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Personal Knowledge Management among Managers: Mobile Apps for Collective Decision Making

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Abstract The current observation in collaborative technology witnesses the changing trends from email and short messaging system (SMS) to social network and mobile apps, for almost every task including personal tasks, group tasks, and even organisational tasks like making important decisions on-the-go. As a concurrent control function, managers now depend on mobile apps to instantly decide by connecting to their resources (i.e. connections or contacts) in the palm of their hands.

Despite the recent studies on knowledge sharing practices over social media within organisational boundaries, there is a gap in the realm of mobile apps regardless of the wide use of smartphone features by managers. Since the concepts of knowledge sharing and knowledge management are relevant to the process of making organisational decisions, it is believed that there is a trend in managing organisations using mobile devices and applications, which is not limited to social media alone.

This paper uses the concept of personal knowledge management (PKM) to analyse the patterns of sharing and managing knowledge among knowledge workers over mobile devices. A model called the GUSC Model is proposed to outline this pattern, and this is expandable to the tasks of making decisions among managers.

Keywords: personal knowledge management, decision making, mobile apps.

1. INTRODUCTION

The current trend of mobility and being reachable anywhere anytime, supported by the new technologies like mobile applications (apps) and social media, has been taken for granted by every user, including people who manage teams and make decisions for their organisations. Current observation in such technologies witnesses the changing of trends from email and short messaging system (SMS) to social network and mobile apps, for almost every task including personal tasks, group tasks, and even organisational tasks like making important decisions on-the-go. As a concurrent control function, managers depend on mobile apps to instantly decide by connecting to their resources (i.e. connections or contacts) in the palm of their hands.

Recent studies in Europe revealed the existence of knowledge sharing practices over the social media within organisational boundaries. However, there is a gap in studies in the realm of mobile apps, despite the wide use of the smartphone features by managers. Since the concepts of knowledge sharing and knowledge management are relevant to the process of making organisational decisions, it is believed that there is a trend in managing organisations using mobile devices and applications, and this is not limited to social media alone.

A recent study on Personal Knowledge Management (PKM) in Malaysia has proven that there is a pattern of sharing and managing knowledge among knowledge workers over mobile devices, particularly in managing team or group during project development and implementation (Ismail et al., 2013; Ismail et al., 2014). A model called the Get-Understand-Share-Connect (GUSC) Model was proposed to outline this pattern (Ismail & Ahmad, 2012). It is suggested that this study is expanded to the task of decision-making among managers, which is also seen to exist over the usage of mobile apps.

This paper examines the area that is being neglected concerning "what the tool is used for" in management trends. Often, knowledge workers and managers use tools (or in this case, apps) obviously for communication, oblivious of their actions in completing some management tasks while using the tools. It is a contribution to the body of knowledge if this management trend is captured in a proper framework.

2. RELATED WORKS

Intrinsically across the literature, decision making is partially about how people manage knowledge, i.e. knowledge management. However, it is dynamic, since situations differ every time a problem needs to be solved, and having 'enough' knowledge itself does not ensure that decisions made are suitable at a particular point of time.

This section covers two main aspects of the study related to KM: knowledge management in decision making; and perspectives from personal to collective knowledge management. The changes in management trend is covered by this study in terms of managing decision making on a different platform than the conventional boardroom, thus the need to understand the theories underlying the personal and collective knowledge.

2.1 Knowledge Management in Decision Making

Knowledge is the insights, understandings, and practical know-how that we all possess. From a cognitive science perspective, knowledge is the fundamental resource that allows us to function intelligently (Wiig, 1993). The transformations of knowledge to other manifestations (e.g. books, technology practices and traditions) result in cumulate expertise and increased effectiveness when used appropriately. It is one of the principal factors that makes personal, organisational and societal intelligent behavior possible (Wiig, 1993), which in turn leads to better decision making at all levels of organisational hierarchy. In expanding this understanding of knowledge, the process and technology perspectives use the term 'knowledge management' as the concept under which "information is turned into actionable knowledge and made available effortlessly in a usable form to the people who can apply it" (Information Week, 2003). A better way to describe this is "a systematic approach to manage the use of information in order to provide a continuous flow of knowledge to the right people at the right time enabling efficient and effective decision making in their everyday business" (Dalkir, 2005).

According to Wiig (2004), knowledge management (KM) "provides benefits to individual employees, communities of practice, and organisation itself". In relation to this study, KM provides benefits to individuals in terms of: helping people do their jobs and save time through better decision making and problem solving; building a sense of community bonds with the organisation; helping people to keep up to date; and providing challenges and opportunities to contribute (Wiig, 2004). In addition, KM provides benefits to the organisation in terms of helping to drive the strategy; solving problem quickly; diffusing best practices; improving knowledge embedded in products and services; cross-fertilising ideas and increasing opportunities for innovation; enabling organisations to stay ahead of the competition; and building organisational memory (Wiig, 2004).

Some critical KM challenges are to manage content effectively, facilitate collaboration, help knowledge workers connect and find experts, and help the organisation to lead and make decisions based on complete, valid, and well-interpreted data, information, and knowledge (Wiig, 2004). There is a link to how KM influences these decisions that manifest the organisation's strategic position (Nicolas, 2004), and this is covered in previous research on KM strategy.

Among a few models for decision-making, some may be appropriate for particular types of decisions, and can be classified from least participatory to most: team leader decides and informs the team; team leader gathers input from team then decides; consensus decisions; consensus with a fallback; and team leader sets constraints and delegates decisions to team members (Stein, 2008). Consensus decision means that an entire team has to come to an agreement on a course of action, even if individuals might have different preferences, and they often lead to completely new solutions (Stein, 2008). In the process of doing so, they may use general knowledge to survey exceptional situations at hand, and use knowledge to describe the situations and scope of the problem (Dalkir, 2005), among a few processes of managing knowledge. KM processes help widen the spectrum of potential choices in decision making by providing new knowledge and new competencies (Dalkir, 2005).

Despite the need to develop good meeting practices in consensus decision-making in ensuring every individual has an opportunity to participate in the process (Stein, 2008), there is a gap in referring to situations that demand decisions to be made immediately when there is no time to gather for a meeting. This gap is mentioned in an earlier research by Daft in 1982, who stated that "specific decisions do not follow an orderly process from problem to solution, but are outcomes of several relatively independent streams of events within the organisation". Hence the need to investigate the KM processes in decision-making team using a model that is not rigid in sequence of processes.

2.2 From Personal to Collective Knowledge

"Most enterprise strategy is determined in the boardroom but is implemented by the individual actions of employees throughout the organisation" (Wiig, 2004). Hence, it is important to improve the quality of the innumerous 'small' decision-making and problem-solving situations that are parts of every employee's daily work, which cumulates into significant improvement in their performance (Wiig, 2004) for contribution to the organisation in the form of collective knowledge. These small decision-making and problem-solving situations are those that contribute to the body of personal knowledge at individual employees' level.

Typically at the operational level, the important aspect of personal knowledge management (PKM) is "to allow the

individual to better manage their knowledge processes and interaction, collaboration and knowledge exchanges with others" (Razmerita et al., 2009). The concept has evolved over time and now involves making sense of information, sharing, interacting and negotiating meaning, on top of organising personal information, creating new ideas, developing networks and collaborating (Efimova, 2004; Wright, 2005). The PKM environments integrate individual work environments and infrastructures (including mobile apps and social apps) to support joint creation, distribution, sharing and application of knowledge (Maier & Sametinger, 2004). Even though a mobile apps is considered a closed network (i.e. every participant of a mobile apps group would usually know one another since mobile phone number is needed to be within the environment) unlike other types of network covered by previous research, it is still aimed to "directly support PKM and fostering collective intelligence" (Razmerita et al., 2009). The change in technology and communication trend from Web 2.0 to mobile apps is the result of a social dimension provided by the technologies, which better fits the individual needs of knowledge workers. Hence, the PKM model is introduced to facilitate interaction, collaboration and knowledge exchanges on the web and in organisations (Razmerita et al., 2009) and today it is not limited only by the web but also the mobile apps in the palm of everybody's hand.

In the Asian region, a research on PKM postulated four processes called GUSC (Ismail & Ahmad, 2011): get/retrieve knowledge (G); understand/analyse knowledge (U); share knowledge (S); and connect to knowledge source (C). This previous research relates the PKM to the organisational KM by projecting the individual/personal key performance indicators (KPI) to the organisational KPIs that also define the collective goals. The intersection of common personal goals (that constitute personal knowledge) achieved by individuals collectively produces the collective knowledge. Analysing this, the following equations are formed in extension to the previous research by Ismail and Ahmad (2011).

If the collective knowledge processes of achieving an organisational KPI_O is construed as follows:

$$KPI_O = KPI_1 + KPI_2 + KPI_3 + \ldots + KPI_{N-2} + KPI_{N-1} \quad (1)$$

Then the collective knowledge of the organization is construed as the intersections of individuals' personal knowledge:

$$CK_O = PK_1 \cap PK_2 \cap PK_3 \cap \ldots \cap PK_{N-1} \cap PK_N \quad (2)$$

where CK_O is the organisational collective knowledge and PK defines the personal knowledge of each numbered individual. The intersections are manifested through knowledge sharing activities during the PKM processes of GUSC, when individuals are connected (via meetings face-to-face or virtually) to get knowledge (by receiving new knowledge on a problem or new situation), and understand knowledge (by analysing the situation of a problem to be solved). This is not limited to organisational collective knowledge only, but the intersection of small number of individuals' personal knowledge would contribute to the 'small' decision-making.

2.3 The GUSC Model

The GUSC Model (Ismail & Ahmad, 2012) has covered the knowledge management aspect at personal level, particularly in the Malaysian working environment. Most of the technologies covered in this model were based on the trend of communication and interactions over social media and Web 2.0. The GUSC processes (Get-Understand-Share-Connect) are found to be in similar nature as the renowned SECI Model by Nonaka and Takeuchi in 1995 (Ismail et al., 2014), which stated the processes of knowledge transfer and conversion between explicit and tacit forms.

According to Ismail, et al. (2012), the similarities of processes between personal knowledge management (PKM) in the GUSC Model and the knowledge management processes in SECI Model are detailed out in the Table 1.

Table 1: GUSC Processes of PKM

GUSC Process	Description	SECI Model
Get or retrieve knowledge	A person retrieves knowledge that has been converted from tacit to explicit form	Externalisation of knowledge: Tacit → Explicit
Understand knowledge	A person analyses the explicit form of knowledge and convert in his/her own way of understanding in tacit form	Internalisation of knowledge: Explicit → Tacit
Share knowledge	A person shares the knowledge he/she has understood in explicit form to be transferred to another person who would get it in explicit form	Combination of knowledge: Explicit → Explicit
Connect to knowledge source	A person makes contacts with another person where discussion may occur between them, which results in transforming tacit form to another tacit form of knowledge	Socialisation of knowledge: Tacit → Tacit

The GUSC Model is originally designed to support agent-mediated PKM, however it is applicable to other situations and environments, such as Agents of Things (AoT), intelligent systems, and mobile learning.

2.4 The Concept of Agents of Things (AoT)

The concept of AoT is derived from the concept of the Internet of Things (IoT), which entails that if all devices or things are equipped with some kind of electronic tags, they could be identified and their situations could be monitored for some immediate actions. For example, with the IoT, a refrigerator automatically orders more food items (to which tags are attached) before they run out of stock by communicating with a supplier's IoT system. However, the IoT generally considers these things as passive unintelligent devices, reacting only to queries or requests but do not proactively exploit their environment for other value-added services to humans (Mzahm et al., 2014).

In the AoT, the things are embedded with intelligent software agents to give them the power of self-reasoning and intelligence in providing value-added services to humans. All these things and systems that work under the AoT concept interact with each other via software agents. Figure 7 shows the general architecture of the AoT in software agent's perspective.

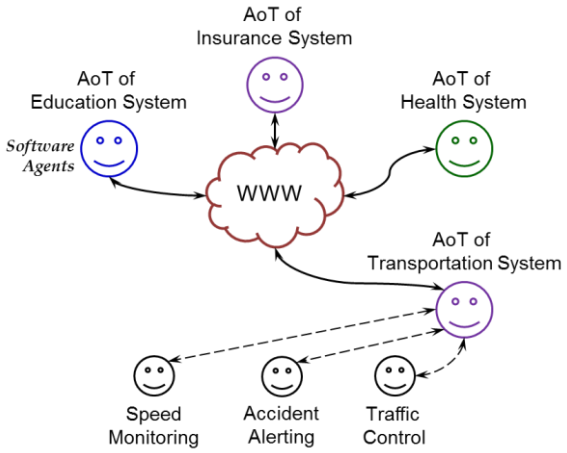

Figure 1: The General Architecture of the AoT (Adapted from Mzahm et al., 2014)

The IoT and the AoT differs in that the individual things of the IoT are not intelligent since they are not equipped with any artificial intelligence software to give them the reasoning ability, whereas, the AoT is an intelligent concept that uses software agents to give its associated things the ability to reason, negotiate and delegate (Mzahm et al., 2014).

3. THE CASE FACULTY

An exploratory study is conducted on a case group in a faculty of an institute of higher learning, through a qualitative method of participant observation. The analysis is translated into conceptual diagrams to visualise the overall view of the interactions over mobile apps, the GUSC processes performed during the interactions, and the GUSC patterns over mobile apps based on individual characteristics.

The decision makers in the case faculty are the people in the management team, assigned with jobs that are mostly contract-based between two to four years. This results in constant restructuring of managerial positions and reshuffling of support staff. Due to frequent movement in the management team, decision-making is crucial especially when a newly-elected manager has limited time to learn the new knowledge needed for the position held. Additionally, it is a challenge to assemble the whole management team for repeated formal meetings without missing anyone out due to hectic schedule since each manager has unique job commitments which include giving lectures and attending other important meetings. This beckoned the usage of mobile apps, in particular, the WhatsApp Messenger©, to be in constant reach as a team and decide on management issues at anytime, anywhere.

The management team's span of control and decision making expand further via the mobile apps when WhatsApp Messenger© Groups are created based on the groups of people involved. In some cases, one decision maker is a member of two groups, who assists both groups with better decision-making when some of the relevant knowledge is shared by this particular member. Figure 2 shows the overall span of management decision makers who are members of three other groups that extend from the management team: institute academic committee group; special task force group; and management services group.

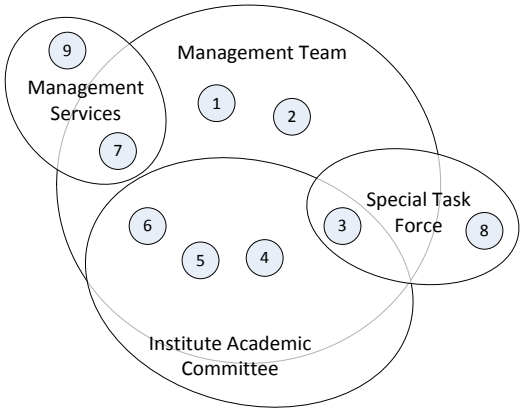

Figure 2: Overall Span of Management Decision Makers

From Figure 2, the management team members are numbered from 1 to 7 (shown as numbered nodes). Node 3 forms a group with Node 8 to keep in touch with Node 8, whereas Node 7 forms a group with Node 9 for similar reasons. The special task force is an example of an informal group or committee that is formed to develop a solution for the faculty. On the other hand, the management services group is a formal structure with Node 7 as the leader and the rest of its members are prominent staff who assist Node 7 to make better decisions while controlling the group. Since the core

business of the faculty is academic management, many of the management team members (i.e. Node 3, 4, 5 and 6) are members of the institute academic committee, a mirror structure of one governed at the chancellery level, formed at the faculty level.
These groups (and their members) are samples of possible mobile apps groups that exist with some of the names altered to make them generic and ensuring confidentiality. In reality, there are 14 members in the management team, with six sub-management teams expanded from this main team. This does not include special task forces and ad hoc project-based teams or committees formed as and when needed. In facilitating the visualisation of the conceptual framework, this study takes into account a few groups, including the main management team that is known to use mobile apps (i.e., WhatsApp Messenger© Groups).

Figure 3 shows the positions of the management team, represented as nodes. The arrows in Figure 3 indicate how each member of the groups are connected, with one-way arrows indicating the membership of the groups, and two-way arrows indicating individual interactions without group formation. Compared to Figure 2, some of the interactions are within formal mobile apps groups (e.g. Head of Management Services and Facilities Management Unit in management services group), whereas some are without groups (e.g. Dean and Head of Management Services personally interacting over mobile apps).

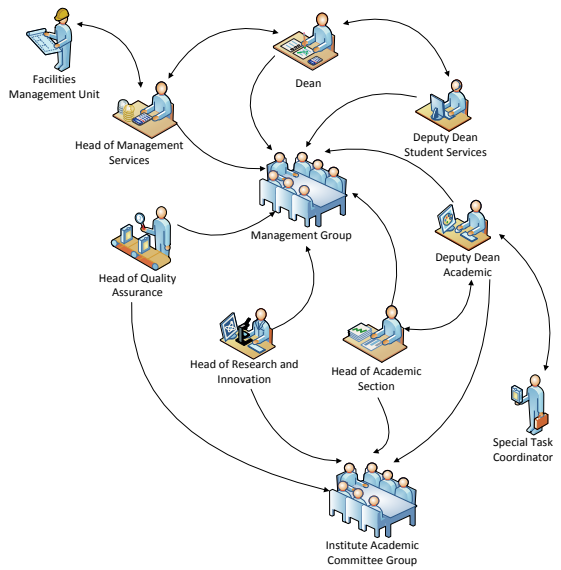

Figure 3: Overview of Interaction over Mobile Apps

Figures 2 and 3 are the basis for the conceptual diagrams derived during the analysis stage. These figures are the results of the observation on interactions within the management team, which also reflects a formal (and informal) organisational structure of the case faculty.

4. PRELIMINARY FINDINGS: THE GUSC PROCESSES WITHIN THE MOBILE APPS ENVIRONMENT

The findings are divided into two parts: the preliminary findings on the overview of the GUSC processes over mobile apps; and discussions on the GUSC pattern based on characteristics of the mobile apps participants.

Regardless of being connected to each other via the Management Group, the GUSC processes differ among the members, mostly due to the authority, seniority and necessity. The GUSC processes that are seen existed within the context of mobile apps participation are as shown in Table 2.

Table 2: GUSC Process over Mobile Apps

GUSC Process	Description
Get knowledge	Members GET data, information, messages, announcements, documents, images, videos and other forms of explicit knowledge from other members in the mobile apps group
Understand knowledge	Members UNDERSTAND and make sense of what they get, by verifying, confirming, getting assurance, reviewing, analyzing and commenting on the information in the mobile apps group – this knowledge becomes tacit to them
Share knowledge	Members SHARE data, information, messages, announcements, documents, images, videos and other forms of knowledge that are converted into explicit form from what they know in tacit form.
Connect to knowledge source	Members CONNECT to other members in the mobile apps group by accepting invitation to be part of the group, and connect to other sources of knowledge (e.g. links to data, information, people, etc.) that other members share with them in the mobile apps

From the descriptions of Table 2, the GUSC processes could be visualised from the environment within the mobile apps. Figure 4 shows an overview of these processes with 7 members connected to Management Group, as derived from Figures 2 and 3. Despite being connected to the same group, not all members share (S) and understand (U) knowledge within the environment. All members get (G) knowledge from the group with the Dean sharing (S) most knowledge and Deputy Deans understand (U) most knowledge. This does not mean that the rest of the management team is not participative,

but in general they mostly share knowledge on non-specific issues or that do not contribute to major management decision making, unless when they are requested to do so.

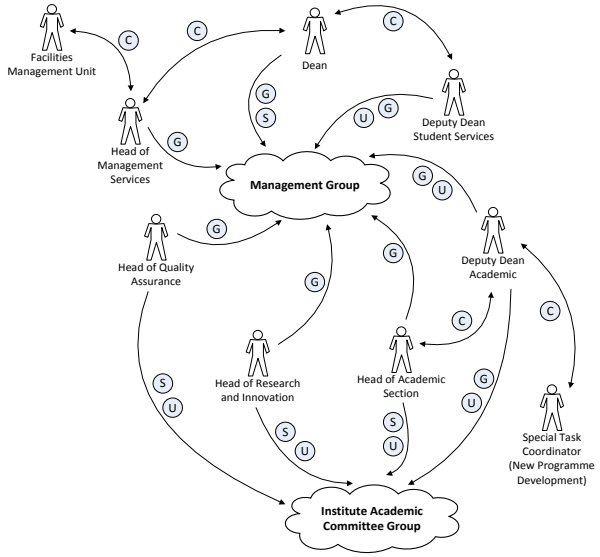

Figure 4: Overview of GUSC processes over Mobile Apps

The scenario is slightly different at sub-management group (i.e. Institute Academic Committee mobile apps group), in which the members share (S) more, and understand (U) better in this close-knit group. Trust is built, with a more transparent channel and straightforward messages to disseminate knowledge, resulting in a better effort in sharing (S) and understanding (U) knowledge. This proves the need of forming groups at micro management level, to which members feel they belong and in which their voices are heard. This finding also supports the significance of 'small' decision-making that is commonly performed at sub-management level.

Among the interactions that exist in the mobile apps environment, there are some private networks or connections between individuals from a (management) group to individuals outside the group. These connections are identified as connect (C) with 2-way arrows, indicating mutual get (G), understand (U) and share (S) between the two connected individuals. Since this connection only involves two individuals at one time, creating a WhatsApp Messenger© Group is not a necessity, even if the individual outside the management group is working on a specific task that contributes to the management.

5. DISCUSSION: GUSC PATTERNS AMONG MOBILE APPS PARTICIPANTS

Interesting patterns are observed that suggest the types or characteristics of individuals from their interactions in the mobile apps environment. Figure 5 shows a case scenario that was observed in a mobile group, which defines some of these characteristics.

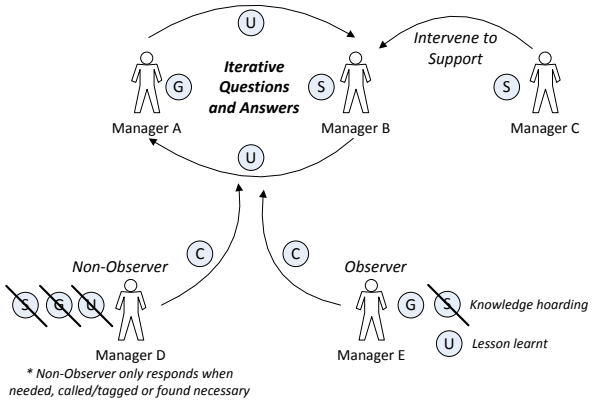

Figure 5: The GUSC Pattern based on Characteristics of the Mobile Apps Participants

In a situation when Manager A and Manager B are discussing over a matter or problem, there is an iteration of questions and answers between them, in which one person gets (G) more than the other (i.e. Manager A) whereas the other shares (S) more than the former (i.e. Manager B). During this iterative questions and answers, both managers gradually understand (U) the issue until the point when both agree on the final decision. At some point of time, if Manager C happens to be witnessing the interactions between Manager A and Manager B, and thinks that he or she has some additional personal knowledge to support Manager B's answers and to better clarify Manager A's understanding, then Manager C may intervene with a share (S). In most cases, when the intervention is positively contributing to the issue being discussed, then the iteration could be shortened with a decision made faster than without intervention.

In any group, regardless whether it is virtual (e.g. over Web 2.0, social media, mobile apps) or real (e.g. focus group interview, discussion, meeting), there would be silent observers. This is represented as Manager E in Figure 5, who observes the whole interactions and gets (G) new knowledge but does not share (S) any knowledge that he or she may possess. If Manager E understands (U) the issue being discussed and how the discussion (between Manager A, B and possibly C too) is concluded, then he or she can be considered as a knowledge hoarder. Manager E learnt from the lesson understood and may or may not share with anyone after the situation ends.

On the other hand, there is another type of individuals that exist in the mobile apps group, who is contrary to the observer. Manager D in Figure 5 represents this non-observer, in which he or she does not 'follow' any interactions occurring over the mobile apps environment, mainly because the issue is not of his or her concern, or he or she is not connected to the environment at that time. This type of person does not

get (G), understand (U), nor share (S) any knowledge, unless he or she is tagged or requested to join the conversation.

6. CONCLUSION AND FURTHER WORKS

This paper discusses the preliminary findings on an exploratory study of mobile apps interactions for extension to and deployment of collective intelligence. While this paper discusses the issues embodying PKM, it is not about developing a KM system. It highlights KM pervasive occurrences even in decision making using collective knowledge, over real-time mobile apps. Changes in scenarios and situations affect the decision-making processes over mobile apps, and this is observed when there is a restructuring of management team and changing of leadership. Such occurrences cause the emergence of different patterns of the GUSC processes which will be investigated further in our future work.

Additionally, the future work will also include cognitive enablers (i.e. method, identify, decide and drive), which are inevitable in PKM processes, since it is influenced by humanistic nature and characteristics of the individuals within the mobile apps group. As more and more sub-management teams and micro management groups are created, there is ample opportunity to expand this research further with more quantifiable qualitative analysis.

In generalising the idea proposed in this paper, consider Figure 6, which highlights a few issues. Is it possible that a similar scenario is found in a generic organisation, such as a manufacturing or a service providing company? Would the GUSC pattern be similar to the case study presented in this paper? These will be covered in the future work, with a larger ground to cover and a wider set of respondents.

On another note, it is proven that the features of a technology in hand would be the contributing factor that links the Share (i.e. a user's willingness to share knowledge) and Understand knowledge (i.e. ability to understand the knowledge better) (Ismail et al., 2014). This aspect of knowledge management processes will be the next focus in the research as well, in which it is approachable through a quantitative method.

Another aspect of contribution is from the domain of Agents of Things (AoT), since the GUSC Model is originally developed for agent-mediated knowledge management system and research has been done proving that the GUSC can be deployed for systems based on AoT concept (Ismail & Ahmad, 2014). Clearly, based on Figure 1, the GUSC Model could be implemented within the framework of the Agents of Things, the architecture of which is isomorphic to that of the interaction model of Figure 3. Details of such implementation will be deliberated as another aspect of our future work.

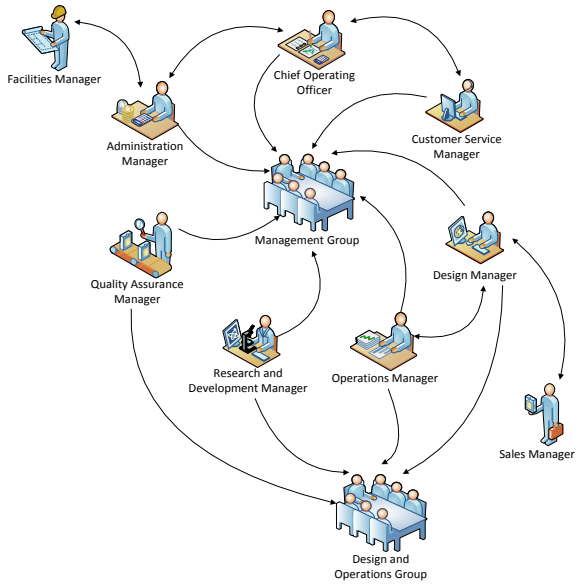

Figure 6: Generalising Interactions over Mobile Apps

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Mohd Sharifuddin Ahmad received his Bachelor of Science in Electrical and Electronic Engineering from Brighton Polytechnic, United Kingdom, in 1980. He started his career as a power plant engineer specialising in Instrumentation and Process Control in 1980. After completing his MSc in Artificial Intelligence from Cranfield University, United Kingdom, in 1995, he joined Universiti Tenaga Nasional (UNITEN) as a Principal Lecturer and Head of Department of Computer Science and Information Technology. He obtained his PhD from Imperial College, London, United Kingdom, in 2005. He has been an Associate Professor at UNITEN since 2006. His research interests includes applying constraints to develop collaborative frameworks in multi-agent systems, collaborative interactions in multi-agent systems and tacit knowledge management using AI techniques.

