management research, 4th Edition*, Sage Publications, Inc., London, United Kingdom.
- Eisenhardt, K.M., 1989. Building theories from case study research. *The Academy of Management Review*, 14(4), pp.532–550.
- Fong, P., 2003. Knowledge creation in multidisciplinary project teams: An empirical study of the processes and their dynamic interrelationships. *International Journal of Project Management*, 21(7), pp.479–486.
- Giardano, V. et al., 2015. WhatsApp messenger is useful and reproducible in the assessment of tibial fractures: Inter- and intra-observer agreement study. *International Journal of Medical Informatics*, 54, pp.141–148.
- Gunnlaugsdottir, J., 2003. Seek and you will find, share and you will benefit: Organising knowledge using groupware systems. *International Journal of Information Management*, 23(5), pp.363–380.
- Hoegl, M., Weinkauff, K. & Gemuenden, H.G., 2004. Interteam coordination, project commitment, and teamwork in multiteam R&D projects: a longitudinal study. *Organisational Science*, 15(1), pp.38–55.
- Hofstede, G. et al., 1990. Measuring organisational cultures: A qualitative and quantitative study across twenty cases. *Administrative Science Quarterly*, 35, pp.286–316.
- Jackson, P. & Klobas, J., 2008. Building knowledge in projects: A practical application of social constructivism to information systems development. *International Journal of Project Management*, 26(4), pp.329–337.
- Johannessen, J.A. & Olsen, B., 2011. Projects as communicating systems: Creating a culture of innovation and performance. *International Journal of Information Management*, 31(1), pp.30–37.
- Jonhston, M. et al., 2015. Smartphones let surgeons know WhatsApp: an analysis of communication in emergency surgical teams. *The American Journal of Surgery*, 209(1), pp.45–51.

- Juarez-Ramirez, R., Pimienta-Romo, R. & Ocegueda-Miramontes, V., 2013. Supporting the software development process using social media: Experiences with student projects. *2013 IEEE 37th Annual Computer Software and Applications Conference Workshops*, pp.656–661.
- Karim, N. & Hussein, R., 2008. Managers' perception of information management and the role of information and knowledge managers: The Malaysian perspectives. *International Journal of Information Management*, 28(2), pp.114–127.
- Koskinen, K.U., Pihlanto, P. & Vanaranta, H., 2003. Tacit knowledge acquisition and sharing in a project work context. *International Journal of Project Management*, 21(4), pp.281–290.
- Kotlarsky, J. & Oshri, I., 2005. Social ties, knowledge sharing and successful collaboration in globally distributed system development projects. *European Journal of Information Systems*, 14(1), pp.37–48.
- Kruger, C. & Johnson, R.D., 2010. Information management as an enabler of knowledge management maturity: A South African perspective. *International Journal of Information Management*, 30(1), pp.57–67.
- Liu, J., Meng, F. & Fellows, R., 2015. An exploratory study of understanding project risk management from the perspective of national culture. *International Journal of Project Management*, 33(3), pp.564–575.
- Liu, P.L., Chen, W.C. & Tsai, C.H., 2004. An empirical study on the correlation between knowledge management capability and competitiveness in Taiwan's industries. *Technovation*, 24(12), pp.971–977.
- Lynn, G.S. & Reilly, R.R., 2000. Measuring team performance. *Research Technology Management*, 43(2), pp.48–56.
- Mehta, N., Hall, D. & Byrd, T., 2014. Information technology and knowledge in software development teams : The role of project uncertainty. *Information & Management*, 51, pp.417–429.
- Mickan, S. & Rodger, S., 2000. Characteristics of effective teams: A literature review. *Australian Health Review*, 23(3), pp.201–208.
- Nahapiet, J. & Ghoshal, S., 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), pp.242–266.
- Nonaka, I., 1991. The knowledge creating company. *Harvard Business Review*, 69(6), p.96.
- Pemsel, S. & Wiewiora, A., 2013. Project management office a knowledge broker in project-based organisations. *International Journal of Project Management*, 31(1), pp.31–42.
- Petruzzi, M. & De Benedittis, M., 2015. WhatsApp: A telemedicine platform for facilitating remote oral medicine consultation and improving clinical examinations. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*.
- Prencipe, A. & Tell, F., 2001. Inter-project learning: processes and outcomes of knowledge codification in project-based firms. *Research Policy*, 30(9), pp.1373–1394.
- Project Management Institute, 2013. *PMBOK Guide* 5th ed., Pennsylvania: Project Management Institute, Inc.
- Rooke, C.N. et al., 2010. Using the physical properties of artefacts to manage through-life knowledge flows in the built environment: an initial exploration. *Construction Management and Economics*, 28(6), pp.601–613.
- van Rooyen, A., 2015. Distance education accounting students' perceptions of social media integration. *Procedia - Social and Behavioral Sciences*, 176, pp.444–450.
- Sage, D.J., Dainty, A.R.J. & Brookes, N.J., 2010. Who reads the project file? Exploring the power effects of knowledge tools in construction project management. *Construction Management and Economics*, 28(6), pp.629–639.
- Shachaf, P., 2008. Cultural diversity and information and communication technology impacts on global virtual teams: An exploratory study. *Information & Management*, 45(2), pp.131–142.
- Shenhar, A., 2001. One size does not fit all projects: Exploring classical contingency domains. *Management Science*, 47(3), pp.394–414.
- Stefanidis, D. et al., 2015. Research priorities for multi-institutional collaborative research in

- surgical education. *The American Journal of Surgery*, 209(1), pp.52–58.
- Sultan, A.J., 2014. Addiction to mobile text messaging applications is nothing to “lol” about. *The Social Science Journal*, 51(1), pp.57–69.
- Turner, J., 2010. How to calculate the ROI of your social media campaign. <http://mashable.com/2010/11/05/calculate-roi-social-media/#aCevMm86QZqd>. Available at: <http://mashable.com/2010/11/05/calculate-roi-social-media/#aCevMm86QZqd> [Accessed January 14, 2016].
- Watson, L. et al., 2015. Ensuring safe communication in health care: a response to Johnston et al on their paper “Smartphones let surgeons know WhatsApp: an analysis of communication in emergency surgical teams.” *American Journal of Surgery*, 211(1), pp.302–303.
- Wilson, T.D., 2005. The nonsense of knowledge management. In E. Maceviciute & T. D. Wilson, eds. *Introducing information management*. London, UK: Facet Publishing, pp. 151–164.
- Winkler, R., 2013. WhatsApp hits 400 million users, wants to stay independent. Available at: Wall Street Journal--Available at: <http://blogs.wsj.com/digits/2013/12/19/whatsapp-hits-400-million-users-wants-to-stay-independent> [Accessed January 4, 2016].
- Yang, L.-R., Chen, J.-H. & Wang, H.-W., 2012. Assessing impacts of information technology on project success through knowledge management practice. *Automation in Construction*, 22, pp.182–191.
- Yin, R.K., 2009. *Case study research: Design and methods* 4th ed., London, United Kingdom.: Sage Publications, Inc.
- Ziek, P. & Anderson, J.D., 2009. Communication, dialogue and project management. *International Journal of Managing Projects in Business*, 8(4), pp.788–803.