THE INFLUENCE OF VIRTUAL COMMUNICATION TOWARDS RESPONSIVENESS IN MANUFACTURING COMMUNITY

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ABSTRACT

With the rapid development of Information Communication Technology, many types of virtual communication channels are available to the employees. Email has been commonly used by the manufacturing community for virtual communication due to disparity of locations and time constraint. Responsive delivery of job with short cycle time requires zero waste information flow. Therefore, effective communication is essential for time-based job performance to keep a manufacturing company competitive. Additionally, effective communication has the mediating influence in the relationship between job satisfaction and behavioural intentions towards job accomplishment. Therefore, the relationship of communication satisfaction and job performance is crucial and need to be investigated. This experimental study was conducted to examine the responsiveness of job performance induced with time pressure by using email communication. Results show that email is a moderately effective communication channel for assigning job to a group of virtual workers, in some cases for repetitive and organized jobs that could not be completed within 24 hours. Quantitative analysis was also conducted to measure satisfaction level of communication using email as perceived by virtual workers towards performance of completed job. The relatively high in perceived communication satisfaction showed that email is effective in collaborative aspects of work. The communication satisfaction factors of communication climate and relation with superior could be enhanced by the organization in order to increase employees' job performance.

Keyword: virtual communication, email, responsiveness, job performance, communication satisfaction.

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CHAPTER 1: INTRODUCTION

1.1 Introduction to the Study

Statistically reported by Department of Statistics Malaysia, there are total 1,020,265 employees engaged in the Manufacturing sector in December 2012. As compare to December 2011, the number of employees increased by 16,339 persons year-on-year basis. Based on the Malaysia Standard Industrial Classification 2000, there are total of 197 industries in the Manufacturing Sector. The three major contributors of the manufacturing groups to the gross output in 2009 were manufacture of refined petroleum products; manufacture of vegetable and animal oils and fats; and manufacture of electronic components and boards. Collectively, these three groups accounted for more than one-third of the gross output. However, the manufacture of electronic components and boards industry accounted for the highest number of employees totaling 183,579 persons or 10.8% in 2009.

According to SME Corp Malaysia, the annual sales turnover or number of full-time employees classified the small and medium enterprise in each of the respective sectors. In manufacturing, manufacturing-related services and agro-based industries classify micro-enterprise has less than 5 employees whereas for small and medium enterprise having the employees between 5 to 50, and 51 to 150 respectively. Meanwhile, a medium or large Malaysian company is defined as a business entity with an annual sales turnover of more than RM10 million or more than 50 full-time employees. There were a total of 30,607 companies in Malaysia as reported in 2009. Statistically, 24,992 companies employed 50 employees and below which accounted for 81.6%, whereas their contribution to gross output and total employment was only 6.1% and 15.4% respectively. On the contrary, the only 2,169 large companies with 151 workers and above contributed to 77.4% of gross output and 66.9% of total employment respectively.

Many large companies setup its manufacturing plant in other countries which has lower cost in labors while ensuring the quality of its products. Therefore, these firms adopted the use of electronic network in communication media such as electronic mail to tighten the organizational linkages due to dispersed in location, time zone and cultures. The use of electronic network believed to increase personal and organization productivity in intra organizational coordination (White, 1986).

The production system in a manufacturing plant refers to the gather of inputs such as raw material and information, to be process or reprocess the inputs, and finally deliver the marketable outputs which term as goods. In the manufacturing environment, every employee interacts with one another in order to contributing to the success of organizational goals. The workforce in a large manufacturing entity, especially multinational based company has more than 150 of employees. These manufacturing plants may be located in different countries or areas, affected by different time zones and cultures. Typically, the organization is structured into departments for management, which consists of main and supporting functional. For examples, the main department refers to production department which responsible to produce or assembly the end products to its customers. The supporting department consists of Information Technology department which develop and provide the infrastructure for information technology system to support daily operation. Besides that, Quality Management department is responsible to monitor and implement the quality assurance policies and others. Structurally, each department may establish different sets of mission and goals which usually being measured and monitored using key performance indicators. In order to achieve the targets of the organizational goals, it is crucial and important that these employees from each department to be integrated and communicate closely.

The communication process is crucial in determining the effectiveness of an organization. The increase pace of business limits the time available for discussion and execution. Additionally, the separation of workplace and work time added the complexity in the communication process. This creates problems in achieving the consensus among the members due to lack of accuracy and quality in communication. Most of the large manufacturing companies invest in Information System such as Enterprise Resource Planning system and Supply Chain Management system. This software is expensive and complexity in development and maintenance. However, this Information System integrates, interconnects, incorporates and synchronizes the processes in the organization to achieve the best communication channel for information flow. Therefore, responsiveness is one of the capabilities in an agile organization in order to response better to changes taking place in its business environment. It refers to the ability of a company to gather information from its environment, to identify changes and respond quickly to them reactively or proactively, and recover from them (Sharifi and Zhang, 1999). Besides that, Mason-Jones and Towill (1999) define "zero waste total cycle time" and "zero waste information flow" are the prerequisites that enable responsiveness. In the concept of responsiveness by Huang and Nof (1999), the Information Communication Technologies played important roles in speeding up activities, providing intelligent and autonomous decision-making processes, and enabling distributing operations with collaboration.

The work performed by groups belongs to each department involves diverse goals and tasks. Thus, the time constraints to meet the tasks deadline often leading to work pressure among employees. The time pressure indicates that the time constraint induces some feeling of stress and creates a need to cope with the limited time

(Ordonez and Benson, 1997). Gibson and Cohen (2003) revealed that the ways of operating and time management in group work have been strongly influenced by information and communication technologies. The development and advancement of information and technology has created a new way for managing corporate communication processes. The Internet provides new communication possibilities and significantly increases the speed of information exchange. With the new opportunity and challenges given using virtual communication, this enables the employees who are geographically remote from one another to be connected within and even between organizations. Conceptually, virtual communication can be realized using computer mediated, which can be an automated type of communication technology.

There are many ways of communication, such as face-to-face, letter writing, telephone, electronic mail, networked video conference and others. Numbers of studies show that communication was less efficient in virtual than in face-to-face teams (McGrath and Hollingshead, 1994; Straus, 1996). Besides that, Olson and Olson (2003) indicate that there was difficulty for team members to aware the presence of each other virtually. On the other hand, there were studies revealed that communication virtually reflects better performance than face-to-face teams (Maznewski and Chudoba, 2000). However, these appear to suggest that there are no differences between the way of communication in face-to-face and virtual among team members.

With the use of virtual communication channels for information flow, the control mechanisms on the work processes and communication effectiveness are crucial. Electronic mail or email is one of the commonly used virtual communication channel in manufacturing environment due to its advantages such as universal

platform, cost effective, generally accessible and easily learned and used. In order to communicate effectively via email, some researchers suggests that "one email message, one appropriate subject heading, one message". The significant feature of email is that both sender and recipient can control the timing of their portion of the communication (Kettinger and Grover, 1997). This is an important issue in timely responsiveness in manufacturing environment via virtually.

1.2 Background of the Problem

Usually, multinational company sets its manufacturing facilities at different location across the world. Thus, the employees need to work closely with one another even though located in different countries, time zone and cultures. The separation of these employees within an organization has formed the virtual workforce. Curseu and Wessel (2005) defined a virtual team is a "collection of individuals who are geographically and/ or organizationally or otherwise dispersed and who collaborate, using varying degrees of communication and information technologies in order to accomplish a specific goal". The definition of virtual is not dominated by the location of the team members, but in the extent that the members mainly relies on technology in order to communicate, coordinate and execute team processes. The level of virtual communication is affected by the degree of synchronization, the presence of nonverbal and para-verbal cues, and the extent of use of communication media (Baltes et al., 2002).

Cost issues and process responsiveness are the challenges faced by the manufacturing company nowadays. The management continuously focuses on effective ways to speed up responsiveness of task in order to increase its profit margin and productivity output. In reality, these processes are complexity in its nature, as the activities for execution are connected in many sequences, levels, departments and organizations. The availability of Information Communication

Technologies played important roles in speeding up activities, providing intelligent and autonomous decision-making processes, and enabling distributing operations with collaboration.

To maximize the profitability and output productivity, the manufacturing strategically operates 24 hours continuously. Therefore, the number of workforce for large company may have more than thousands of employees to support the 24 hours operation. According to the labor law in Malaysia, the maximum daily allowable work duration is 12 hours for shift work in Section 60C (2) of Employment Act, 1955. In order to comply with the law, the working shift pattern been set up to fit the capacity of the assembly line.

The worker's relationship with work is gradually changing from the need to responding to the unexpected and the increasing complexity of the environments. Furthermore, time pressure incurred into the work process. Teamwork involves interaction with other team members in the group, with whom the individual interdependent to complete a tasks. Thompson (1967) treated task interdependence as the product of technological requirements. Thus, the instructions and the context of task performance are capable to affecting the degree of interdependence between the members of a team. With the availability of communication technologies, it serves as the bond linking the members by allowing them to communicate and share data and information despite disparities in location and time zone.

The media richness theory is one of the most frequently used to explain that different communication media use in organizations can affect task performance. Communication media differ in richness where task performance improved when employees use richer media for equivocal tasks and leaner media for unequivocal tasks (Daft and Lengel, 1986; Daft et al., 1987). Under time pressure, groups need

media that fit the richness of the task. Commonly, time pressure creates problems in sharing information between team members and in achieving team consensus. Besides that, the need for speed often neglected the examining alternatives and added difficulty in achieving acceptance of team decision during time pressure situation. Email should provide less satisfaction because the media is poor in transmitting the information requirements of the task. Besides that, the performance of task relies on the level of interdependence of task and the type of using synchronous or asynchronous communication systems. Rico and Cohen (2005) proved that synchrony in the communication technology is positively correlated to team performance for high task interdependent teams.

Asynchronous tools enable communication and collaboration over a period of time through a "different time-different place" mode. These tools allow people to connect together at each person's own convenience and own schedule. Asynchronous tools are useful for sustaining dialogue and collaboration over a period of time and providing people with resources and information that are instantly accessible, day or night. Email is one of the asynchronous communications which is useful for one-to-one or one-to-many communication. On the other hand, email may be misused as a "collaboration tool" and become overwhelming. Besides that, email communication posses a number problem due to the difficulty of eliciting social cues and constructing the kind of relational ties that smooth interaction (McGrath, 1990; Warkentin et al., 1997; Maznewski and Chudoba, 2000). However, McGrath (1984) showed that virtual teams using asynchronous communication perform better than face-to-face teams in generation tasks.

In manufacturing floor space, the employees work virtually due to disparity of location, building and working time frame. Thus, there is a need for the employees

to be connected for information flow and the influential of time pressure. Generally, the employees will communicate face-to-face, but the absent of the receiver party disallowed this way of communication in many time in a plant. Alternatively, one of the virtual communication channels being used in manufacturing is electronic mail to linking its employees. With the information flow in this way, both sender and recipient can control the timing of their portion of the communication. However, the responsiveness of work process to complete a task by a group of workers needs to be measured. There is a need to determine whether email has the capable to achieve desired task performance in the time pressure situation with the adequate perceived level of media richness and asynchronous type of communication.

Amparo et al. (2005) showed that group working in the face-to-face condition under time pressure present the lowest process satisfaction compared to email and video-conferencing. However, there is no difference detected in process satisfaction between groups working mediated by email and video conferencing. Besides that, several researchers found that despite a lack of differences in performance quality, groups using new information technology were less satisfied with the process and the outcomes than face-to-face groups (Hollingshead et al., 1993; Straus, 1996; Thatcher and De la Cour, 2003).

Hargie et al. (2002) found poor communication correlated with lower commitment, reduced productivity, increase absenteeism, and higher turnover. Besides that, Ramsower (1985) found that less frequent communication reduced quality of information communicated and a loss of contextual information. Many researchers used communication satisfaction variables such as personal feedback, communication climate, relationship with supervisor, horizontal and informal communication, and organizational integration to test the relative levels of

satisfaction of workers. With the above uncertainties of communication satisfaction, there is a need to understand the satisfaction level of manufacturing worker whether using email is an adequate virtual communication channel to assign work in process.

Nonetheless, over-rich media are dysfunctional, not only for the performance and efficacy of the group, but also for the satisfaction of its members. Narges et al. (2011) reveals that increase in technology ease of use for users leads to higher level of task performance and user satisfaction. It showed that individuals experienced moderate to high level of task performance when use email. However, email lacks of nonverbal cues and slow feedback. This drawback could leads to the lower task performance. However, email is one of the alternative communication channels to decrease the cost of communication, increase productivity and efficiency in manufacturing company.

1.3 Problem Statement

Basically, problem arises in the daily environment in manufacturing processes. Mostly of the time will be allocated to response the problem. In the cases of urgent customer request or ad hoc situation, the time constraints and time pressures are the disturbance in responsiveness. Thus, sharing of information among employees is a fundamental requirement for effective responsiveness. The cycle time in task completion and satisfaction are perceived as the two main measurements for responsiveness.

There are many ways of communication such as face-to-face, telephone, video conferencing and email. A number of experiments conducted by researchers in the past are designed with a view to investigated the preference of email as the medium used by managerial level (Markus, 1994), preferences for email in organizational communication tasks (Sullivan, 1995), to compare between the degree of synchronization and presense of nonverbal and para-verbal cues for many type of

communication including face-to-face, letter and email (Baltes et al., 2002) and to investigate whether computer-mediated asynchronous communication improve team processes and decision making (Berry, 2006). Additionally, there were different mediation processes employed by teams in situations to investigate the better or worse fit between task characteristics and type of communication (Rico and Cohen ,2005; Caballer et al., 2005). In manufacturing, email is highly being used and also a common type of communication among its employees. Employees are increasingly likely to communicate by email with coworkers, customers and other colleagues (Byron and Baldridge, 2005). Some issue arises would cause low responsiveness such as conflict escalation is more likely to occur due to the characteristic of email (Friedman and Currall, 2003), misunderstandings and uncertainty regarding the emotional content of email messages may misinterpreted the message by the receiver (Byron and Baldridge, 2005), received average of 57 emails a day by people within a complex company and estimate that 56% of these were unnecessary in which had caused the time wasted (Hall, 2007). As the manufacturing environment is high in complexity, diverse in location and operating 24 hours continuously, virtual communication such as email has been heavily used. Therefore, the responsiveness of task performance using email to communicate in manufacturing community is important to be investigated. It is crucial to investigate the responsiveness of jobs which induced by different urgency level, where these jobs are monitored by cycle time.

Besides the above concerns, the communication satisfaction among the manufacturing community need to be understand. An efficient and effective way of communication has positive impact on employee's satisfaction, which lead to better performance. Therefore, it is important to determine the appropriateness and fitness

of communication by using email for tasks assignment among the manufacturing community.

1.4 Research Questions

RQ1: Could the tasks to be accomplished in time if a group of workers are being informed by using email?

RQ2: Does communication satisfaction affects job performance, in which the jobs being assigned by using email?

1.5 Research Objectives

The general objective of this study is to examine the responsiveness of job performance using email as the channel of virtual communication. Additionally, it also provides the insight whether email is an appropriate, efficient and effective type of communication channel in manufacturing community by measuring satisfactory level.

The specific objectives of this study are as follows:

- To measure the job performance (cycle time of task completion) in time pressure situation which communicated via email in group level.
- To analyze the communication satisfaction (horizontal communication, communication climate, and relation with supervisor) of employees towards job performance, in which the task assignments are being informed via email.

1.6 Significance of the Study

In the past research on technology, many studies have been carried out on tasks and time in groups. It shows that the workflow management system and technologies plays an important role for supporting organization information flow between the participants.

Using email as the virtual communication channel, this study provides some insight of the integration of work flow, the timely sharing of information and the

harmonious among the recipients in the collaborative aspects of work. Besides that, it also provides the data to the management to understand the communication satisfaction of its employees.

This study enables an organization to decide, refine and restructure the type of communication channels best suited to response to production disturbance in a cost conscious way. It is intended that responsiveness assessment helps in indicating which areas to concentrate on and improve the response mechanisms in production using Information Communication Technology. Additionally, it also determines the appropriateness and fitness of email in task assignment to achieve communication satisfaction within manufacturing community.

1.7 Scope and Limitation of the Study

This study focused only on email as the virtual communication instead of other channels such as video conference or live chat (messenger). A defined communication process is being designed and added into the specific work process flow. A multinational semiconductor manufacturing plant in Melaka was being chosen, where a group of employees in a department being participated. The working pattern of these employees included office hours and shift pattern spanning 24 hours. The responsiveness in this study measures the completion of task in time within allowable cycle time, which induced by time pressure. Besides that, it also reflects to the communication satisfaction of these employees who perceived better communication satisfaction leading better response in productivity.

1.8 Operational Definition

- Email communication is the communication channel used to assign tasks to the virtual workers.
- Cycle time is defined as the period required to complete a job.

- Cycle time (hour) = End Date & Time of Job – Start Date & Time of Job

- Communication satisfaction consist three factors, which are horizontal communication, communication climates and relation with superiors.
- Horizontal communication refers to the communication between peers group. This includes the extent to which communication is accurate and free flowing.
- Communication climate refers to communication in the organization motivates and stimulates workers to meet organizational goals.
- Relationship with superiors reflects satisfaction with the supervisor's communication.

1.9 Organization of the Thesis

Chapter one provides an overview of study which includes an introduction of the research background, problem statement, research objectives, significance of the study and the organization of the study. Chapter two concentrates on the literature review on the virtual communication and communication satisfaction. Chapter three describes the data source and methodology used. Chapter four reports the results and interpretation on the findings. Finally, Chapter five provides the summary, conclusion and recommendation for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Review of Related Literature

Many communication media research have been generated comparing face-to-face interaction with computer-mediated communication. Some of the results showed that face-to-face communication is preferable than electronic mediated communication such as email (Suvillan, 1995; Narges et al., 2001). The social presence (Short et al., 1976), media richness (Daft and Lengel, 1984) and social information (Sproull, 1991; Whalter, 1995) have attempted to explain differences between media in processes and outcomes. According to Daft et al. (1987), the appropriate match of media and task enhanced managerial effectiveness. This had lead the study attempted to investigate the impact of communication media on task performance. The performance is discussed in terms of making better decisions and time required to reach conclusion. According to Narges at el. (2011), media choices for task-media fit could be based on technology acceptance, media richness and media characteristic influence the degree to which communicators perceive each other.

Social presence in activities include asking questions, staying in touch and exchange information. Short et al. (1976) argue that a media with low social presence can be easily preferred when the result of the communication will not personally reflect on the person. Face-to-face communication is considered to have the most social presence, whereas written or text-based communication the least (Short et al., 1976). A communication media with lower social presence may be selected for tasks which require simple or routine information exchange (Steinfield, 1986; William et al., 1988). Written or textual communication media are better suited for less equivocal tasks (Daft and Lengel. 1986), for low ambiguity messages (Trevino et al., 1987; Russ et al., 1990), and for reducing uncertainty (El-Shinnawy and Markus,

1997). Daft et al. (1987) predicted effective senior manager would use face-to-face communication when equivocality is high. Fulk and Steinfield (1990) found that managers preferred face-to-face communication for tasks that required a high degree of interpersonal involvement such as negotiation and persuasion. Because email is lean, it is not appropriate for equivocal communication tasks. The asynchronous communication erasing many of the cues that permit regular intercourse and feedback where interruptions are frequent, pauses are long and information overload may arise (McGrath, 1991; Ocker et al., 1998).

Media richness refers to the content of managerial communication (Daft et al., 1987). The richness ranking of communication media depends on its ability to handle equivocality and uncertainty. Higher information richness is required for communicating tasks which is high in ambiguity or equivocal. Verbal media are believed richer than written media. Synchronous media provide immediate feedback, are believed richer than asynchronous media which poses delays between the origination and completion of communication. Media richness had been challenged in failure to take into consideration of situational (time and place) and social (influenced by coworkers) factors which might shape perception of media (Fulk et al., 1987; Markus, 1994). Markus (1994) found that email was elected as the primary medium of internal work-related communication by effective senior managers, regardless of equivocality, which cannot be explained by information richness theory. Rather, it was influenced by social processes such as social control and behavior. If the media is not 'rich' in information carrying capacity for the tasks to accomplish, the effectiveness is believed to be low. Increase use of electronic media might lead to reduced organizational performance if accordance to information richness theory. It examined perceived media appropriateness by gauged against individual to perceive

the correct medium for a given communication task, rather than actual media choices. But, perceptions are subject to various distortions and biases which may be individually different. Therefore, appropriate media choice is required to match the tasks for effective communication and outcome. Lean media is lack of adequate support for high equivocal tasks whereas rich media have more than enough capacity to support low equivocal tasks. Comparatively, too much richness is likely to be wasteful whereas too little media richness may result in miscommunication.

According to Huber and Daft (1987), rich communication is fast communication. The communication speed often depends more critically on social behavior than on the communication media (Sproull, 1991). It is the pattern of responsiveness in the use of a medium that makes the medium rich. Markus (1994) demonstrated that even text-based electronic mail could be used for complex communication, and richer media such as face-to-face were not necessarily preferable or more effective than leaner electronic media. While transmission speed in email may be nearly instantaneous, timeliness of response is not inherent in the medium, but depends critically on the behavior of the receiver (Markus, 1994). Therefore, Markus (1994) suggested that the adoption of use, and consequences of media in organizations can be powerfully shaped by social information such as sponsorship, socialization, and social control, which require social perspective to understand them.

Media choices are related to both work-related and social communication needs (Treveno et al., 1987; Rice, 1991). The media characteristic consists of opportunity for timely feedback, ability to convey multiple cues, tailoring of message to personal focus to the communication (Sullivan, 1995). It emphasized actual media use patterns, such as frequency and nature of media use. Lower information level

tends to have fewer numbers of verbal and nonverbal cues in a message (Rutter, 1987). According to Sullivan (1995) email provides a fairly rich and more efficient communication channel for certain type of activities. Thus, email is preferable to older means of communication such as face-to-face or telephone. Sullivan (1995) showed that more staff director assign people tasks over the email system and more secretaries receive tasks. As one rises in the organizational hierarchy, the lower the reliance on the use of emails. It is clear that the use of email varies across the communication activities. In this study, email is most preferred for circulating memoranda or text-based activities which exhibit task congruence. Even though averagely email is more preferred than telephone, memos and letters, but majority of the participants preferred telephone communication especially in assigning tasks and receiving assignments. Walther (1995) shows that computer mediated communication system members may need more time to manage the task at hand if the rate of social information exchange was slower. Ku (1996) found that upper manager tended to use electronic messages for routine tasks and for complex task when time pressure was involved.

The key factors in user's acceptance of technologies are usefulness and ease of use of communication media. The implementation of any technology has the potential to fail if insufficient consideration is given to the user's perspective (Zakaria et al. 2004). The virtual team members must be trained and master the appropriate skills, hardware, software and prerequisite computer knowledge. Rico and Cohen (2005) found that virtual teams using synchronous communications as a whole performed better than those working with asynchronous communication tools. There is no significant different in achieving high performance in the condition for high task interdependence-synchronous communication system and low task

interdependence-asynchronous communication system. However, the asynchronous communication in high task interdependence has resulted low team performance. It recommends that organization shall adjust the task/communication technology fit in order to facilitate the choice of appropriate media. Email was not always the most convenient medium as it requires typing the messages; particular who were not skilled in expressing themselves in writing. These shall take into the consideration of requirements and design in accordance with task interdependency.

Members who meet primarily electronically but may occasionally meet face-to-face are considered as virtual team (Geber, 1995; Melymuka, 1997; Townsend et al., 1996). The implementation of "virtual" workplace in organization had been introduced naturally due to the advancement in communication technology and the increasing complexity of organization structures. This virtual, Internet-based communication enables the users to interconnect one another, especially those organizations which are large and dispersed geographically. Pragmatically, the "virtual" refers in the sense of net-based, on the Internet or online, offering the opportunity to connect people and to support cooperation in different ways (Helling et al., 2005). The virtual workplace could provide flexibility to work at anytime and anyplace by using information and communication technologies, working independently with a shared purpose across physical space, time and organization boundaries (Crandall and Wallace, 1998; Lipnack and Stamp, 2000; Ali & Drew, 2005). Kirkman and Mathieu (2005) describes high level of virtuality exhibited with the highly use of virtual tools to coordinate and execute team processes. Indeed, this new way of managing corporate communication process has given new opportunities and also challenges to the organization.

To overcome the constraint of geographical and time differences, many organizations setup virtual workplace as a solution for improve productivity, reducing costs, increasing competitive advantage, and improving customer service. There is more likely to be extensive deployment of technology for information, communication and coordination purposes. The computer mediated communication system (CMCS) supported the fundamental activities of virtual team which undertaken by individuals. Electronic mail correspondence, internet forums, chat rooms, audio and video conferencing and groupware solutions support communication among virtual networks. These systems have been shown that virtual members improve work productivity (Valacich et al., 1994), effectiveness (Easton et al., 1990) and increase collaboration (Kock and McQueen, 1997).

Due to the low possibility of face-to-face communication in virtual work process, the electronic communication has been used to achieve the same effect. Email is one of the commonly used virtual communication channel in manufacturing environment due to its advantages such as universal platform, cost effective, generally accessible and easily learned and used. Electronic mail or email is both written and asynchronous, suggesting it is relatively low in richness, but uses computer technology to make it faster than paper-based communication (Sproull and Kiesler, 1986; Trevino et al., 1987). The technology attribute of email such as multiple addressability (Culnan and Markus, 1987; Sproull, 1991), externally recorded and computer-processable memory had overlap with the asynchronousity, speed and oral/written of media richness framework. The multiple addressability enable email to reach many people simultaneously is an attribute that email shares with face-to-face communication, clearly demonstrated that telephone was inferior compared to email. The externally recorded and computer-processable memory have

made email uniquely among the media, which added to the concept of richness. The usage of electronic mail or email can have an important impact on organizational communication (Sullivan, 1995).

The increase in email richness and ease of use perception improve task performance (Narges et al.,2011). Executives perceived email in moderate to high level in richness while they perceived email as an easy to use communication medium. The email richness includes the factors of feedback capacity, multiple cues, language variety and personal focus. The factor for perceived email ease of use includes easy to use, easy to learn, easy to become skillful and clear/understandable. Besides that, email displays unique characteristic which allow it to cross over traditional boundaries between paper and electronic media. The advantages of using email for exchanging information are its asynchronous, textual and permanent nature. Additionally, email combines many of the low-involvement attributes of writing with high-involvement attributes such as the speed of interactivity (Sullivan, 1995). Besides that, emails allowing the receivers to access their messages in multiple locations and at any time after the message is sent.

The relative lack of cues in email communication causes email senders to focus less on the communication partner and more on themselves (Sproull and Kiesler, 1986). Time pressure may lead to personal stress and exhaustion (Orasanu and Connolly, 1993). The user inability to interrupt a message means that feedback is delayed rather than immediate. Under time pressure, the accuracy and quality in the communication process may be reduced leading to poor decision making (Maule, 1997). However, the challenge in this electronic communication way is controlling (Sims and Galpin, 1998; Jackson, 1999). Kristin and David (2005) found that misunderstanding and uncertainty regarding the emotional content of email messages

can be expected to affect on workplace relationships and perhaps even organizational effectiveness. The receiver may misinterpret the message if the emotion behind the email is not clear.

A highly synchronicity environment allow for communication in real time where timely exchange of information and rapid adjustment of messages exchanged between the partners. However, virtual teams do not have the frequency of synchronous real-time communication characteristic. Some of the identified issues in virtual communication are conflict arising and it is difficult to manage disagreements. Communication via email cannot accurately convey emotion (Daft and Lengel, 1986) and has led to the argument that conflict escalation is more likely to occur than communication via face-to-face (Friedman and Currall, 2003). The level of team virtuality influences the relation between intra-team conflict and perceived team performance (Remco et al., 2008). The higher the level of team virtuality, the greater the positive impact of task conflict on perceived team performance. The team will opt to communicate more virtually in low level tasks because there is not much task-related interaction needed. This tends to have less synchronization which can lead to a lack of cohesion and misunderstanding among team members, and eventually lead to task conflict. On the other hand, it recommended that a team use more virtual form of communication such as email to manage disagreements of high level tasks. However, active communication must be established among team members to provide timely information and feedback of status to other members. Lastly, the development of virtual networks depends on financial support. The use of email and telephone conversation recorded very low ratings in term of usage due to technology deficiency in developing countries (Aburge, 2011).

In the concept of responsiveness by Huang and Nof (1999), the Information Communication Technologies played important roles in speeding up activities, providing intelligent and autonomous decision-making processes, and enabling distributing operations with collaboration. Mason-Jones and Towill (1999) define "zero waste total cycle time" and "zero waste information flow" are the prerequisites that enable responsiveness. The communication timing factor reflected how well communication meets immediate needs on time. Therefore, responsiveness could be measured by cycle time to reflect the communication effectiveness. Joinson (2002) suggests that industries such as manufacturing may not be conducive to the use of virtual teams. He indicates that "any type of work that's very sequential or integrated can pose problems for virtual team". Moreover, the future potential of virtual communication is directly influenced by the technological progress of information technology (Helling et al., 2005). Individual shall increase efficiency and minimize effort by choosing a medium appropriate to the situation.

The media richness was a prescriptive model originally in which achieving a match between information processing requirements such as equivocality, and communication channels such as face-to-face interaction and written memos, and was posited as essential for organizational effectiveness (Daft and Lengel, 1986). Fann and Smeltzer (1989) state the richness selection of media matched with the level of message ambiguity create more effective communication. Effective communication is important in organization success especially geographically dispersed and different time zone (Adler, 1999), fundamental requirement for effective responsiveness by sharing information among organization members Buyukozkan G. (2004) and would support all other processes to be efficient (Abugre, 2011). According to Adler (1999), clear on information enable employees to carry

out their jobs. As a result, employees who experience a lack of information about how to perform a task are likely to suffer higher level of frustration than those equipped with the necessary information to easily negotiate a work task. Abugre (2011) found that effective communication from leadership in the formal sector can affect employees' work behaviors in a positive manner and consequently affect organizational work output. In his study, the most preferred choice of communication is face-to-face, followed by letters and memos, then formal organizational meeting.

Information in an organization provided by the formal communication makes the managers' activities easier (Litterst and Eyo, 1982). It can be horizontal and vertical directions of communication. Formal communication is related to productivity (Litterst and Eyo, 1982) and job satisfaction (Holtzhausen, 2002). Besides that, cohesiveness tends to enhance motivation, better decision making and more open communication (Mabry and Barnes, 1980; Keller, 1986; Budman et al., 1993). Cohesive members communicate more openly and display higher task satisfaction and conform to group norms (Seashore, 1954; Keller, 1986; Miranda, 1991; Burke and Chidambaram, 1995). Price (1997) defined formal communication as the degree to which information about job is transmitted by an organization to its member and among the members of an organization. Continuous communication is crucial for sharing information about the group and activities related to the task and the progress of work (Rasker et al., 2000). When employees are not obtaining sufficient information through the formal channels, they rely on informal channels (Gray and Laidlaw, 2002).

In media richness theory, the determinant of satisfaction with the preference communication media is based on individual's perception or social presence. Social presence refers to characteristics of the channel that offer psychological closeness

(Short et al., 1976), are people oriented or allow rich interpersonal involvement (Rutter, 1987). Lengel and Daft (1988) stated that effective communication depends on the selection of a medium that has the capacity to engage both the sender and receiver. User satisfaction is also suggested as an element of performance (Trevino et al., 1990). Therefore, communication satisfaction of sender and receiver is another factor of performance. Communication satisfaction covers many different emotional responses and behaviors, such as agreement in thinking, cooperativeness, sensitivity to partner, and openness (Hoskins, 1983; Downs and Hazen, 1977).

Communication satisfaction questionnaire (CSQ) by Downs and Hazen (1977) has been widely used as an instrument to predict the job satisfaction on communication. It revealed that communication satisfaction is a multidimensional construct. CSQ stays the most prominent investigation tool in communication assessment and discovering the relationship between communication satisfaction and job satisfaction (Rubin et al, 2004). The primary dimensions include general organizational perspective, organizational integration, relation with superiors, horizontal-informal communication, communication with subordinates, media quality, and communication climate. Communication climate was then splitted into three factors: a narrower communication climate factor, the personal feedback factor and communication timing factor. According to Downs and Hazen (1977), three most important communication satisfaction factors interacting with job satisfaction are personal feedback, relation with supervisor, and communication climate. The factors of supervisor and communication climate remain the top ranking and consistent with Downs and Hazens, following by horizontal communication, organizational integration and personal feedback as the least satisfied (Ali and Drew, 2005).

The factor of communication climate measured the communication on both the organizational and personal level. It reflected the extent to which communication in the organization motivates and stimulates worker to meet organizational goals; the extent to which attitudes toward communication are perceived to be basically healthy; the extent to which superiors know and understand the problems faced by subordinates and information about how I am being judged. The factor of relation with superior covered the upward and downward dimensions of the communication with superior. For organizational integration, this factor accessed the satisfaction of individuals with the information that they receive about the organization and the immediate work environment. The factor of media quality reflected the degree to which employees perceive major forms of company media as functioning effectively. The items referred to the extent in which written directives are well written, organizational publications are helpful, and the amount of communication in the organization is about right. Horizontal informal communication factor reflects items relating to both horizontal communication and informal communication. The items included the extent to which horizontal and informal communication is accurate and free-flowing, the extent to which the grapevine is active in the organization. The factor of general organizational perspective reflected information relating to the overall functioning of the organization. The factor of communication with subordinates focused on both upward and downward communication with subordinates. Items reflected the extent to which subordinates are responsive to downward communication, the extent to which they feel responsible for initiating upward communication, and the degree to which the manager feels he has a communication overload.

The early study revealed that accuracy of information has the moderating effect upon the relationship between job performance and satisfaction with work (Robert and O'Reilly, 1974). Huseman et al. (1978) noted that employees' satisfaction with job and performance is affected by the messages communicated from a supervisor to subordinates due to the content of the message. Thus, communication content is important. Penley and Hawkins (1985) identified five dimensions of communication contents: task communication, performance communication, carrier communication, communication responsiveness, personal communication. Pettit et al. (1997) found that if employees were exposed to appropriate communication (trust, accuracy of information), job performance will in turn be improved leading to increased job satisfaction. Results showed that job performance has a direct, weak-to-moderate relationship with job satisfaction. Organizational communication – trust in superiors, influence of superiors, desire for interaction, and accuracy of information satisfaction with communication, information load, and directionality of communication – will be a moderator of the job performance-job satisfaction relationship. The highest correlation was between performance and satisfaction with work where independent variable (job performance) and the dependent variable (job satisfaction). Directionality of communication (upward, downward, and lateral) and communication load (underload and overload) would appear to have the greatest potential as moderators. Conversely, trust in superiors, perceived influence of superiors, accuracy of information, desire for interaction, and satisfaction with communication appear to have the least potential. Besides that, Jolanta (2012) revealed that task communication has a mediating influence on the relationship between job satisfaction and behavioural intention towards job in terms of the task

accomplishment. Appropriate information about the task and supervisor-subordinate communication has stronger relationship with employees' behavioural intention toward job (task accomplishment) than with employees' job satisfaction.

In parallel with the study of job performance-job satisfaction relationship, the communication satisfaction and job satisfaction were found positively correlated by using the Communication Satisfaction Questionnaires (Downs and Hazen, 1977; Irena et al., 2010). Additionally, communication openness and trust were positively related to employee's job satisfaction (Wulandari and Burgass, 2011). Wheeless et al., (1983) found that Interpersonal communication between supervisor and subordinate has an influence upon employee's satisfaction on job. Thereafter, communication has been shown to be related to job performance (Pincus, 1986) and employee's productivity (Clampitt and Downs, 1993). Pincus (1986) showed that there were significant positive relationship between communication satisfaction and job satisfaction, and communication satisfaction and job performance. The communication satisfaction – job satisfaction link was stronger.

Gabriele et al. (2004) shown that high levels of coordination and communication effectiveness increased team member's satisfaction. There is a significant relationship between effective organizational communication and employees' job satisfaction (De Rider, 2004; Aburge, 2011). However, communication satisfaction was not correlating significantly with job performance itself in small firm (Pearce and Segal (2004). Aburge (2011) suggested that effective organization communication is very critical in retaining worker's job satisfaction and consequently worker performance in organization. The consequences of poor communication would result in an increased turnover rate of employees due to lower level of worker satisfaction.

Ramsower (1985) found that full-time workers in virtual workplaces experienced similarly diminished work experiences that could be attributed to less frequent communication, reduced quality of information communicated, and a loss of contextual information (the social and professional context of the information flows). Many researchers found that virtual workplace negatively affected communication and interaction with co-workers and managers (Huws et al., 1990; Hill et al., 1998). Hergie et al. (2002) found poor communication correlated with lower commitment, reduced productivity, increase absenteeism, and higher turnover. Additionally, Staples (2001a) found that employees in a virtual workplace experienced lower levels of job satisfaction and manger-subordinate trust while experiencing higher levels of job stress, all correlated with lower quality communication. However, the finding by Ali and Drew (2005) did not support the idea that a virtual workplace would have a categorically negative impact on organizational communication. It found that virtual office worker were more satisfied with organization communication than traditional office workers. However, the higher level of work virtuality leads to a lower level of work satisfaction, mainly due to inappropriate management techniques and problems related to information and communication technology mediated communication (Ali and Drew, 2005; Gerda et al., 2011).

Baltes et al. (2002) stated that time constraint played a moderating role between media and satisfaction. However, the behaviour control mechanisms created pressure on the team to ‘meet’ and complete the required reports. This added pressure created a context in which individual expectations for work commitment and contributions were easily broken, leading to decreased satisfaction with the team experience. Caballer et al. (2005) measure three type of satisfaction which included

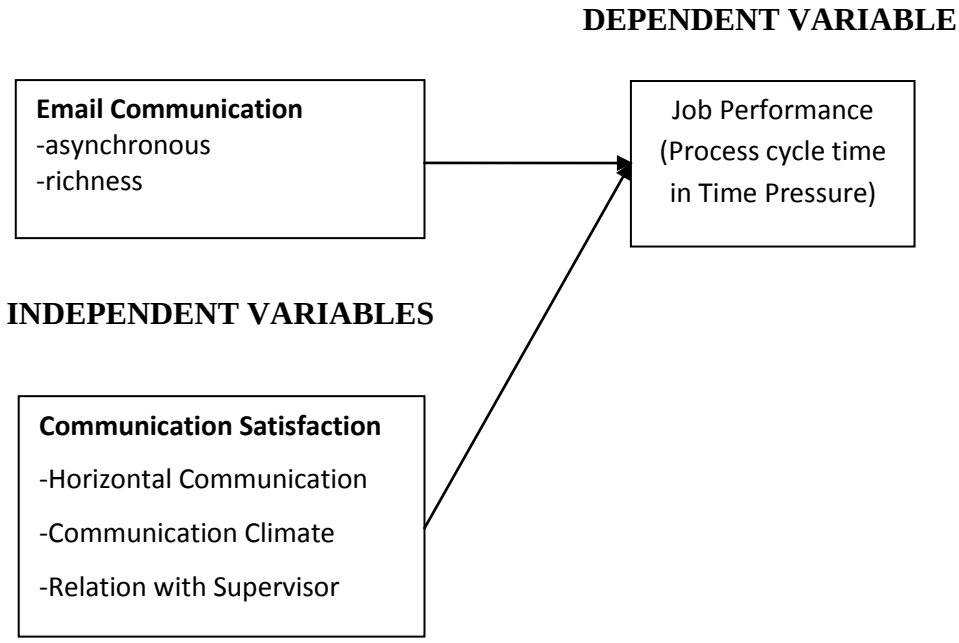
process satisfaction, result satisfaction and commitment to the solution achieved, in the present and absent of time pressure situation. It found that process satisfaction increased in time pressure situation with the use of email. However, there was decreased in results satisfaction and commitment to solution achieved by using email. Compare to face-to-face communication, the groups achieved higher satisfaction by using email in time pressure situation.

Numbers of literature inter-relate communication, communication satisfaction, job performance and job satisfaction. Many researchers have been investigated on the relationship of communication and job satisfaction (Downs and Hazen, 1977), communication as a moderator or mediator of the relationship between job satisfaction and performance (Pettit et al., 1997; Jolanta, 2012). Communication satisfaction in an organization can be described as a person's satisfaction with information flow and relationship variables within an organization (Nakra, 2006). Communication is an antecedent of communication satisfaction (Carriere & Bourque, 2009; Nader et al., 2010). Nader et al. (2010) found that formal communication is stronger predictor than informal communication at the group level of communication satisfaction. Formal communication with providing information regarding to the work issues will enhance employees' interpersonal communication satisfaction. The more formalized, planned and well organized communication between managers and workers may increase satisfaction with communication (Duxbury and Neufeld, 1999; Fritz et al., 1998; Shirley, 1985).

In overall, the influence of communication upon a worker's job performance is not nearly as clear. Besides that, the results are often mixed with job satisfaction. This may be due to the varying methodologies and definitions being used in their researches.

CHAPTER 3: METHODOLOGY

3.1 Research Framework



This study is about the virtual communication via email and job performance. The email has the characteristic of asynchronous and flexible capacity of richness, which are the independent variables. The effectiveness of email due to these characteristics has the impact towards job performance, in which to affect the process cycle time especially the job is induced by time pressure. The asynchronous characteristic of email enables the communication and collaboration over a period of time through a "different time-different place" mode, providing people with resources and information that are instantly accessible by day or night and has the capability for one-to-one or one-to-many communication. These significant features of email allowed both sender and recipient to control the timing of their portion of the communication. This is an important issue in timely responsiveness especially for the people who are working virtually. With the timely responses for job execution by using email, higher process efficiency could be achieved in which leading to high job performance. Additionally, the information richness capacity in email content could

affect the effectiveness of communication. Insufficient information flow prevents the job to proceed immediately and carried out in the right way, which leading to lower job performance. On the other hand, too much of information flow may require longer time for interpretation and understanding, which could lead to lower efficiency. Therefore, the adequate richness of information flow using email communication could lead to better job performance and be able to sustain the process cycle time for job completion especially in time pressure situation.

The perceived communication satisfaction of email could be related to job performance. In this research, the communication factors developed by Downs and Hazen (1997) are used, as it stays the most prominent investigation tool to assess the communication satisfaction and job satisfaction. Despite that, effective communication has the mediating influence in the relationship between job satisfaction and behavioral intentions toward job in terms of task accomplishment. Therefore, the job performance can be improved via achieving higher level of communication satisfaction. The communication satisfaction factors used in this study consist of horizontal communication, communication climates and relation with supervisor. According to Sekaran (2003), independent variable is one that influences the dependent variable in either a positive or negative way. The factor of horizontal communication described the coordination and teamwork of the group at the same level of hierarchy, where the information is accurate and free-flowing; this could lead to achieve better job performance if higher horizontal communication satisfaction is achieved. Secondly, the communication climate reflected the communication on both the organizational and personal level to which communication motivates and stimulates workers to meet organizational goals and attitudes toward communication are perceived to be basically healthy. Therefore, it

tends to relate to better job performance if higher satisfaction in communication climate. Lastly, the factor of relation with superiors described both upward and downward dimensions of communication with superiors. The better job performance could be related with the higher level of communication satisfaction in relation with superiors.

3.2 Research Hypotheses

To achieve the stated purpose of this study, the following research questions were investigated.

Research Question 1**:** Could the tasks to be accomplished in time if a group of workers are being informed by using email?

The first hypothesis assumes that the tasks will be completed in time if communicate via electronic mail due to better control of communication timing in the virtual community and able to carry sufficient richness capacity. Even though the information is shared within the same period via email, the higher priority task which induces higher time pressure will be completed faster than those lower priority tasks which have longer cycle time. It analyses the combined effects of email and time pressure on group members' affective responses to their job performance. Therefore, the following hypothesis has been formed:

H1: Communication using email tends to have higher job performance in time pressure situation.

Research Question 2**:** Does communication satisfaction affect job performance, in which the jobs being assigned by using email?

In second hypothesis in this study tests on the communication satisfaction of workers in respond to the work assigned to them via emails. It contributes to a better understanding of ways of communication effects on worker's satisfaction level which lead to better job performance. This study tests on the workers'

communication satisfaction with job performances by using the three factors which are horizontal communication, communication climates and relation with superior. This examines whether communication satisfaction affect job performance. Therefore, the following hypotheses have been constructed:

H2a: Satisfaction in horizontal communication is positively correlated to job performance.

H2b: Satisfaction in communication climate is positively correlated job performance.

H2c: Satisfaction in relation with superior is positively correlated job performance.

3.3 Research Design

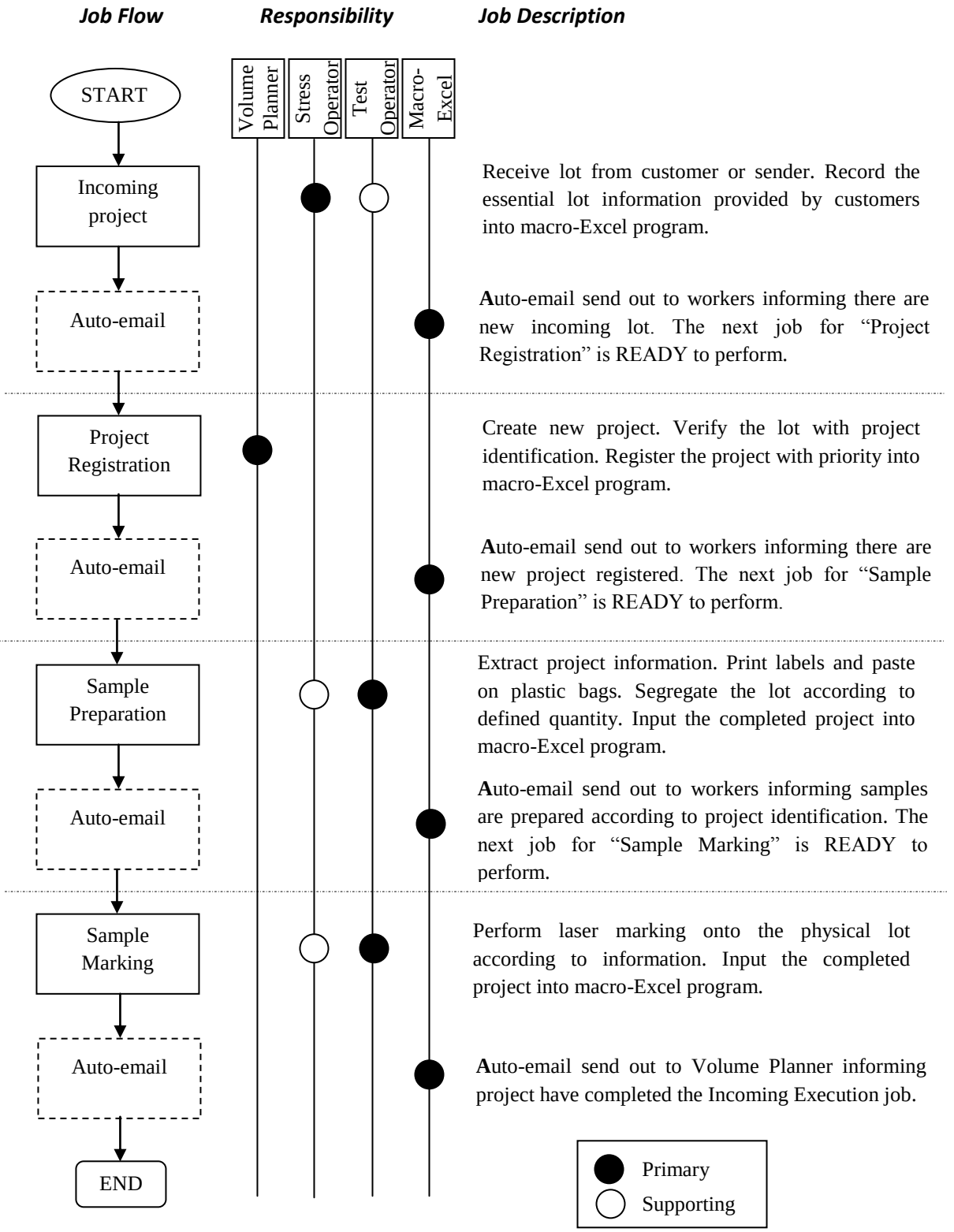
3.3.1 Type of Study

For hypothesis H1, an experimental study has been carried out within a group of virtual workers in a manufacturing company to examine their job performance, where the jobs are assigned by using email communication. The job assignments in this experiment stimulate the actual Incoming Execution in Quality department, where the jobs consists of receiving incoming project, project registration, sample preparation and sample marking. Figure 3.1 shows the job flow for Incoming Execution and the description of jobs. The job performance is measured by the cycle time for the job completion. The results for a period of 6 weeks which the jobs are being undertaken by the virtual workers will be used to calculate the cycle time.

For hypotheses H2, the quantitative data analysis approached has been carried out. Survey questionnaires will be handed out to measure the communication satisfaction of the group of virtual workers. The Communication Satisfaction Questionnaire (CSQ) developed by Downs and Hazen (1977) has proven highly reliable (r=0.94) across many settings (Clampitt, 1981). Salant and Dillman (1994) listed seven steps for conducting a successful questionnaire survey: (1) define the objectives, (2) select a sample, (3) write items, (4) construct the questionnaire, (5)

pretest, (6) prepare a letter of transmittal, and (7) sent out the questionnaires and follow-ups.

Figure 3.1: *Job Flow for Incoming Execution*



3.3.2 Sources of Data

In this research, only primary data has been used in analyses to achieve the objectives. Primary sources consist first on hand information. For hypothesis H1, these data were collected from the experimental data which logged by the workers in a macro-Excel program. For hypotheses H2, these data were collected and from the distribution of self-administered questionnaires to 59 virtual workers in Quality department.

3.3.3 Unit of Analysis

The unit of analysis is the virtual workers of Quality department in manufacturing plant in Melaka.

3.3.4 Population Frame

This research was carried out within the largest multinational electronic manufacturing plant located in Free Trade Zone, Melaka, Malaysia. There were primarily five functional departments which are Assembly, Quality, Information Technology, Human Resource and Purchasing. The total workers registered were 5,675 in November 2012.

3.4 Measurement of Variables/ Instrumentation

Information Communication Technology played important roles in speeding up activities and enabling distributing operations with collaboration (Huang and Nof, 1999). According to Mason-Jones and Towill (1999), "zero waste total cycle time" and "zero waste information flow" are the prerequisites that enable responsiveness. Therefore, fast responsive of job which assigned via email requires short cycle time. The cycle time is the total elapsed time to move a unit of work from the beginning to the end of a physical process (Nadarajah and Kotz, 2008). For hypothesis H1, the instrument used to measure job performance was the cycle time for a job completion. The classification of job's priority and targeted cycle time to complete were the performance index set by the top management of the department. Therefore, time

pressure has been induced. Table 3.1 shows the table for Job Priority and Completion Targeted Cycle Time.

Table 3.1 *Table for Job Priority and Completion Targeted Cycle Time*

Priority of Job	Targeted Cycle Time to Complete Job
1	Within 24 hours
2	Within 48 hours
3	Within 96 hours
4	Within 120 hours
5	Within 168 hours

According to Downs and Hazen (1977), the communication satisfaction was multidimensional and could be a useful tool in audit of organizational communication. The most important factors of communication satisfaction were relation with supervisor and communication climate (Downs and Hazen, 1977). The Questionnaire developed by Downs and Hazen's (1977) has proven highly reliable (r = 0.94) across many organizational settings (Clampitt, 1981). According to Abugre (2011), effective organization communication is very critical in retaining worker satisfaction and consequently worker performance in organization. For hypotheses H2, three communication satisfaction factors from the Communication Satisfaction Questionnaire were being used to measure the communication satisfaction of virtual workers. These factors were horizontal communication, communication climate and relation with superiors. These questionnaires were set using 5-point Likert scale, where 5 indicated strongly satisfied and 1 indicated strongly dissatisfied. Each of these factors has loaded with 6 items, where 18 items in total number for communication satisfaction. Instruction for taking the survey in Section 2 was as follow, "Please read each statement carefully. Give a ranking between 1 (strongly dissatisfied) and 5 (strongly satisfied) depending on your level of satisfaction with

the statement regarding the communication satisfaction via electronic mail in daily job**.** Please circle only ONE scale for each statement.**"** Table 3.2 described the details of each factors.

Table 3.2 *Distribution of Variables for Communication Satisfaction*

Variables	Dimensions	Total number of items	Scales	Sources
Horizontal Communication	• Extent to which assists me to do my best to convey merely reliable and exact information. • Extent to which enable me to exchange important information with my colleagues continuosly. • Extent to which enable me to provide information to other employees need in a timely, clear and exact manner. • Extent to which my colleagues provide reliable information to me. • Extent to which horizontal communication with my colleagues is accurate and free flowing. • Extent to which the vast majority of daily information is provided to me by colleagues.	6	Likert Scale 1-5	Self-construct
Communication Climate	• Extent to which the daily information i receive is clear and concise. • Extent to which task assignment are well organized, clear and concise. • Extent to which information needed to do my job is received on time. • Extent to which important information is targeted by using email. • Extent to which the status of tasks are spread in timely	6	Likert Scale 1-5	Self-construct

	manner. • Extent to which superior know and understand the problems face by subordinates			
Relation with Superior	• Extent to which supervision given to me is accurate and comprehensible. • Extent to which my supervisor provides reliable information to me and my colleagues. • Extent to which supervisor listens and pay attention to employees for any problem arises. • Extent to which superior offers guidance for solving job related problems. • Extent to which the vast majority of daily information is provided to me by my superior. • Extent to which i accept the style of communication used with superior.	6	Likert Scale 1-5	Self-construct

Table 3.2 *Distribution of Variables for Communication Satisfaction (continue)*

According to the performance management policy in this department, work performed below 50% of targeted cycle time is highly efficient, 50%-100% targeted cycle time is efficient, 100%-150% targeted cycle time is meeting expectation, 150%-200% is inefficient and more than 200% is highly inefficient. Therefore, the dependent variables in hypothesis H2 was converted into 5-point Likert Scale in order measure job performance by cycle time. The 5 indicated highly efficient, 4 indicated efficient, 3 indicated meet expectation, 2 indicated inefficient and 1 indicated highly inefficient. The conversion of calculated cycle time is accordance to

the policy achieved the same scaling or unit measurement for analysis. Table 3.3 showed the conversion range from cycle time to Likert scale.

Table 3.3 *Conversion Table for Calculated Cycle Time to Likert Scale*

Priority of Job	Calculated cycle time (CT) of completed job				
	Likert scale 1 (Highly inefficient)	Likert scale 2 (Inefficient)	Likert scale 3 (Meet Expectation)	Likert scale 4 (Efficient)	Likert scale 5 (Highly efficient)
1	CT ≥ 48 hours	36 hours ≤ CT < 48 hours	24 hours ≤ CT < 36 hours	12 hours ≤ CT < 24 hours	CT < 12 hours
2	CT ≥ 96 hours	72 hours ≤ CT < 96 hours	48 hours ≤ CT < 72 hours	24 hours ≤ CT < 48 hours	CT < 24 hours
3	CT ≥ 168 hours	120 hours ≤ CT < 168 hours	96 hours ≤ CT < 120 hours	48 hours ≤ CT < 96 hours	CT < 48 hours
4	CT ≥ 240 hours	180 hours ≤ CT < 240 hours	120 hours ≤ CT < 180 hours	60 hours ≤ CT < 120 hours	CT < 60 hours
5	CT ≥ 360 hours	264 hours ≤ CT < 360 hours	168 hours ≤ CT < 264 hours	96 hours ≤ CT < 168 hours	CT < 96 hours

3.5 Validation of Instruments

Pilot tests had been conducted to perform the feasibility of experimental test and to determine the validity and the reliability of the self-constructed items. For the experimental test in hypothesis H1, a macro-excel program with graphic user interfaces (customized UserForms) had been scripted using Visual Basic for Application (VBA) according to the job flow for Incoming Execution. This macro-excel is being install in a networked-drive where it can be assessable via computer. All the workers had been given the account and password to login the program, as well as the individual email account. Using Simple Mail Transfer Protocol (SMTP)

server, an email will be automatically send to the workers immediately by clicking the command button created in the graphic user interface. This button will check all the field data input by the workers after the job is completed before it proceed to send out the email. If the field data return null, the auto-email would trigger the workers to input the data accordingly. It had been tested by a few workers on this macro-excel program with graphic user interface. The results shown that the data inputted by the workers is recorded and saved in the excel sheet, and they received the auto email immediately after the completed job had been registered. The time and date for the start and end of each job were recorded accordingly, where the cycle time were calculated. Therefore, the use of macro-excel program was feasible to proceed the experimental test in this study. Additionally, Table 3.1 shows the targeted cycle time to complete the job according to priority, which was the performance index of the department set by the top management.

For hypothesis H2, a pilot study or pre-test of questionnaire is crucial to discover the problems either in the instruction or in the questions. A pilot study is to do a brief exploratory investigation, to try out particular procedures, measurement instruments, or methods of analysis. Finked and Kosccoff stated: “All types of questionnaires and interviews must be pilot tested. Self-administered questionnaires are heavily dependent on the clarity of their language, a pilot testing quickly reveals whether people understand the directions you have provided and if they can answer the questions. Pilot test can also tell you how much time it takes to complete the survey (1998, p.5)”. Prior to release of the survey, a pilot test has been conducted to refine the questions in the survey. Questionnaires were given to 10 workers in the experimental group and 10 sets of surveys were collected and used for pilot test. They were asked to answer the questionnaires which were subsequently carried out

to check whether the respondents could understand all the questions. Comments and feedbacks given were gathered and some items considered vague by these respondents were later reworded before the final data collection. Cronbach-Alpha method is used to assessing reliability for the three factors of communication satisfaction, which is found in Section 2 of the survey. The alpha coefficients obtained were between 0.8624 and 0.8988, indicating that the items form a scale that has reasonable internal consistency reliability.

Table 3.4 *Alpha Coefficient for Variables*

Dimension	Alpha Coefficient	Number of Items
Horizontal Communication	0.8988	6
Communication Climate	0.8611	6
Relation with Superiors	0.8264	6

According to the performance management policy in this department, work performed below 50% of targeted cycle time is highly efficient, 50%-100% targeted cycle time is efficient, 100%-150% targeted cycle time is meeting expectation, 150%-200% is inefficient and more than 200% is highly inefficient. There are 5 categories to classify the performance which allow the calculated cycle time of completed job to be converted to Likert scale 1-5. Therefore, the variables in hypothesis H2 achieved the same scaling or unit measurement for the analysis.

3.6 Sampling

Virtual workers are found in three departments in this manufacturing plant. This study utilizes purposive sampling as approval in conducting research can be obtained from only one department. Furthermore, these departments have different work processes. In order to remain the sampling homogeneity, therefore 100% of the virtual workers in the Quality Management, Reliability Product Testing is chosen. The sample in this study consists of total 59 workers who work as a team in Reliability Product Testing division which sharing the common goals. 50 workers are

male and 9 are female workers. 36 out of 59 workers are employed to work in three shift three crews pattern, where shift A: from 7 a.m. to 3 p.m., shift B: from 3 p.m. to 11 p.m., and shift C: from 11 p.m. to 7 a.m.. The remaining participants report to work on office hours which start from 8 a.m. to 5 p.m..

3.7 Data Collection Procedures

In order to perform the experimental study in a departmental division, an application letter was submitted to the Head of Execution. The feedback from the management team approved this experimental to be carried out which they accepted it as a Continuous Improvement Project.

Firstly, computers were used in this experiment with the communication channels of email. A macro-excel program with Graphic User Interface was scripted according to the Incoming Execution job flow. Each worker were given an individual email account (Microsoft Office Outlook). All the workers received experimental training to acquire the competent use of the technology – macro-excel program and Microsoft Office Outlook, and had several practical sessions in order to become familiar with the process and method. Figure 3.1 showed the "Incoming Execution" job flow used in this experimental design. The macro-excel program collects the data input by the responsible workers at each of the stages mainly with the information of "Name", "Date", "Project ID" and "Priority". There are 5 levels of priority for execution, which tabulated in Table 3.1. In explanation, the 24 hours deadline for priority one project was to induce the time pressure to the work group. At each stage of completed job, the information will be sent out via email (auto-email) to respective responsible workers to start the next assigned job. These data was recorded and saved when the command button was pressed. The cycle time will be calculated using the completion date of pre-job and current job recorded in the macro-excel program. The data collected in this experiment started in mid of

November 2012 till end of December 2012, which has a 6 weeks period of time. There are a total of 168 projects registered as incoming.

After 6 weeks of the experimental had been carried out, the survey forms were distributed to all 59 workers who involved in the used of macro-excel program and Microsoft Office Outlook. These survey questionnaires were directed to these workers by printed form or by email in Microsoft Word. A covering letter explaining the objective of this study was attached together, instructing them to complete the questions and assuring them of the confidentiality of their responses. The questionnaire forms were collected from these workers after one week from the date handed or email to them. 100% response rate achieved in this survey conducted.

3.8 Techniques of Data Analysis

The analysis in of the collected data in this study is performed using Microsoft Excel and Statistical Package for the Social Sciences (SPSS, version 11.5). The data was coded and recoded for appropriateness in analysis. The analysis utilized included: frequency distribution, descriptive statistics, Cronbach's alpha reliability analysis, Pearson correlation analysis, and multiple regression analysis.

3.8.1 Frequency Distribution

Frequency distribution is critical to understanding the use of measurement terms. It is a tally or count of the number of times each score on a single variable occurs (Leech, Barrett, & Morgan, 2005). When there are small numbers of scores for the low and high values and most scores are for the middle values, the distribution is said to be approximately normally distributed. Frequency analysis was carried out in comparing the priorities of the jobs which the workers need to accomplish within the targeted cycle time and the demography of the workers in this study.

3.8.2 Descriptive Statistics Analysis

According to Sekaran (2003), quite frequently, descriptive studies are undertaken in organization to learn about and described the characteristics of a group of employees, as for example, the age and years of working experience in an organization. The descriptive statistics were used to find the frequencies, percentages and determine the mean for the variables in the questionnaires. In this study, descriptive statistics was carried for the independent variables and dependent variables.

3.8.3 Cronbach's Alpha Reliability Analysis

As mentioned earlier, Cronbach's coefficient alpha is the most commonly types of measure of internal consistency reliability. Alpha is used when there have several Likert-type items that are summed to make a composite score or summated scale. Alpha is based on the mean or average correlation of each item in the scale with every other item (Leech, Barrett, & Morgan, 2005). Cronbach's Alpha Reliability Analysis was used in pilot study. It assumed that respondents should answer similarly on the parts being compared, with any differences being due to measurement error.

3.8.4 Pearson's Correlation Analysis

Correlation is a technique for investigating the relationship between two quantitative variables. Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables. The index ranges in value from -1 to +1, in which determine the two variables are negatively to positively in relationships. There is no relationship between the variables if the correlation coefficient equal to zero. In this study, Pearson Correlation analysis was carried out to investigate the correlation between each communication satisfaction factors and job performance.

3.8.5 Multiple Regression Analysis

The general purpose of multiples regression is to learn more about the relationship between several independent variables and a dependent variable. It could provide the conditional expectation of the dependent variable when any one of the independent variables is varied, while the other independent variables are held fixed. The correlation coefficient (R) values between -1 and 1, determining the relationships of the two variables are negatively or positively correlated. There is no relationship between the variables if the correlation coefficient equal to zero. In this study, multiple regression analysis was carried out between the three factors of communication satisfaction (independent variables) and job performance in cycle time (dependent variables) to predict which the most affecting factor towards job performance.

CHAPTER 4: RESULT AND DISCUSSION

4.1 Hypothesis H1

Within the period of 6 weeks, the macro-excel program recorded 168 incoming projects which submitted by customers. In order to complete the Incoming Execution, the jobs were divided into Project Registration, Sample Preparation and Sample Marking in the sequential flow as in Figure 3.1. These jobs were being dedicated to the groups of Volume Planner, Stress Operator and Test Operator. The Volume Planner responsible for the job of Project Registration; Test Operator responsible for the job of Sample Preparation; and Test Operator responsible for the job of Sample Marking. There were 5 levels of priority dedicated for the projects, in which priority 1 refer to the most important and urgent and priority 5 refer to the least important and urgent. In this experiments, there were 32 projects registered as priority 1; 6 projects as priority 2; 119 projects as priority 3; 6 projects as priority 4; and 5 projects as priority 5. From the observation in Table 4.1, most of the projects were registered as priority 3 which accounted for 70.8%. Subsequently, the priority 1 projects ranked the second which accounted for 19%. There are least projects registered for priority 2, 4 and 5 which accounted only 10.2% in total.

Table 4.1 *Incoming Project's Priority*

Statistics

PRIORITY

N	Valid	168
	Missing	0

PRIORITY

		Frequency	Percent	Valid Percent	Cumulative percent
Valid	Priority 1 < 24hrs	32	19.0	19.0	19.0
	Priority 2 < 48hrs	6	3.6	3.6	22.6
	Priority 3 < 96hrs	119	70.8	70.8	93.5
	Priority 4 < 120hrs	6	3.6	3.6	97.0
	Priority 5 < 168hrs	5	3.0	3.0	100.0
	Total	168	100.0	100.0	

The cycle time of each jobs type (Project Registration, Sample Preparation and Sample Marking) performed for 168 projects were recorded in the macro-excel program. Irregardless of project priorities, the job of Project Registration required 42.93 hours averagely to complete, Sample Preparation required 32.71 hours averagely to complete and Sample Marking required 47.91 hours averagely to complete. The Sample Preparation job required the shortest time to complete averagely, following by Project Registration and Sample Marking. However, the mean value of cycle time for all type of jobs were more than 24 hours but within 48 hours, which has the possibility that the targeted cycle time for priority 1 projects could not be meet. Table 4.2 showed the jobs' cycle time for 168 projects regardless of priorities. It found that the standard deviation value for these three type of jobs were within 24.91 and 31.26, where Sample Marking has the highest value following by Project Registration and Sample Preparation. According to hypothesis H1, this experiment is to investigate whether communication using email tends to have higher process efficiency in time pressure situation. The time pressure was induced by the priority setting, in which higher the priority has the shortest targeted cycle time. The process efficiency was determined whether the jobs could be completed within the targeted cycle time according to priorities. Therefore, further analysis was carried out to measure the cycle time of each project priorities with these jobs.

Table 4.2 *The Jobs' Cycle Time for 168 Projects regardless of Priorities*

Descriptive Statistics

Job Type	N	Minimum	Maximum	Mean	Std. Deviation
P_REGISTER	168	2.08	120.01	42.93	29.26
SAMPREP	168	2.40	101.12	32.71	24.91
SAMMARK	168	2.09	164.34	47.91	31.26
Valid N (listwise)	168				

The targeted cycle time in this experiment for priority 1 to priority 5 were within 24 hours, 48 hours, 96 hours, 120 hours and 168 hours respectively. The cycle

time achievement for job completion will be discussed according to the project priority.

Firstly, the performance of job for priority 5 projects was presented in Table 4.3 and Table 4.4. The longest targeted cycle time of 168 hours enable 100 % good performance achievement for the jobs of Project Registration, Sample Preparation and Sample Marking. The mean cycle time value for Project Registration, Sample Preparation and Sample Marking was 88.19 hours, 36.25 hours and 101.11 hours respectively. The best ranking for job performance was Sample Preparation, following by Project Registration and Sample Marking.

Table 4.3 *The Jobs' Cycle Time for 5 Priority 5 Projects.*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
P_REGISTER	5	6.06	120.01	88.19	46.53
SAMPREP	5	12.62	81.14	36.25	29.41
SAMMARK	5	19.20	164.34	101.11	57.00
Valid N (listwise)	5				

Table 4.4 *The Jobs' Performance for 5 Priority 5 Projects*

P5PG_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<168hrs	5	100.0	100.0	100.0

P5SP_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<168hrs	5	100.0	100.0	100.0

P5SM_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<168hrs	5	100.0	100.0	100.0

Secondly, Table 4.5 showed the jobs cycle time for 6 priority 4 projects. Comparatively with priority 5 projects, the mean cycle time of jobs completion for priority 4 projects did meet the targeted cycle time of within 120 hours. The job of

Project Registration, Sample Preparation and Sample Marking achieved 100% in good job performance. Table 4.6 tabulated the job performance according to different jobs for priority 2 projects.

Table 4.5 *The Jobs' Cycle Time for 6 Priority 4 Projects.*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
P_REGISTER	6	29.14	111.01	66.71	34.06
SAMPREP	6	15.39	101.12	30.68	34.53
SAMMARK	6	24.17	118.78	93.20	34.53
Valid N (listwise)	6				

Table 4.6 *The Jobs' Performance for 6 Priority 4 Projects*

P4PR_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<120hrs	6	100.0	100.0	100.0

P4SP_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<120hrs	6	100.0	100.0	100.0

P4SM_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<120hrs	6	100.0	100.0	100.0

In this experiment conducted, priority 3 recorded the highest projects of 119. The calculated mean time for all jobs completed was within the targeted cycle time of within 96 hours, which were shown in Table 4.7. Similarly, the percentage of performance achievement within targeted cycle for these 3 types of jobs was 100%. The performance ranking for priority 3 projects from the shortest cycle time was Sample Preparation, following by Project Registration and Sample Marking.

Table 4.7 *The Jobs' Cycle Time for 119 Priority 3 Projects.*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
P_REGISTER	119	2.08	95.12	45.91	27.80
SAMPREP	119	2.74	93.06	37.50	26.02
SAMMARK	119	5.72	95.21	50.54	27.26
Valid N (listwise)	119				

Table 4.8 *The Jobs' Performance for 119 Priority 3 Projects*

P3PR_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<96hrs	119	100.0	100.0	100.0

P3SP_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	119	100.0	100.0	100.0

P3SM_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	119	100.0	100.0	100.0

The analysis for priority 2 projects showed that all jobs in Project Registration, Sample Preparation and Sample Marking were able to be completed with the targeted cycle time of 48 hours. These were tabulated in Table 4.10. Averagely, the calculated cycle time for the jobs of Project Registration, Sample Preparation and Sample Marking were within the targeted cycle time which was 23.46 hours, 24.83 hours and 41.20 hours respectively. Table 4.9 showed the jobs cycle time for 6 priority 2 projects. The performance ranking started from the best was Project Registration, Sample Preparation then Sample Marking.

Table 4.9 *The Jobs' Cycle Time for 6 Priority 2 Projects.*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
P_REGISTER	6	10.36	36.06	23.46	10.39
SAMPREP	6	13.22	41.05	24.83	11.64
SAMMARK	6	31.95	45.83	41.20	5.82
Valid N (listwise)	6				

Table 4.10 *The Jobs' Performance for 6 Priority 2 Projects*

P2PR_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<48hrs	6	100.0	100.0	100.0

P2SP_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<48hrs	6	100.0	100.0	100.0

P2SM_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<48hrs	6	100.0	100.0	100.0

Lastly, Table 4.11 showed the jobs cycle time for 32 priority 1 projects. In average, all the jobs meet the targeted cycle time of within 24 hours, in which Sample Preparation has the minimum mean of 16.19 hours, following by Sample Marking with 22.61 hours and Project Registration with 23.97 hours. By analyzing each of the jobs completed by the virtual workers, there were 11 out of 32 jobs exceeded the targeted cycle time for Project Registration. Besides that, the Sample Preparation and Sample Marking did show that 3 out of 32 jobs and 12 out of 32 jobs were not meeting the targeted cycle time as well. In summary, the Sample Preparation accounted for the best performance due to 90.6% of job completed within the targeted cycle time, following by Project Registration with 65.5% and Sample Marking with 62.5%. The job performances were tabulated in Table 4.12.

Table 4.11 *The Jobs' Cycle Time for 32 Priority 1 Projects.*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
P_REGISTER	32	5.05	77.07	23.97	16.38
SAMPREP	32	2.40	31.75	16.19	7.42
SAMMARK	32	2.09	79.01	22.61	16.40
Valid N (listwise)	32				

Table 4.12 *The Jobs' Performance for 32 Priority 1 Projects*

P1REG_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<24hrs	21	65.6	65.6	65.6
	>=24hrs	11	34.4	34.4	100.0
	Total	32	100.0	100.0	

P1SP_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<24hrs	29	90.6	90.6	90.6
	>=24hrs	3	9.4	9.4	100.0
	Total	32	100.0	100.0	

P1SM_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<24hrs	20	62.5	62.5	62.5
	>=24hrs	12	37.5	37.5	100.0
	Total	32	100.0	100.0	

According to the performance analysis for each priority, the calculated mean cycle time for Sample Preparation was the shortest. This result showed that the jobs of Sample Preparation which were communicated by email have higher process efficiency than Project Registration and Sample Marking in 5 different time pressure situations. 98.12% of 168 projects for Sample Preparation were completed within the targeted cycle time, whereas for Project Registration and Sample Marking has achieved 93.12% and 92.50% respectively. Table 4.13 showed the percentage of jobs completed within targeted cycle time.

Table 4.13 *Percentage of Jobs Completed Within Targeted Cycle Time*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
P_REGISTER	5	65.60	100.00	93.12	15.38
SAMPREP	5	90.60	100.00	98.12	4.20
SAMMARK	5	62.50	100.00	92.50	16.77
Valid N (listwise)	5				

In this experiment, the communication using email does not improve the process efficiency. As the shorter cycle time due to higher time pressure, there are increasing numbers of jobs which could not be completed within the targeted cycle time. Overall, the targeted cycle time for job completion had been achieved for priority 2 to priority 5 projects. But all types of jobs could not meet 100% in cycle time for priority 1 which has the shortest cycle time, especially the Sample Marking and Project Registration. In order to better understand the root cause, investigation had been conducted regarding the low efficiency. The main reason feedback for the delay in Project Registration was due to incorrect information provided during the submission of projects. Therefore, the Volume Planner needed to communicate with and waiting the feedback from the customers in order to complete the jobs. For Sample Marking situation, the feedback on the delay of job completion was mainly due to machine's capacity bottleneck. Therefore, the cause of the longer cycle time for job completion has no relation with the communication using email for job assignment, but rather the target cycle time is affected by the throughput time.

In conclusion, email is useful for communication between the virtual workers if the job is highly repetitive in flow and adequate in richness to perform the jobs. However, the communication using email tends not to induce higher process efficiency in higher time pressure. According to the findings of the cycle time achievement for the job at different level of time pressure, some cases of jobs in

priority 1 projects did not meet the targeted cycle time whereas all the jobs in priority 2 to priority 5 had been completed within the targeted cycle time. Therefore, this experiment rejected the hypothesis H1.

4.2 Hypotheses H2

This section provides an overall analysis for hypotheses H2. Firstly, the profile of the respondents surveyed will be presented, following by the job performance results conducted in the experiment, then the findings from the questionnaires surveyed. The analysis of the questionnaires and respondent's job performance will assist in answering the research objectives that were developed in Chapter One: to analyze the communication satisfaction (horizontal communication, communication climate, and relation with supervisor) of employees towards job performance, in which the task assignments are being informed via email.

4.2.1 Profile of Respondents

A sum of 59 survey forms was distributed to the virtual workers who participated in the experiment in a manufacturing department. All the survey forms were completed and returned, which indicated 100% of the questionnaires were applicable and can be used for analysis.

4.2.2 Gender Grouping

Out of the sample size of 59 respondents, 50 respondents (84.7%) were male while female accounted for 15.3%, which consisted of 9 respondents.

Table 4.14 *Gender*

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	50	84.7	84.7	84.7
	female	9	15.3	15.3	100.0
	Total	59	100.0	100.0	

4.2.3 Age Grouping

There are three groups of age generation identified which were Generation Y, Generation X and Baby Boomer. Most of the respondents were Generation Y, which consisted 57.6% or 34 respondents. Secondly, 22 respondents were Generation X and only 3 respondents were Baby Boomer.

Table 4.15 *Age*

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	gen Y	22	37.3	37.3	37.3
	gen X	34	57.6	57.6	94.9
	baby boomer	3	5.1	5.1	100.0
	Total	59	100.0	100.0	

4.2.4 Level of Education

67.8% of the respondents were non-university graduate, which consisted of 40 respondents. The university graduate accounted for 19 respondents, in which they obtained the academic title of bachelor degree, master degree or doctoral degree from the university. The non-university graduate however obtained the academic title such as Sijil Pelajaran Malaysia (SPM), Sijil Tinggi Persekolahan Malaysia (STPM), Certificate, Diploma or Advance Diploma.

Table 4.16 *Level of Education*

EDULEVEL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Uni graduate	19	32.2	32.2	32.2
	non-Uni graduate	40	67.8	67.8	100.0
	Total	59	100.0	100.0	

4.2.5 Level of Position

The organization charts in the department were classified into management and non-management position. The management position referred to the managerial level, who responsible for the execution of plans of the organization in accordance with the policies and directives of the top management. Overall, the managers were responsible for planning, organizing, leading and controlling. The non-management position referred to the workers who reported to the mangers, and execute the jobs which instructed or assigned to them. According to the response, only 3 respondents were delegated in management position, whereas the remaining of 56 respondents were in non-management position.

Table 4.17 *Level of Position*

POSITION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	management	3	5.1	5.1	5.1
	non management	56	94.9	94.9	100.0
	Total	59	100.0	100.0	

4.2.6 Job Performance

From table 4.18, all the 59 respondents participated in the experiments conducted for hypothesis H1. Due to the confidentiality of the respondents, their identity was denoted by Participant Number. The Participant 1 had completed the highest number of jobs which was 38 jobs. Participant 52 and Participant 57 recorded the lowest count of 1 job done each.

Table 4.18 *The Job Frequency of Participants*

PARTICIP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Participant 01	38	7.5	7.5	7.5
	Participant 10	5	1.0	1.0	8.5
	Participant 11	19	3.8	3.8	12.3
	Participant 12	30	6.0	6.0	18.3
	Participant 13	33	6.5	6.5	24.8
	Participant 14	19	3.8	3.8	28.6
	Participant 15	12	2.4	2.4	31.0
	Participant 16	8	1.6	1.6	32.5
	Participant 17	21	4.2	4.2	36.7
	Participant 18	6	1.2	1.2	37.9
	Participant 19	7	1.4	1.4	39.3
	Participant 02	24	4.8	4.8	44.0
	Participant 20	6	1.2	1.2	45.2
	Participant 21	19	3.8	3.8	49.0
	Participant 22	8	1.6	1.6	50.6
	Participant 23	8	1.6	1.6	52.2
	Participant 24	10	2.0	2.0	54.2
	Participant 25	5	1.0	1.0	55.2
	Participant 26	15	3.0	3.0	58.1
	Participant 27	8	1.6	1.6	59.7
	Participant 28	7	1.4	1.4	61.1
	Participant 29	9	1.8	1.8	62.9
	Participant 03	4	.8	.8	63.7
	Participant 30	7	1.4	1.4	65.1
	Participant 31	7	1.4	1.4	66.5
	Participant 32	8	1.6	1.6	68.1
	Participant 33	8	1.6	1.6	69.6
	Participant 34	8	1.6	1.6	71.2
	Participant 35	7	1.4	1.4	72.6
	Participant 36	7	1.4	1.4	74.0
	Participant 37	7	1.4	1.4	75.4
	Participant 38	7	1.4	1.4	76.8
	Participant 39	7	1.4	1.4	78.2
	Participant 04	6	1.2	1.2	79.4
	Participant 40	4	.8	.8	80.2
	Participant 41	6	1.2	1.2	81.3
	Participant 42	7	1.4	1.4	82.7
	Participant 43	7	1.4	1.4	84.1
	Participant 44	2	.4	.4	84.5
	Participant 45	2	.4	.4	84.9
	Participant 46	3	.6	.6	85.5
	Participant 47	2	.4	.4	85.9
	Participant 48	9	1.8	1.8	87.7
	Participant 49	8	1.6	1.6	89.3
	Participant 05	10	2.0	2.0	91.3

	Participant 50	3	.6	.6	91.9
	Participant 51	2	.4	.4	92.3
	Participant 52	1	.2	.2	92.5
	Participant 53	2	.4	.4	92.9
	Participant 54	2	.4	.4	93.3
	Participant 55	2	.4	.4	93.7
	Participant 56	3	.6	.6	94.2
	Participant 57	1	.2	.2	94.4
	Participant 58	2	.4	.4	94.8
	Participant 59	4	.8	.8	95.6
	Participant 06	6	1.2	1.2	96.8
	Participant 07	5	1.0	1.0	97.8
	Participant 08	6	1.2	1.2	99.0
	Participant 09	5	1.0	1.0	100.0
	Total	504	100.0	100.0	

Table 4.18 *The Job Frequency of Participants (continue)*

The calculated cycle time for job performance of each participant was recoded into Likert Scale of 1-5 as tabulated in Table 4.19. The Scale 1 represents highly inefficiency. As the higher number of scale, the higher the efficiency in job performance. In the experimental, there are total of 9 participants' job performance below the scale of 3. There are 50% of job performance score the scale of 5, following by 44.8% with the scale of 4. In total, there were 478 jobs completed efficiently.

Table 4.19 *The Frequency of Job Performance*

LS_JP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Inefficient	5	1.0	1.0	1.0
	Inefficient	4	.8	.8	1.8
	Meet Expectation	17	3.4	3.4	5.2
	Efficient	226	44.8	44.8	50.0
	Highly Efficient	252	50.0	50.0	100.0
	Total	504	100.0	100.0	

4.2.7 Mean and Standard Deviation

As shown in Table 4.20, the overall mean value for satisfaction of horizontal communication scored 3.7345. The highest positive response was given to the item "Extent to which enable me to provide information to other employees need in a timely, clear and exact manner" with the mean of 4.0508. On the other hand, the item "Extent to which the vast majority of daily information is provided to me by colleagues" received the lowest mean of 3.4576. With the overall mean value of 3.7345, which is well above the middle point of the Likert scale, it indicates that the respondents perceived themselves are moderately high satisfaction in horizontal communication.

Table 4.20 *The mean and standard deviation for Satisfaction in Horizontal Communication*

Satisfaction in Horizontal Communication	**Mean**	**Standard Deviation**
Extent to which assists me to do my best to convey merely reliable and exact information.	3.6610	0.5757
Extent to which enable me to exchange important information with my colleagues continuously.	3.8983	0.6350
Extent to which enable me to provide information to other employees need in a timely, clear and exact manner.	4.0508	0.6804
Extent to which my colleagues provide reliable information to me.	3.7797	0.6451
Extent to which horizontal communication with my colleagues is accurate and free flowing.	3.5593	0.7491
Extent to which the vast majority of daily information is provided to me by colleagues.	3.4576	0.6248
AVERAGE	3.7345	0.6517

As shown in Table 4.21, the overall mean value for satisfaction of communication climate scored 3.8870. The highest positive response was given to the item “Extent to which the status of tasks are spread in timely manner” with the mean of 4.0847. On the other hand, the item “Extent to which the daily information i receive is clear and concise” received the lowest mean of 3.6610. With the overall mean value of 3.8870, which is well above the middle point of the Likert scale, it indicates that the respondents perceived themselves are moderately high satisfaction in communication climate.

Table 4.21 *The mean and standard deviation for Satisfaction in Communication Climate*

Satisfaction in Communication Climate	**Mean**	**Standard Deviation**
Extent to which the daily information i receive is clear and concise.	3.6610	0.7098
Extent to which task assignment are well organized, clear and concise.	3.7627	0.6782
Extent to which information needed to do my job is received on time.	3.9492	0.5995
Extent to which important information is targeted by using email.	3.9831	0.5721
Extent to which the status of tasks are spread in timely manner.	4.0847	0.5956
Extent to which superior know and understand the problems face by subordinates	3.8814	0.6717
AVERAGE	3.8870	0.6378

As shown in Table 4.22, the overall mean value for satisfaction of relation with superior scored 4.0766. The highest positive response was given to the item "Extent to which the vast majority of daily information is provided to me by my superior" with the mean of 4.1695. On the other hand, the items "Extent to which my supervisor provides reliable information to me and my colleagues" and "Extent to which i accept the style of communication used with superior" received the lowest mean of 4.0169. With the overall mean value of 4.0766, which is well above the middle point of the Likert scale, it indicates that the respondents perceived themselves have relatively high satisfaction in relation with superior.

Table 4.22 *The mean and standard deviation for Satisfaction in Relation with Superior*

Satisfaction in Relation with Superior	**Mean**	**Standard Deviation**
Extent to which supervision given to me is accurate and comprehensible.	4.0678	0.5529
Extent to which my supervisor provides reliable information to me and my colleagues.	4.0169	0.7309
Extent to which supervisor listens and pay attention to employees for any problem arises.	4.0678	0.8683
Extent to which superior offers guidance for solving job related problems.	4.1186	0.7676
Extent to which the vast majority of daily information is provided to me by my superior.	4.1695	0.6201
Extent to which i accept the style of communication used with superior.	4.0169	0.6563
AVERAGE	4.0766	0.6994

Table 4.23 tabulated the mean of job performance for all the participants. The lowest mean value was Participant 40 with the value of 3, which the job performance was meeting the expectation. However, there were 3 participants performed their jobs highly efficiently. These mean values of job performance will be used as the dependent variables to analyze the level of communication satisfaction by using email.

Table 4.23 *The mean and standard deviation for Job Performance of participants*

Report

LS_JP

PARTICIP	Mean	N	Std. Deviation
Participant 1	4.2368	38	.99822
Participant 10	4.2000	5	.44721
Participant 11	4.4737	19	.51299
Participant 12	4.5333	30	.50742
Participant 13	4.2727	33	.83937
Participant 14	4.3684	19	.59726
Participant 15	4.5833	12	.51493
Participant 16	4.7500	8	.46291
Participant 17	4.7143	21	.56061
Participant 18	4.8333	6	.40825
Participant 19	4.5714	7	.53452
Participant 2	4.1250	24	.67967
Participant 20	5.0000	6	.00000
Participant 21	4.6842	19	.58239
Participant 22	4.8750	8	.35355
Participant 23	4.8750	8	.35355
Participant 24	4.4000	10	.51640
Participant 25	4.4000	5	.54772
Participant 26	3.8667	15	1.18723
Participant 27	4.0000	8	.92582
Participant 28	4.5714	7	.53452
Participant 29	4.1111	9	.33333
Participant 3	5.0000	4	.00000
Participant 30	4.2857	7	.48795
Participant 31	4.5714	7	.53452
Participant 32	4.6250	8	.51755
Participant 33	4.6250	8	.51755
Participant 34	4.5000	8	.53452
Participant 35	4.2857	7	.48795
Participant 36	4.5714	7	.53452
Participant 37	4.7143	7	.48795
Participant 38	4.8571	7	.37796
Participant 39	3.8571	7	1.34519

Participant 4	4.3333	6	.81650
Participant 40	3.0000	4	.81650
Participant 41	4.5000	6	.54772
Participant 42	4.2857	7	.48795
Participant 43	4.5714	7	.53452
Participant 44	4.0000	2	.00000
Participant 45	4.0000	2	.00000
Participant 46	4.3333	3	.57735
Participant 47	4.5000	2	.70711
Participant 48	4.6667	9	.50000
Participant 49	4.3750	8	.51755
Participant 5	4.8000	10	.42164
Participant 50	4.6667	3	.57735
Participant 51	4.5000	2	.70711
Participant 52	5.0000	1	.
Participant 53	4.0000	2	.00000
Participant 54	4.5000	2	.70711
Participant 55	4.0000	2	.00000
Participant 56	4.0000	3	.00000
Participant 57	4.0000	1	.
Participant 58	4.5000	2	.70711
Participant 59	4.2500	4	.50000
Participant 6	4.0000	6	1.09545
Participant 7	4.2000	5	.44721
Participant 8	4.6667	6	.51640
Participant 9	4.2000	5	.44721
Total	4.4206	504	.69194

Table 4.23 *The mean and standard deviation for Job Performance of participants (continue)*

4.2.8 Reliability Test

Reliability check was applied to three variables, which were horizontal communication, communication climate and relation with superior. The Cronbach's Alpha will test a total of 6 questions on each variable to observe the consistency. The Cronbach's Alpha for horizontal communication is 0.7810, communication climate is 0.8101 and relation with superior is 0.7899. The values indicated that these factors were deemed to be reliable. The reliability statistics for each of the factors are presented in Table 4.24.

Table 4.24 *Cronbach's Alpha Reliability Test*

Dimension	Alpha Coefficient	Number of Items	Number of Cases
Satisfaction in Horizontal Communication	0.7354	6	59
Satisfaction in Communication Climate	0.8069	6	59
Satisfaction in Relation with Superiors	0.8537	6	59

4.2.9 Pearson's Correlation

The correlation study is carried out to examine the relationship between one variable and another variable. The strength of association of the association between two or more variables is described quantitatively by the size of the correlation coefficient (Hair, Money and Samouel, 2007). The index ranges from -1 to +1, with zero indicating no relationship between two variables. When the correlation coefficient is near to 1 or -1, the strength of association is stronger. Table 4.25 provides the rules of thumb about correlation coefficient size.

Table 4.25 *Rules of Thumb of Correlation Coefficient Size*

Coefficient Range	**Strength of Association**
$\pm$ 0.91 to $\pm$ 1.00	Very strong
$\pm$ 0.71 to $\pm$ 0.90	Strong
$\pm$ 0.41 to $\pm$ 0.70	Moderate
$\pm$ 0.21 to $\pm$ 0.40	Small but definite relationship
$\pm$ 0.01 to $\pm$ 0.20	Slight, almost negligible
*Assume correlation coefficient is statistically significant	

Source: Adopted from Hair, Money and Samouel, 2007

Table 4.26 displays the correlation between the four variables (job performance, satisfaction in horizontal communication, satisfaction in

communication climate and satisfaction in relation with superior). As shown in Table 25, Satisfaction in Horizontal Communication, Satisfaction in Communication Climate and Satisfaction in Relation with Superior have a significant positive correlation with Job Performance, with the significant value of 0.000 for all, which is less than 0.01. Satisfaction in Horizontal Communication, Satisfaction in Communication Climate and Satisfaction in Relation with Superior have a moderate positive correlation with Job Performance with the correlation coefficient of 0.481, 0.651 and 0.624 respectively.

Table 4.26 *Pearson Correlation between Variables*

Correlations

		JOBPERF	AVERS	AVECC	AVEHC
JOBPERF	Pearson Correlation	1	.624(**)	.651(**)	.481(**)
	Sig. (2-tailed)	.	.000	.000	.000
	N	59	59	59	59
AVERS	Pearson Correlation	.624(**)	1	.684(**)	.476(**)
	Sig. (2-tailed)	.000	.	.000	.000
	N	59	59	59	59
AVECC	Pearson Correlation	.651(**)	.684(**)	1	.722(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	59	59	59	59
AVEHC	Pearson Correlation	.481(**)	.476(**)	.722(**)	1
	Sig. (2-tailed)	.000	.000	.000	.
	N	59	59	59	59

** Correlation is significant at the 0.01 level (2-tailed).

4.2.10 Multiple Regression Analysis

The following tables display the results of regressing three independent variables against job performance. Table 4.27 is the Model Summary, which shows the R square value of 0.484. This indicates that 48.40% of the variance in job performance is significantly explained by the three independent variables

(satisfaction in horizontal communication, satisfaction in communication climate and satisfaction in relation with superior).

Table 4.27 *Model Summary*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.696(a)	.484	.456	.26131

a Predictors: (Constant), AVEHC, AVERS, AVECC

Table 4.28 is the ANOVA table which shows that the F value of 17.177 is significant at the 0.000 level. The result indicates that at least one of the factors has significantly predicted the dependent outcome, in this case, the job performance.

Table 4.28 *Annova Table*

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.519	3	1.173	17.177	.000(a)
	Residual	3.755	55	.068		
	Total	7.274	58			

a Predictors: (Constant), AVEHC, AVERS, AVECC
b Dependent Variable: JOBPERF

Table 4.29 pointed out which of the independent variables is the most important predictor in explaining the variance in job performance. From the Unstandardized Coefficient Beta column, it can be seen that the strongest predictor is the Satisfaction in Communication Climate, with a Beta value of 0.306, and it is significant at 0.023, which is less than 0.05. The second predictor that significantly explained the variance of job performance is Satisfaction in Relation with Superior, with a Beta value of 0.222 and significant at 0.014, which is less than 0.05. Satisfaction in Horizontal Communication does not contribute to explain the variance

of job performance as its significant level is 0.803, which is greater than the rule of thumb of 0.05. With this, the following equation is formed:

Job Performance = 2.206 + 0.306 (Satisfaction in Communication Climate) + 0.222 (Satisfaction in Relation with Superior)

Table 4.29 *Coefficients*

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.206	.332		6.644	.000
	AVERS	.222	.088	.337	2.532	.014
	AVECC	.306	.131	.395	2.336	.023
	AVEHC	.029	.116	.035	.251	.803

a Dependent Variable: JOBPERF

With 95% of confidence level, it can be concluded that Satisfaction in Communication Climate and Satisfaction in Relation with Superior are positively associated with job performance. Therefore, only Hypothesis H2b and Hypothesis H2c are supported. The Hypothesis H2a should be rejected as the result indicates that Satisfaction in Horizontal Communication is not significantly contributing in explaining the variance of job performance.

4.3 Summary of Hypotheses

Table 4.30 displays the summary for the result of the hypotheses. Two out of four of the hypotheses are supported.

Table 4.30 *Result of Hypotheses*

	Hypothesis	Result
H1	Communication using email tends to have higher process efficiency in time pressure situation.	Not Supported
H2a	Satisfaction in horizontal communication is positively correlated to job performance.	Not Supported
H2b	Satisfaction in communication climate is positively correlated job performance.	Supported
H2c	Satisfaction in relation with superior is positively correlated job performance.	Supported

CHAPTER 5: Conclusion and Recommendation

5.1 Introduction

This chapter contains the concluding remarks and implications of the study. The Chapter is organized as follows. The first section summarizes the major findings. The second section is concerned with the implication based on this study. Lastly, in the final section, limitations as well as recommendations for future research agenda are presented.

5.2 Concluding Remarks

The experiment conducted showed that email communication did not improve job performance in higher time pressure situation. Besides that, the results of this study clearly indicate that communication satisfaction has positively correlated to job performance, especially satisfaction in communication climate and satisfaction in relation with superior. All in all, the important findings of this study are showed as follows:

5.2.1 Email Communication and Job Performance

Could the tasks to be accomplished in time if a group of workers are being informed by using email? The finding revealed that the jobs could be completed in time for priority 2 to priority 5, where the targeted cycle time setting were shorter as priority level from 5 to 1. However, there are number of job could not be completed within the targeted cycle time for priority 1 setting. The targeted cycle time for priority 1 for job completion is within 24 hours. This concluded that communication using email did not improve job performance in the time pressure of within 24 hours, which is the highest importance and urgency. Investigation had been carried out related to the delay in job completion by requesting the feedback of the workers. The main delay for Project Registration was due to insufficient information provided by customers, in which the information capacity was not rich enough. The root cause of

the delay in this experiment supported the statement by Narges et al. (2011) that the increase in email richness and ease of use perception improve task performance. The ease of use perception in this experiment referred to the email will be automatically send out to the next worker after the current job completed, and this was performed by the macro-Excel program. Furthermore, the finding in this experiment supported that asynchronous communication in high task interdependence resulted low team performance (Rico and Cohen, 2005). In conclusion, the findings of the study do not support the claim that communication using email tends to have higher job performance in time pressure situation.

5.2.2 Communication Satisfaction

Does communication satisfaction affects job performance, in which the jobs being assigned by using email? The communication satisfaction consist the factors of horizontal communication, communication climate and relation with superior, which were developed by Down and Hazen (1997).

5.2.2.1 Satisfaction in Horizontal Communication

Based on the findings, it shows that satisfaction in horizontal communication does not affect job performance. According to Pettit et al. (1997), horizontal communication acts as a moderator to influence the relationship between job performance and job satisfaction, rather has a direct influence to job performance. It appears that the relationship between performance and communication is more job specific.

5.2.2.2 Satisfaction in Communication Climate

This study found that there is a positive relationship between satisfaction in communication climate and job performance. Abugre (2011) shown that there is a significant relationship between effective organizational communication and workers' job satisfaction. He suggested that effective organization communication is very

critical in retaining worker's job satisfaction and consequently worker performance in organization.

5.2.2.3 Satisfaction in Relation with Superior

Finding show that satisfaction in relation with superior is positively correlated to job performance. Huseman et al. (1978) noted that employees' satisfaction with job and performance is affected by the messages communicated from a supervisor to subordinates due to the content of the message. Appropriate information about the task and supervisor-subordinate communication has stronger relationship with employees' behavioral intention toward job (task accomplishment) than with employees' job satisfaction (Jolanta, 2012).

5.3Implication of the Study

This study shows that email is a moderate effective communication channel for assigning job to a group of virtual workers. The asynchronous characteristic of email could support the information flow between the virtual workers who work at different time shift and location. Besides that, email could integrate the work flow effectively and lead to good job performance if the jobs are repetitive and organized. However, the experiment showed that certain cases of jobs could not be completed within 24 hours. If the job required to be completed within 24 hours, communication using email may not be an effective way. Therefore, alternate communication channel shall be used such as face-to-face or telephone.

The relatively high in communication satisfaction perceived by the virtual workers showed that email is good in the collaborative aspects of work. The satisfaction in communication climate and relation with superior shall be enhanced by the organization in order to have better job performance. The satisfaction in communication climate could be enhanced by improving the clarity and conciseness of the daily information delivered to the workers. Besides that, the organization

could decide the use of email as the major and formal communication channel, in order to influence the workers to accept email as the communication style used with superior. Additionally, the superior shall provide reliable information to subordinates to enhance the satisfaction in relation with superior.

5.4 Limitations and Recommendation for Future Research

Any further conclusions drawn from this study must be considered tentative as it was based on a relatively small sample of respondents (N= 59) taken solely from Quality Department in one of the manufacturing factory in Melaka. To remedy this weakness, further research should include other department such as Human Resource Department, Information Technology Department, Purchasing Department, and Assembly Department, to enable generalization to be made. Additional research is clearly needed by utilizing larger and more diverse samples.

In addition, this study mainly focuses on email communication to measure the job performance. There are other communication channels available such as face-to-face, video-conference calls, messenger and telephone could affect the job performance. Therefore, other type of communication channels shall be included to measure and compare the job performance.

Besides that, there are only three communication satisfaction factors (horizontal communication, communication climate and relation with superior) being studied in this study. Therefore, it is also critical to consider other factors such as media quality and organization integration. Furthermore, job satisfaction could be included as a variable in future study to study the role of job satisfaction in influencing communication satisfaction and job performance.

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