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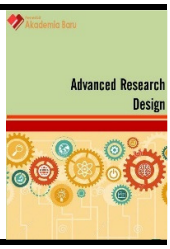


# Measuring Expected Participation in Project Knowledge: Analysing Communication Patterns in Social Messaging Application using GUSC Model

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**ABSTRACT**

The advancement of technology has allowed a variety of tools for employees and managers, or knowledge workers, to choose as communication tools, especially for managing project teams. Instead of communicating and updating project progress through emails and short messaging system, social messaging (SM) applications, such as WhatsApp™, are the current daily choice among them. The over-utilisation of the SM applications has given an opportunity for a research on project knowledge retention within project team, since it becomes an addiction to create new groups each time a new project team is formed. It is believed that project knowledge resides within these virtual groups, and this paper looks into how project knowledge is managed by analysing the communication patterns against a measurement metrics based on personal knowledge management (PKM) theory called GUSC Model. The communication patterns found existed in the SM application are qualitatively identified and mapped against the PKM processes within, with weighted score assigned to each process to quantitatively measure the overall project knowledge management participation. The differences among the organisational communication levels, namely upper and lower level communication levels, are analysed and the final result of participation expectation on member of SM application groups is presented. The outcome of this research recommends the future intervention on SM application usage and the application of knowledge management concept in current communication tool.



## 1. Introduction

It is important to ensure that knowledge is well managed at all levels of an organisation, including at project level. As quoted by Abdul Mannan *et al*., [1], "knowledge has been viewed as a competitive advantage and a source of power for those who possess it at the right place and at the right time

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[2,3]" Knowledge management has been claimed to be important for organisations due to this link between competitive advantage and knowledge, in which it does not stop at trainings nor decision-making alone, but should be part of the organisational culture. It is necessary to facilitate employees in "identifying existing and accessible knowledge in order to transfer and tally this knowledge to solve specific tasks better, faster and cheaper" [1]. If perceived from the aspect of providing trainings alone, the performance of employees may not be significant because employees learn and re-learn in many ways to improve their existing knowledge [4], including through indirect coaching using communication tools while performing tasks based on projects.

Managing project knowledge requires reliable communication tools. The emergence of social media has contributed to the expansion of the communication tools including instant messaging services, when smartphone and mobile devices are enabled with messaging applications extended from the social networking tools. This results in the current trend of managing tasks and knowledge through information and communication technologies. Recent research looks into the usage of these current technologies for managing knowledge at operational level, such as usage of social network (e.g. Facebook™), social messaging application (e.g. WhatsApp™) and blog, among nurses, which benefit them better in problem solving tasks as compared to using email and intranet [1]. The instant messaging feature has become more real-time than before, complementing the purpose of managing tasks and knowledge on-the-go.

This paper refers to the advancement of mobile messaging applications that has emerged into a hybrid of social media and mobile applications, such as WhatsApp™, WeChat™, Telegram™, Facebook™ Messenger™ and Viber™, in which we refer to as 'social messaging (SM) applications'. Most research on social messaging (SM) is on teaching and learning among students and instructors [5-7]. Despite the vast scope in education research area, recent research has covered the usage of social messaging (SM) among managers, focusing on managing tasks and knowledge among them and how this leads to quick decision making [8, 9]. The current observation on the changing trend of technology usage for managing tasks and knowledge has found that SM applications (i.e. over mobile phones) are heavily used to make important decisions on-the-go. This results to the addiction of creating new SM groups every time a new team or special task force is formed, to ensure constant communication among the team members and to solve issues immediately. In other words, the SM availability and ease of use have caused the technology to be taken for granted.

With the advantage of viewing the communication patterns (e.g. for making quick decision and solving problem instantly) from the perspective of knowledge management (KM), it is believed that the KM concept can be used to investigate the communication patterns in the SM group environment and identify the KM patterns that emerge from these patterns. The purpose is to further understand and prove that KM processes exist in the virtual world for the official duties, as much as they happen in the education environment. In addition to that, in order to avoid lack of response and commitment in the SM group created, it is beneficial to know beforehand the expected participation of the project team members, hence the purpose of this research.

This paper uses the GUSC Model, which is established under the concept of personal knowledge management (PKM), as a tool to analyse these communication patterns. The focus is on three sample groups formed for the purpose of solving issues and making decisions on-the-go. It further proves the existence of KM patterns among members of the social messaging groups. These KM patterns are believed to lead to project knowledge within the management groups.

Having said this, the research question that need to be answered here is: "How to measure expected participation in social messaging application?" In answering this research question, the objectives of this study are:

- To identify the communication patterns in social messaging application groups;

- To identify the PKM processes exist in the communication patterns;
- To analyse the differences in terms of communication patterns among the organisational communication levels; and
- To analyse the differences in terms of participation expectation in communication through social messaging application groups.

## 2. Literature Review

Due to the scope of this research that is applying the concept of PKM model onto communication pattern over social messaging application, this section is separated into two major parts: Usage of Social Messaging Applications; and Personal Knowledge Management over Mobile Applications.

### *2.1 Usage of Social Messaging Applications*

Over time, there are changes in organisational communication: leaders tend to inspire, clarify their vision and motivate followers in achieving organisational goals rather than giving orders and instructions [10]. On another note, "communication is an essential aspect of leadership relationship" [11]. It is also suggested that effective performance, motivation, inspiration, understanding the vision and many more is a result from effective communication. A daily interaction and communication between leaders and organisational units leads to organisational effectiveness and leadership effectiveness as trust is the result from it [12].

Leaders' communication styles have an effect on how their management team members communicate as they need to match out with each other [13]. A strong leader may have a strong influence within organisation, which sometimes could prevent the management team members to share their views due to negative perception, and this would contribute to their inability to contribute good ideas. It is also noted that trust and close relationship within the management team could be promoted by informal communication, to motivate them to contribute ideas and views equally.

Budd and Velasquez [14] implied that a potential communication conflict could be avoided by applying openness and transparency in communication practices, as employees aware of the company's direction, the business strategies and the decision that has been made. For a company to achieve its competitive advantages, trustfulness and active communication from its members is needed to acquire knowledge from people involved in knowledge generation, since knowledge is the most valuable resource [15]. Employees are commonly categorised by socio-demographic and organisational variables, such as level of involvement and specific knowledge in specific area, to gain different types of information [15]. Looking at the need for knowledge sharing on top of having different sets of employees with different knowledge capabilities, it is important to set the aim for the organisation to improve organisational knowledge sharing, spread information across organisation in gaining active support from its members to achieve organisational goals, and promote active communication behaviour through appropriate communication tools [15].

Interactive communication channels and tools give employees opportunity to express themselves and encourage active communication behaviour among them [15]. With rapid communication technology support, it is noted that there are changes in communication patter within an organisation and between internal and external of the organisation, especially among those who are proficient in using new communication technology. There is a positive growing number of communication technology platform as additional tools for existing interaction modes [16]. Barrett [17] believed that a full range of communication skills and resources are needed to create and deliver messages as guidance, direction, and motivation to inspire actions from others.

Steinmueller [18] claimed that a new communication application enables organisation to gain more control, cooperation and coordination capabilities, as this technology enables them to become more flexible and gives a suitable reaction for unexpected occurrence events. Complementing this, Steele [19] noted that social media platform is more informative compared to communication platform in recent decades, which did not support one-to-many communication model. The recent communication model is group reception-focused that enables collective communication processes by using smartphone and mobile devices, such as tablets and tabs. It is also posited that compared to traditional communication process, advancement on social media networking and electronic communication tools are leading to a lower barrier of communication, not only supported by its richness and ubiquity but also mainly of its cost for communicating beyond geographical boundaries [19].

WhatsApp™, among other social messaging applications, is adopted largely by people around the world due to certain criteria: low cost; ability to send unlimited number of messages; immediacy; the desire it makes people feel to be part of the trend since everyone known to them has adopted its use; and capacity to conduct on-going conversation with multiple people simultaneously [20]. This suggestion is supported by Bouhnik and Deshen [21] who implied that the vast usage of WhatsApp™ compared to other social messaging services is due to its use that comes naturally to people of all ages, mainly adults and teenagers, in their daily lives. There is no need for training as it is an upgrade from the previous cousin, the short messaging system (SMS), with the hybrid of social networking features.

A recent research claimed that social media contributes to the relationship changes between organisations and customers, as well as within organisations and the way people communicate [22]. It is also noted that an Internet-based communication tools enable users to make a voice communication, personal messages and picture exchange activities in real-time without having to pay mobile carrier service provider, hence have changed users' way of communication.

Another recent research in Asia specifically mentioned the usage of WhatsApp™ in real patient management process environment. Choudhari [9] revealed that WhatsApp™ real-time chat is able to reduce time interval between the first recognition of any unexpected effect and starting the management, by implementing one-to-many communication, as well as redundant step of reporting system. This communication method also enables the unit members to detect problems occurrences in early stage and started the pre-management for each case.

On another case of WhatsApp™ usage, Church and Oliveira [20] revealed that WhatsApp™ enables its users to chat, do quick catch-ups, coordinate and organise, as well as share personal news and life events. It is also noted that WhatsApp™ is heavily use for planning and coordination of social interaction in real-time.

A recent research has proven the WhatsApp™ usage patterns, from a study on different levels of communication based on the organisational structure. Table 1 shows the summary of WhatsApp™ Usage, indicating similarities and differences between the upper level and lower level communications postulated from the study [23]. Among the identified similar usages are information sharing, notification and task delegation.

**Table 1**
WhatsApp™ Usage in Organisational Communication [23]

| WhatsApp™ Usage | Upper Level Communication | Lower Level Communication |
|---|---|---|
| Idea sharing | Yes | No |
| Group work motivation | Yes | No |
| Information sharing | Yes | Yes |
| Notification | Yes | Yes |
| Task delegation | Yes | Yes |
| Clarification | No | Yes |
| Alert | No | Yes |
| Follow up | No | Yes |

### *2.2 Personal Knowledge Management over Mobile Applications*

Personal knowledge management (PKM) is an area under knowledge management (KM), focusing on how knowledge workers manage knowledge at personal or individual level in general and how they manage knowledge over computer and Internet technologies [24-30]. Despite these various models, one model emerged to be applicable to software agent technology [30], namely GUSC Model, which is found suitable to be adopted in this research.

In Malaysia, it is proven that PKM exists through a pattern of sharing and managing knowledge among knowledge workers over mobile devices, particularly in managing team or group during project development and implementation [31,32]. The Get-Understand-Share-Connect (GUSC) Model was validated to outline this pattern [30], and it was suggested that the study of PKM model is expanded to the task of decision-making among managers, also found to exist over the usage of mobile applications.

The GUSC Model [30] is focused on PKM aspect, particularly in the Malaysian working environment, and it supports the trend of communication and interactions over social media and Web 2.0. The processes introduced in GUSC are found to be in similar nature as the renowned SECI Model, a KM model proposed by Nonaka and Takeuchi in 1995 [32], which stated the processes of knowledge transfer and conversion between explicit and tacit forms.

Result from Ismail and Ahmad [8] has shown that the GUSC Model is applicable to other situations and environments, even though it is originally designed to support agent-mediated PKM. Nevertheless, knowledge workers who are connected to each other via the social messaging group still appear to perform the GUSC processes differently among the members, mostly due to the authority, seniority and necessity, and this finding is summarised as follows [8]:

- *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; and
- *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.

Significant findings from the same research proved the existence of observers and non-observers, especially on the social messaging group. Unlike the observers who may hoard knowledge when they get and understand it, instead of sharing it, the non-observers are described as follows:

> *"This non-observer does not 'follow' any interactions occurring over the mobile apps [i.e. social messaging application] 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." [8]*

Despite the interesting findings, the features of a current technology 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) [32]. Extending this, project knowledge could be measured by analysing the PKM processes, using measurement scoresheet and formulas on GUSC weightage calculations. It is suggested that the GUSC percentages on each element under investigation (for this case, communication pattern) and on the overall project [33]. This measurement would provide an information on knowledge health of a project, which is common in project management status report that has common criteria including time, cost, resources, scope, quality and actions [34]. "It is recommended that project knowledge could be included as one of the criteria, to gauge the project health as well" [33]. It is to ensure the retention of the knowledge within the project and organisation, in mitigating knowledge loss when a project member decides to leave the team.

In defining further, 'project knowledge' includes relevant information and knowledge on projects, which members of a project team specifically need to access, retrieve, understand, and share among them, to better execute and implement the project or tasks that they are assigned to do. It is a term often used in construction industry, due to the importance of knowledge based on projects among project team members, since "projects face specific challenges and the reduction of project risk, time and cost through knowledge management, may well prove worthwhile" [35]. "The ability to manage the knowledge generated from the projects not only can help to prevent the 'reinvention of the wheel' and the repetition of similar mistakes, but also serve as the basis for innovation, overall improvement and sustaining competitive advantage [36]. It is more crucial to manage project knowledge to avoid knowledge loss when the project team splits up or team members move to another project after the completion of one project.

This pattern is similar with other industries and organisations, including information technology and other organisations that often have special task forces formed for particular purposes. Adapted from Turbit [33], project health is the condition or status of a project, in which certain criteria could be monitored and reported. Related to the concept of knowledge management, 'project health' can provide an insight to what is going on in a project, and whether the project is doing well or not.

## 3. Research Settings

This study examined the social messaging (SM) application groups of the three significant teams existed in a case organisation, and performed content analysis on the scripts to analyse unstructured text content. Specifically (as mentioned in the Introduction), this study attempts to identify the

communication patterns in SM application groups, and the PKM processes exist in the communication patterns; and analyse the differences in terms of communication patterns among the organisational communication levels, and the differences in terms of participation expectation in communication through SM application groups.

This research is conducted on a case organisation, in which education management is the core business. As the norm of the working culture in this organisation, a social messaging (SM) application group (i.e. WhatsApp™ group) is created for almost all existing groups or teams formed in real world. Example of groups include: sections/departments with members comprise of academicians and administrative staff; special task forces, formed by members from cross-section/department; and management team. For this research, we have selected three social messaging groups (as shown in Table 2) that possess certain criteria: the groups are formed for constant communication across section/department and institutes, especially in solving ad hoc issues and for making decision on-the-go.

**Table 2**
Research Settings of the Three Case Groups

| Social Messaging Group | Organisational Structure | Number of Members | Duration of Group Formation |
|---|---|---|---|
| MGT: Management Team | Top level and middle level management of a faculty | 14 members (the number changes according to restructure practice) | As long as the leader of the group still exist in the team |
| MMC: Middle Management Committee | Middle level and significant middle-low level management of a sector in a faculty | 23 members (the number changes according to restructure practice) | As long as the leader of the group still exist in the team |
| STF: Special Task Force | Top level, middle level and significant middle-low level management of various faculties, centres, boards and sections in main campus | 31 active participants (the rest of possibly existing members are idle and untraceable) | Temporary, only 2 weeks, for preparation and implementation of an important audit event |

In general, this research followed the thematic synthesis methodology. Thematic synthesis, or also known as thematic analysis, consists of three stages that may overlap with each other up to certain degrees: the free line-by-line coding of the findings of primary study; the organisation of the 'free codes' into related areas to construct 'descriptive' themes; and the development of 'analytical' themes [37]. Referring to the research question and the objectives mentioned in the Introduction, thematic analysis is used to identify the occurrence of communication patterns (as shown in Table 1). Each script extracted from the SM group would have many scenarios that show these communication patterns, based on the issues or topics being discussed at different duration of time throughout the usage of the SM group. Scenarios with clear representation of communication patterns would be chosen during the identification process.

Breaking this process down stage by stage, the conversation of the SM groups is first transcribed, coded and analysed line-by-line in order to extract the communication patterns. Instead of coding the participants, themes and line of entries in a common content analysis practice as conducted in our recent research, we looked at the overall view of the contents and extract significant line of entries that show communication patterns related to our research question. These extractions of data are considered as scenarios that occurred when certain important decision had to be made during the time the members were at remote locations, and when certain important information

needed to be updated for the benefit of making certain decision on-the-go. These scenarios are coded with descriptive themes as suggested by Jamaludin and Hussain [23] on WhatsApp™ usage by upper and lower levels of communication.

This is followed by the second stage, in which the communication patterns, i.e. WhatsApp™ usage, are further analysed line-by-line to describe the communication purpose of each entry. Among the examples are motivating, agreeing, updating progress, sharing information, giving opinion, and expressing concern. These descriptive themes provide the guide for the next stage.

The descriptive themes are then transcribed in the third stage, to tag the GUSC processes (i.e. PKM processes) that are perceived happened during each entry of online conversation. These findings are supported by literature, in order to verify and validate the tagged data. The analysis is then tabulated in a form of graphical data for better illustration and discussion.

## 4. Data Analysis

From the qualitative data analysis, the results are quantified and presented here in numerical and graphical view, based on three levels of view: scenarios identification; communication patterns; and PKM processes. (As described in the previous section, a scenario is a part of the raw script, which represents a communication pattern within a period of time. Script, on the other hand, is the raw text consists of time stamp and conversation that happened in the SM group. The script is extracted from the SM group, and the scenario is extracted from the script.)

### *4.1 Scenarios Identification*

A number of significant scenarios are identified from the three case groups, as shown in Table 3. The scripts from these scenarios are extracted from the raw data (full scripts) for further analysis. Table 3 shows two scenarios of data extracted from the MGT group and coded as MGT001 and MGT002, six scenarios extracted from MMC group and coded from MMC001 to MMC006, and eight scenarios extracted from STF group and coded from STF001 to STF008.

As presented in Table 3, only two significant scenarios are identified from 11,104 entries in MGT script, six significant scenarios are identified from 1,561 entries of MMC script, and eight significant scenarios are identified from 624 entries of STF script. Despite the large number of entries retrieved from MGT script, the number of scenarios extraction is the least among the three groups due to the confidentiality of the data. Furthermore, the scenarios are mostly scattered across the script, hence leaving this research with only two prominent scenarios that nicely located. As for the STF script, the small number of entries is due to the short duration of time the WhatsApp™ group was created, which is only two weeks, during the preparation and running of an audit event. Nevertheless, the entries are abundant in STF script, compared to the previous two.

### *4.2 SM Application Usage versus PKM Processes*

After two stages of analysis, the result of SM application usage (i.e. WhatsApp™ usage) is tabulated with the GUSC processes. The weightage of the G, U, S and C processes were measured based on the number of their occurrence in each entry of the scenarios. As postulated in literature, high percentage of sharing knowledge process is aligned with the purpose of using the SM application in the first place, whereas high percentage in connecting to knowledge source is the reason why the SM application is used in the first place.

**Table 3**
Scenarios Identification for the Three Case Groups

| Social Messaging Group | Scenario Code | Number of Entries | Number of Active Members | Duration of Scenario |
|---|---|---|---|---|
| MGT | MGT001 | 27 entries (line 4180 – 4206) | 7 | 61 minutes (10:31AM – 11:32AM) |
| | MGT002 | 33 entries (line 7833 – 7865) | 8 | 74 minutes (7:40AM – 8:54AM) |
| MMC | MMC001 | 17 entries (line 24 – line 40) | 8 | 119 minutes (9:03AM – 11:02AM) |
| | MMC002 | 56 entries (line 194 – line 249) | 5 | 346 minutes (3:48PM – 9:34PM) |
| | MMC003 | 12 entries (line 259 – line 270) | 3 | 6 minutes (4:15PM – 4:21PM) |
| | MMC004 | 15 entries (line 326 – line 340) | 3 | 172 minutes (5:15PM – 8:23PM) |
| | MMC005 | 14 entries (line 398 – line 411) | 3 | 582 minutes (9:37PM – 7:19AM) |
| | MMC006 | 23 entries (line 418 – line 440) | 2 | 47 minutes (1:32PM – 2:19PM) |
| STF | STF001 | 3 entries (line 5 – line 7) | 1 | 2 minutes (5:40PM-5:42PM) |
| | STF002 | 7 entries (line 80 – line 86) | 6 | 30 minutes (7:24AM – 7:54AM) |
| | STF003 | 26 entries (line 89 – line 114) | 7 | 200 minutes (8:23AM – 11:43AM) |
| | STF004 | 11 entries (line 165 – line 175) | 4 | 17 minutes (8:10AM – 8:27AM) |
| | STF005 | 47 entries (line 361 – line 407) | 6 | 93 minutes (9:58AM – 11:31AM) |
| | STF006 | 3 entries (line 418 – line 420) | 1 | 4 minutes (12:14PM – 12:18PM) |
| | STF007 | 9 entries (line 482 – line 490) | 4 | 25 minutes (5:17PM – 5:42PM) |
| | STF008 | 27 entries (line 491 – line 517) | 19 | 160 minutes (5:54PM – 8:34PM) |

Table 4 shows the result of the GUSC patterns in each WhatsApp™ usage. As listed, the WhatsApp™ usage is found aligned with the findings in previous research by Jamaludin and Hussain [23]: idea sharing exists in upper level communication; clarification, alert and follow up exist in lower level communication; and the rest exist in both levels of communication.

Table 5 shows the PKM processes mapping on SM application usage, with GUSC weightage assigned as equal for all communication patterns, giving the total GUSC weight as 8.00. This table is derived from Table 4, with the weightage of the GUSC processes being calculated by taking the average of the occurrences for each communication pattern (i.e. WhatsApp™ usage). For example, in idea sharing (as shown in Table 5), an average of 0.16 (16%) of Get process is found occurred in the two identified scenarios, and this is followed by 0.16 (16%) for Understand process, 0.36 (36%) for Share process, and 0.32 (32%) for Connect process. Due to the format of a weightage system, the value for GUSC processes is translated from percentage (in Table 4) to weightage (in Table 5).

**Table 4**
SM Application Usage versus PKM Processes

| Scenario Code(s) | WhatsApp™ Usage | PKM Processes (%) | | | |
|---|---|---|---|---|---|
| | | G | U | S | C |
| MGT001 | Idea sharing | 11.11 | 11.11 | 100.00 | 33.33 |
| MGT002 | Idea Sharing | 21.21 | 21.21 | 100.00 | 30.30 |
| MMC001 | Clarification | 11.76 | 11.76 | 100.00 | 23.53 |
| MMC002 | Notification | 12.50 | 12.50 | 94.64 | 48.21 |
| MMC003 | Clarification | 16.67 | 16.67 | 100.00 | 16.67 |
| MMC004 | Notification | 20.00 | 20.00 | 93.33 | 46.67 |
| MMC005 | Clarification | 14.29 | 14.29 | 100.00 | 14.29 |
| MMC006 | Information Sharing | 13.04 | 13.04 | 100.00 | 13.04 |
| STF001 | Task Delegation | 33.33 | 33.33 | 100.00 | 33.33 |
| STF002 | Group Work Motivation | 0.00 | 0.00 | 100.00 | 71.43 |
| STF003 | Alert | 30.77 | 30.77 | 100.00 | 30.77 |
| STF004 | Information Sharing | 18.18 | 18.18 | 90.91 | 45.45 |
| STF005 | Follow Up | 21.28 | 21.28 | 100.00 | 27.66 |
| STF006 | Information Sharing | 33.33 | 33.33 | 100.00 | 33.33 |
| STF007 | Notification | 22.22 | 22.22 | 100.00 | 11.11 |
| STF008 | Group Work Motivation | 16.67 | 16.67 | 100.00 | 75.00 |

**Table 5**
PKM Processes Mapping on SM Application Usage

| Scenario Code(s) | WhatsApp™ Usage | Total Weight | PKM Processes Mapping (Weightage) | | | |
|---|---|---|---|---|---|---|
| | | | G | U | S | C |
| MGT001<br>MGT002 | Idea sharing | 1.00 | 0.16 | 0.16 | 0.36 | 0.32 |
| MMC001<br>MMC003<br>MMC005 | Clarification | 1.00 | 0.14 | 0.14 | 0.53 | 0.18 |
| MMC002<br>MMC004<br>STF007 | Notification | 1.00 | 0.18 | 0.18 | 0.28 | 0.35 |
| MMC006<br>STF004<br>STF006 | Information sharing | 1.00 | 0.22 | 0.22 | 0.26 | 0.31 |
| STF001 | Task delegation | 1.00 | 0.22 | 0.22 | 0.34 | 0.22 |
| STF002<br>STF008 | Group work motivation | 1.00 | 0.08 | 0.08 | 0.10 | 0.73 |
| STF003 | Alert | 1.00 | 0.31 | 0.31 | 0.08 | 0.31 |
| STF005 | Follow up | 1.00 | 0.21 | 0.21 | 0.30 | 0.28 |
| Total Weightage | | 8.00 | 1.53 | 1.53 | 2.25 | 2.70 |

It is necessary to make some adjustment on the scoresheet for the PKM processes mapping on organisational communication patterns (as shown in Table 6), to ensure that the total organisational GUSC weightage is 10.00 instead of the initial total of 8.00 (shown in Table 5). This is done by leveling all communication patterns, resulting to having a weightage of 1.70 for idea sharing and group work motivation, whereas the rest of the patterns are of equal 1.10 weightage. With the adjustment made on the GUSC weightage, the PKM processes mapping of each G, U, S and C are also adjusted accordingly.

**Table 6**
PKM Processes Mapping on Organisational Communication Patterns

| Communication Pattern | Organisational GUSC Weightage | Adjusted PKM Processes Mapping (Weightage) | | | |
|---|---|---|---|---|---|
| | | G | U | S | C |
| Idea Sharing | 1.70 | 0.17 | 0.34 | 0.68 | 0.51 |
| Clarification | 1.10 | 0.11 | 0.11 | 0.72 | 0.17 |
| Notification | 1.10 | 0.17 | 0.17 | 0.39 | 0.39 |
| Information sharing | 1.10 | 0.11 | 0.11 | 0.50 | 0.39 |
| Task delegation | 1.10 | 0.33 | 0.33 | 0.11 | 0.33 |
| Group work motivation | 1.70 | 0.17 | 0.17 | 0.17 | 1.19 |
| Alert | 1.10 | 0.33 | 0.33 | 0.11 | 0.33 |
| Follow up | 1.10 | 0.22 | 0.22 | 0.44 | 0.22 |
| Total Weight | 10.00 | 1.61 | 1.78 | 3.11 | 3.52 |

In general, Connect receives a high weightage compared to Get, Understand and Share. Nevertheless, Shared by far receives higher weightage than Get and Understand, leaving a big gap between them (i.e. 1.5 compared to Get, and 1.33 compared to Understand). This is due to the fact that Get can only be measured or assumed happen if the member responds stating that he or she acknowledged the information given. On the other hand, Understand is a process that relates highly to tacit knowledge, and can only be assumed happen when the member responds either in question or statement to verify what he or she has understood from an information shared.

## 5. Results and Discussion

In further analysing the data to achieve the third and fourth objectives, this study looks into members' participation in SM application. This analysis takes into account the total number of members who are active in respective communication patterns in each group. The participation percentage is based on the number of group members who participated or communicated in the SM group (shown as 'active members' in Table 7) divided by the total number of members in the group (shown as 'total number of members' in Table 7). For example, the members' participation in MGT001 for idea sharing is 7 divided by 14, giving the result of 50 percent (50.00%).

As shown in Table 7, a higher percentage of active participation is seen among members in management group or upper level communication (i.e. 50.00% and 57.14% for idea sharing), even though the total number of members in the group is the smallest of the three. This shows commitment among the members of the management team, in which each response is deem important to them. This could also be due to the distance among the members at that particular time, because members of this group are usually dispersed, attending to each focus roles and responsibilities.

The lowest participation (shown in Table 7) is for information sharing and task delegation in special task force group (i.e. 3.23% for each pattern), even though the total number of members are the largest among the three groups. The lowest percentage is possibly due to the inability to trace any response from the communication patterns after the information is shared or the task is delegated. Members preferred to keep silent instead of acknowledging that they have received the message. On another note, the members could be physically near to each other and could verify or acknowledge the receipt of information personally instead of via mobile phone. This is contrast to the disperse proximity of members in the upper level communication group.

From Table 7, the expectation of members' participation in communication through SM application groups could be determined by summarising the participation rate for the same

WhatsApp™ usage (i.e. communication patterns). In other words, the average value of the participation percentage is calculated to derive the participation expectation value. As an example, for idea sharing, the average between 50 percent (50.00%) participation for MGT001 and 57.14 percent (57.14%) participation for MGT002 is 53.57 percent (53.57%).

**Table 7**
Members' Participation in SM Application

| Scenario Code | WhatsApp™ Usage | Active Members | Total number of Members | Participation (%) |
|---|---|---|---|---|
| MGT001[a] | Idea sharing | 7 | 14 | 50.00% |
| MGT002[a] | Idea sharing | 8 | 14 | 57.14% |
| MMC001[b] | Clarification | 8 | 23 | 34.78% |
| MMC002[b] | Notification | 5 | 23 | 21.74% |
| MMC003[b] | Clarification | 3 | 23 | 13.04% |
| MMC004[b] | Notification | 3 | 23 | 13.04% |
| MMC005[b] | Clarification | 3 | 23 | 13.04% |
| MMC006[b] | Information sharing | 2 | 23 | 8.70% |
| STF001[c] | Task delegation | 1 | 31 | 3.23% |
| STF002[c] | Group work motivation | 6 | 31 | 19.35% |
| STF003[c] | Alert | 7 | 31 | 22.58% |
| STF004[c] | Information sharing | 4 | 31 | 12.90% |
| STF005[c] | Follow up | 6 | 31 | 19.35% |
| STF006[c] | Information sharing | 1 | 31 | 3.23% |
| STF007[c] | Notification | 4 | 31 | 12.90% |
| STF008[c] | Group work motivation | 19 | 31 | 61.29% |

[a] Members are from management team (i.e. top level and middle level of organisational structure), with 14 members registered

[b] Members are from middle management committee (i.e. middle level and significant middle-low level management of a sector), with 23 members registered

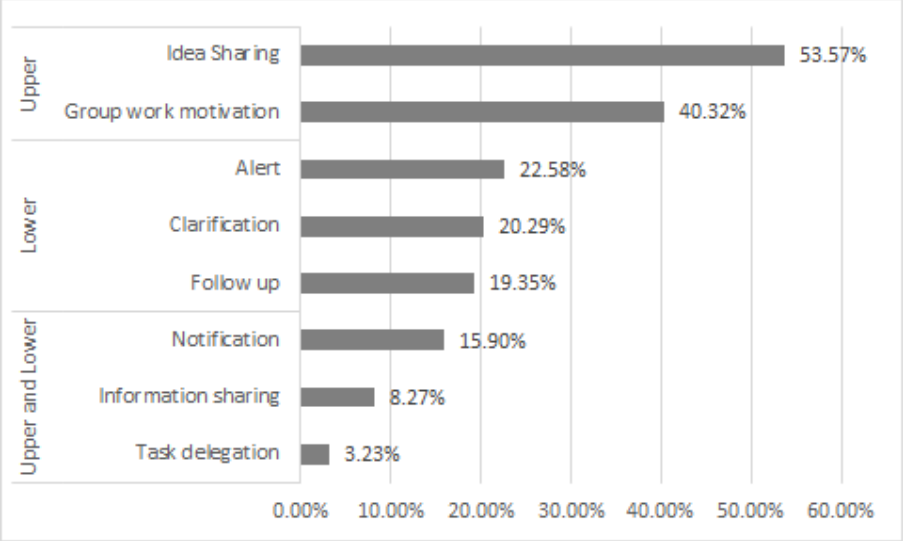
[c] Members are from special task force (i.e. top level, middle level and significant middle-low level management of various branches, centres, departments and sections), with overall 31 active participants since the rest of the registered members are idle and untraceable

Figure 1 shows this result, with prominent high percentages on participation expectation for idea sharing (53.57%) and group work motivation (40.32%) among upper level communication members, with members less than 15. The least percentages are for participation in task delegation (3.23%) and information sharing (8.27%), with members consist of a mixture of upper and lower level employees, with the most number of registered members (i.e. 31 active members).

In general, Figure 1 provides a guideline on participation expectation for knowledge workers before forming SM application group, which would estimate the possibility of ensuring that project knowledge will be in good health. Participation is important in ensuring that the knowledge is shared and received on time within the confinement of project groups. This is supported by a relatively high percentage of alert usage of WhatsApp™ (22.58%) among lower level communication.

The data is sorted according to percentage levels in Figure 1, showing that a mix of upper and lower levels in communication has caused less participation. The gap between the upper and lower levels are obviously seen in communication patterns over SM application, as how it would be in real life situation. Therefore, SM application group initiator may need to reconsider the purpose of forming the virtual group before mixing the members in one.

Deriving from these results, this paper suggests a range for each communication level of participation expectation, as shown in Figure 2 for clearer overview. The range for upper level communication is wider than the rest of the levels (from 35.01% to 80.00%), showing high commitment in retaining the project knowledge within SM application groups. As for the lower level communication, the range is quite narrow (from 19.01% to 35.00%), but still higher than the mix of upper and lower level communication (from 0.01% to 19.00%). The commitment to retain project knowledge by lower level communication is still higher than the commitment expected from the mix of upper and lower levels.




Upper: Members are from management team (i.e. MGT); Lower: Members are from middle management committee (i.e. MMC); Upper and Lower: Members are from special task force (i.e. STF)

**Fig. 1.** Participation Expectation for Communication Patterns in WhatsApp™ Usage

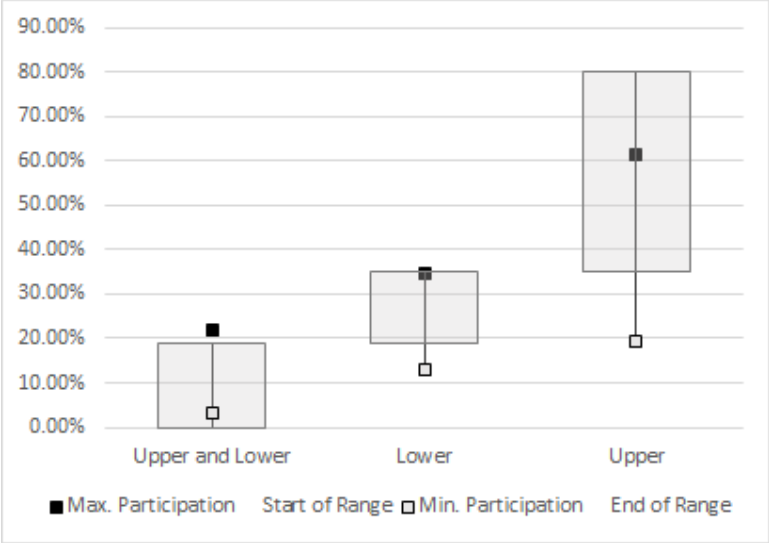



**Fig. 2.** Suggested Range for Each Communication Level of Participation Expectation

Table 8 shows the detail of the data in Figure 2. The minimum and maximum participation percentages are derived from Table 7, based on the percentages for each communication level, regardless of communication patterns. This results to an overlap between ranges if the minimum and maximum participation percentage are taken blindly. Hence the adjustment made in Figure 2, to reduce or avoid the overlaps. This means that the upper level communication could start at minimum 19.35 percent (19.35%) instead of 35.01 percent (35.01%), but for a better view and guideline, it is suggested to be at 35.01 percent (35.01%).

**Table 8**
Suggested Range for Participation Expectation

| Communication Level | Minimum Participation | Maximum Participation | Start of Range | End of Range |
|---|---|---|---|---|
| Upper and Lower | 3.23% | 21.74% | 0.01% | 19.00% |
| Lower | 13.04% | 34.78% | 19.01% | 35.00% |
| Upper | 19.35% | 61.29% | 35.01% | 80.00% |

## 6. Conclusion and Recommendations

This research has successfully presented data analysis from qualitative method to quantitative information, and has proven that GUSC processes exist in the communication pattern or usage within the virtual environment of social messaging application, especially in groups of managers and members who could contribute to decision-making. It also summarizes the contributions of significant knowledge workers within the virtual group, which further proves the performance of GUSC patterns based on the need of the situation as well as the roles and responsibilities of the group members, during an important scenarios when their share of knowledge is needed.

This paper provides a method of structuring the communication content, which current communication channels (e.g. email, SMS) lack of. On top of proving the existence of KM in current technology usage, this research outcome also complements the previous research on decision-making over mobile applications, in which the same concept of GUSC is used. In addition to this, it also expands the research done in 2015 on SM application usage, by tabulating the GUSC processes against the usage to further prove the KM existence among managers and knowledge workers.

Guidelines on participation expectation among members are also provided in this paper, which suggests that social media application group is highly recommended to be used for upper level communication more than for the lower level communication (as shown in Figure 2). It is not very suitable to have a mixture of members from both upper level and lower level in one virtual group, unless the purpose of forming the group is highly necessary. The percentage of participation shown in Table 8 based on communication patterns can be used as guidance too, in considering the purpose of forming the SM application group.

There is still room for improvement, since it is quite a challenge to retrieve raw data of social messaging conversations with the required patterns, especially when the conversation consists of private and confidential data or information, such as those exchanged during conversation among the members of upper level communication. Nevertheless, it is still possible to briefly analyse the transcripts derived from social messaging conversations and compare them across different cases and scenarios of the created groups.

At the end of the day, the results from the communication usage patterns should meet the original purpose of forming the virtual group, hence providing a proof that the key performance index of the group members is achieved, as the collective knowledge is construed and project knowledge health is in check. The key performance index (KPI) of a project can also be measured based on this,

since the project knowledge participation can be gauged to reflect the performance of the group projects using the method presented in this research. This measurement would provide an information on knowledge health of a project, which is common in project management status report [34]. Nevertheless, the purpose of forming the virtual group, i.e. based on the communication patterns, should be clearly planned and communicated to the team members to ensure full participation.

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