

CHAPTER 5

5 DISCUSSION AND CONCLUSIONS

This chapter will discuss the findings and results of the study in detail with direct reference to the results from various sections in above chapter and the overall research objectives of the study. It begins with a summary of the study's findings and their contribution to current knowledge of virtual project decision making and project success factors. These findings are discussed in terms of their implications and at the latter part recommendations will be given for the strategies to achieve the final research objective. Finally it will explain possible limitations and room for future research within this area before concluding with a brief summary of the contribution and the impact of the study.

5.1 DISCUSSION AND MANAGERIAL IMPLICATIONS

The first purpose of this study was to assess the extent to which determining factors which influence the effectiveness of decision making (Conceptual model: Figure 3-1) and to evaluate the impact of effective decision making on project success.

According to the data analysis in chapter 4, some important findings were analysed.

5.1.1 GOODNESS OF DATA

The model which developed in this study was tested with the data collected from field. Initially goodness of data was tested in three step procedure.

As the first step, Cronbach's Alpha values were calculated to aggregate and identify interpretable factors using a cutoff level of 0.5 for each loading and it was found a clear solution to the following variables: *team autonomy* (ten items, $\alpha = 0.816$; variance = 39.82%), *management of socio emotional factors* (twelve items, $\alpha = 0.799$; variance = 35.76%), *effective communication* (seven items, $\alpha = 0.745$; variance = 43.31%), *effective decision making* (eight items, $\alpha = 0.704$; variance = 35.72%) and *project success* (eleven items, $\alpha = 0.697$; variance = 32.25%).

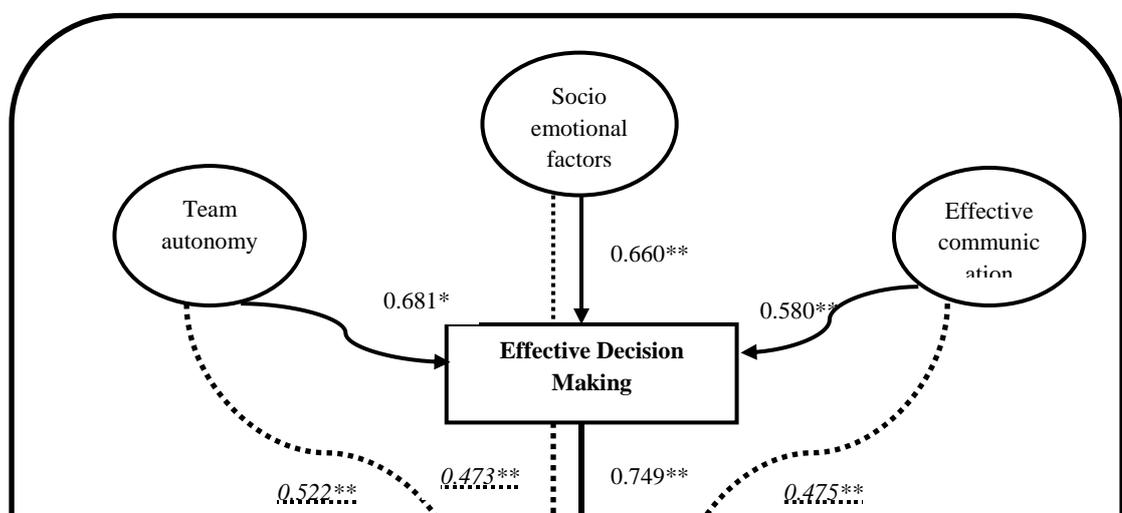
The second step of the analysis consisted with assessing the convergent validity which measures the patterns of intercorrelations among the variables. It was found that the intercorrelations among all independent variables to effective decision making was high. Then as the final step of assessing the goodness of data, discriminant validity has been measured using Principal Component Analysis.

From the model fit statistics, it can be concluded that the all indicators have strong discriminant validity.

Observations from descriptive data analysis in chapter 4, the mean values for all variables were 3 to 4 from the 5-point likert scale and the value around 4 to 5 in 7-point likert scale, which shows that the respondents have mostly agreed with each question in the questionnaire. If project management representatives could give more attention to the aspects of team competence, authority level and resource allocation, coordination and trust, they would achieve the project objectives most effectively. Results from descriptive analysis were also used to give recommendations to improve the decision making effectiveness in later section.

5.1.2 DEGREE OF RELATIONSHIP

Three sets of relationships can be analyzed with correlation coefficient values of the variables.



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

Figure 5-1: Research model with correlation statistics

First, in accordance with the correlation results as shown in the below diagram (Figure 5-1) it strongly supported the predictions of determining factors of effective decision making which tested in the model, were strongly and positively correlated with effective decision making.

Accordingly, team autonomy and management of socio emotional factors were strongly correlated variables to the effective decision making than effective communication. Therefore, team autonomy ($r = 0.681$) became as an important characteristic of virtual team's effective decision making. To meet stakeholders' expectations most project managers has recognized the importance of providing the team with as much autonomy as possible. This has been widely accepted norm in global project management literature and it is certainly applicable to the of virtual software development teams in Sri Lankan context as well. It also has important implications for top managers, who play a vital role in deciding to what extent a virtual team will be empowered. The results of this study clearly indicated the way to go despite the fear of out of sight and out of control syndrome that may be present in some organizations.

Further analyzing the correlation of indicators in each variable, it was found that, indicators of team autonomy: resources and authority level and team competence other than the training availability have the strongest relationship with effective decision making. People tend to be more effective in making decisions if they have required resources, authority level and high of competence. This has been further supported with the data gathered through semi structured interview sessions with

project management representatives who specified that, necessary resources such as technically sound work allocation and reporting system, system to schedule effort and central development environment with virtual logins are needed for effective decision making. They further stressed the fact that not only to making decisions, but also to control and monitor project activities; a sound work allocation system should be available. Another view which was emerged that, if people are more competent enough in terms of technology that they used and domain knowledge, they tend to make correct and speedy decisions independently. Inherently person has a decision making abilities if competence factors are supported to him/her.

The second importance can be given to the management of socio emotional factors (indicators: shared understanding & knowledge transfer, coordination, relationship building and trust) with correlation coefficient of 0.660. Shared understanding and knowledge transfer and coordination were to be the most critical indicators among others on the projects decision making effectiveness. The availability of prerequisite information along with its accuracy and completeness are crucial variables to have sound understandings and knowledge transfer. This has then impacted to make prudent, fast decisions within the context of virtual project teams, which has also supported by the data gathered from semi structured interviews. Project expert has stated that, if a project team is developing a system which integrates several components, then the work allocation for each different task among members has to be interrupted minimally and interfacing requirements should be defined clearly in order to carry out each members' tasks smoothly. He further stressed that there should be a strong coordination among the members of the team.

However, the one indicator (trust) of socio emotional factors has come up with weaker correlation than others. Even in the literature, it was observed that in virtual software teams the trust level is lower at the start of the project, which could lead to reluctance to share information (Herbsleb & Grinter, 2001). This may be due to insecurity and the possibility that teams did not see themselves as partners working towards a common goal. As Herbsleb & Grinter (1999) pointed out, businesses engaged in virtual team projects should arrange face-to-face meetings of team members at regular intervals to build the trust level of the team members. In this

study, this has been identified as a less impacted indicator in effective decision making.

Finally, effective communication was also established a moderate level relationship with effective decision making ($r = 0.580$). Among the indicators of effective communication (motivation to communicate, level of project communication and tools of communication), motivation to communicate has a major impact on the decision making effectiveness. As long as people are dispersed, it seems that people's natural tendencies of perceived need and the initial embarrassment influence the disseminate information about expertise, context, status, workloads and urgency. Moreover, it takes a while before a newcomer is comfortable "chatting" with an instant messaging tool. From this study, it was found that, if people can motivate by increasing the perceived need and avoiding the embarrassment, they could make more effective decisions while communicating with the members especially with collaborative teams/organization.

Second set of relationships established in the study was correlation between effective decision making and project success. As per the results ($r = 0.749$) effective decision making has been considered as a predictor of project success at strong significance level. In other words, it was found that effectiveness of project decisions such as what (aims and goals), when (work schedule) and how (process and support) has strong influence on the project outcome.

Final set of relationship found in this study was the impact of all determining factors (team autonomy, management of socio emotional factors and effective communication) on the success of the project. From the values in correlation coefficients, it can be stated that there was a fairly moderate level relationship exist between the determining factors and project success. Among those, team autonomy and effective communication have noticed as most influential factors.

However, to confirm the third set of relationship whether they have actually valid, mediator analysis with regression was also performed. According to the results of mediation analysis, it was found that, even though there are correlations exist between, determining factors and dependent variable project success, it should be achieved through a mediator such as effective decision making. In other words, if

team autonomy of project has been increased, it will not increase the project success unless it is achieved through the use of effective decision making. From the results of mediator analysis, it was found that decision making has *'full mediation'* impact for all three determining factors.

5.1.3 EXPLANATORY POWER

Next section of discussion will base on the model which developed with simple and multiple regression analysis to test established hypothesis and other effect of relationships. Results of the standardized path coefficients and the fit statistics are demonstrated in the table below.

Table 5-1 Summary of fit statistics

| Hypot hesis | | β | p - value | R^2 |
|-------------|---|---------|-----------|-------|
| H1 | Team autonomy → Effective decision making | 0.368** | 0.001 | 50.9 |
| H2 | Socio emotional factors → Effective decision making | 0.219** | 0.046 | |
| H3 | Effective communication → Effective decision making | 0.196** | 0.011 | |
| H4 | Effective decision making → Project success | 0.749** | 0.001 | 56 |

**P value < 0.05

Similar to earlier correlation analysis, there are two sets of relationships can be analyzed with the regression model.

First it was considered the group of determining factors that hypothetically impact the effectiveness of decision making in virtual teams. A fairly high level of R^2 (50.9%) suggests that the three factors considered have fairly strong explanatory power. 50.9% of the variation in effective decision making is explained by the variability in all determining factors together. To further elaborate, if a software development organization has all these determining factors, there is 50.9% chance of explanatory power of any variations in the decision making effectiveness. Further it has given opportunity to identify most influential factor among the three factors tested in the study. Among them the team autonomy has the highest significant positive effect on

the effectiveness of decision making ($\beta = 0.368$; $p < 0.05$) then the management of socio emotional factors ($\beta = 0.219$; $p < 0.05$) and finally the effective communication ($\beta = 0.196$; $p < 0.05$) has less impact of decision making effectiveness of virtual teams. These results were further strengthening the findings of the correlation analysis.

When analyzing the impact of effective decision making to project success in second set, it has given the strong beta value with significance level at 0.05. The explanatory power of variance ($R^2 = 56\%$) was fairly strong and it can be concluded that there was an impact of effectiveness of decision making on the project success. In other words, more than half of the variations of project outcome can be explained by the variations of decision making effectiveness. Results found in this study were not contradicted with earlier researches, as most of them have considered decision making as one of the critical success factor of project success.

Based on the outcome of above factors, all alternative hypotheses (H1 to H4) were accepted by concluding that there were positive relationships exist in the hypothetically tested liner relations.



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As a concluding remark of discussion, these results extend the literature on decision making effectiveness in the context of virtual project teams. They shed light on the contradictory results found in the literature comparing the performance of virtual teams to that of collocated (teams which are not dispersed) teams. For example, McGrath (1991) suggests that teams with no past history, engaged in a dispersed task, are less likely to be effective than collocated teams, whereas Schmidt et al. (2001) show that dispersed teams may well make better new product decisions than collocated ones. The results of the present study clearly suggest that the effectiveness of virtual team decision making is strongly impacted by team autonomy, management of socio emotional factors and moderately impacted by effective communication within the context of Sri Lanka.

5.2 RECOMMENDATIONS FOR IMPROVEMENT STRATEGIES

The final objective, recommend strategies to improve decision making effectiveness in order to achieve the project success was fulfilled based on the research findings (both quantitative and qualitative results) and mentioned in the recommendation section itself below.

The study revealed findings in tested scenarios, almost all of which can be found in virtual software development literature. The problems of lack of team autonomy, ineffective communication, effects of unclear definitions of roles and responsibilities need for a comprehensive tool support, and needs of concurrent processing are explained in many other articles (Carmel and Agarwal (2001), Chidambaram (1996), Cohen and Bailey (1997), Ebert and Neve (2001), Herbsleb and Grinter (1999), Herbsleb and Moitra (2001), Mockus and Herbsleb (2001), Powell, Piccoli and Ives (2004)) parallel to this study.

This study aimed to reveal major determining factors of decision making effectiveness of virtual software development and then it impacts on the project success. It was found from the data analysis, that there is a strong positive correlation exists between determining factors and effective decision making. Moreover, effective decision making is positively and strongly correlated with the project success.



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Therefore, it is important to identify the possible causes if these determining factors were not existed in an organization. Based on the causes, recommendations will be provided with the data gathered from semi structured interview sessions.

According to findings, team autonomy has a strong correlation with effective decision making than other determining factors. When discussing individual concepts of team autonomy, necessary resources and authority was found in first place. It is required to have necessary resources and authority level in order to minimize the confusions in roles and commitments of collaborative parties. This will be achieved by proposing clear definitions of roles and engagements of the collaborative parties before agreement. Then the second important concept is appeared as team competence for setting up own objectives. There is always a need to select, design and development of teams which suits to the virtual environment to extend the reaches of organizations. It enables them to do things they could not do before. If there is lack of team competence, team ineffectiveness and less performance from teams can be seen.

Therefore, it is recommended selecting the project team with correct competence level. Careful attention should be given to building and maintaining the team while increasing the team performance. Reserve necessary time for the initialization phase to spend required time with team formation activities and provide harmony of teams. Amount of training availability is being the final concept of determining factor of team autonomy. From the results, it has the least importance in order to make effective decisions. However, if the project team is not given the required training on relevant aspects, there will be issues due to lack of knowledge, fear of involving in decision making and lack of information to perform tasks. To overcome these issues, collaborative parties and teams should be trained about the usage of the tool in the development environment/ about project/ about system.

Shared understanding and knowledge transfer was found as the most important concept of second determining factor (management of socio emotional factors) of effective decision making. In virtual project teams, there is a need to maintain a secure common work place to store and achieve work products/ share information/ knowledge. In order to achieve this, organizations should provide a common and secure place and relevant tools and techniques to the project members.

The factor effective communication as the least strength determining factor has measured communication effectiveness through three concepts (tools of communication, motivation to communicate and level of project communication). Among these, Motivation to communicate has the strongest correlation with the effective decision making. Therefore, it is recommended to improve the motivation by enhancing synchronous communication between collaborative teams to make them Know each other. This can be done through frequent team gathering, workshops and informal communication with collaborative parties.

Other recommendations on each concept are summarized in table 5-2 below.

Table 5-2 Summary of Recommendations

| Indicator | Needs | Causes if not available | Recommendations |
|----------------------|-----------------|-------------------------|-----------------------------|
| Team autonomy | | | |
| Team | Need to select, | Team ineffectiveness, | Careful attention should be |

| | | | |
|--|---|---|---|
| competence for setting up own objectives | design and development of teams which suits to the virtual environment to extend the reaches of organizations. It enables them to do things they could not do before. | lack of team performance | given to building and maintaining the team while increasing the team performance. Reserve necessary time for the initialization phase. Spend required time with team formation activities and provide harmony of teams. |
| | Need of participative decision making | Decision inaccuracy, delaying in decisions. | Support inner group discussions, make people have responsible on the decisions |
| Available resources and authority level | Need to minimize the confusions in roles and commitments of collaborative parties | Problems in collaborating and acquiring work harmony | Propose clear definitions for roles and engagements of the collaborative parties before agreement. |
| Training availability | Need for an effective training project related items | Lack of knowledge, fear of involving in decision making, Lack of information to perform tasks | Collaborative parties and teams should be trained about the usage of the tool in the development environment/ about project/ about system |
| Management of socio emotional factors | | | |
| Coordination | Need to enhance parallel work | Single line processing, unbalanced work load, idle time of teams and actors, and late submissions, delay in work, unable to catch up the schedule | Provide effective communication links and clear division of tasks, reserve sufficient time to analysis and planning phases |
| | Need to provide balanced work load | Inefficiency in parallel work, Centralized work, de motivation | Provide reasonable division of tasks, eliminate coordination obstacles |
| | Need to coordinate sequential (dependent) work | Time loss and rework | Carefully plan the division and share of tasks to geographically separated parties, and provide minimum interfaces in between for |

| | | | |
|---|--|--|--|
| | | | sequential work, make the divisions minor enough to provide balanced work load but also major enough to be able to coordinate the tasks |
| Trust | Need to enhance trust between collaborative parties | Lack of trust among coworkers, resistance to work in collaboration | Plan interaction session to improve team identity, clearly propose the roles, responsibilities and engagements of parties |
| | Need a system to follow up the progress of work of dispersed teams | Worried partners about the progress of work, panic before submissions even when the rate of progress is adequate to catch up with the project plan | Provide a publicly available project plan and activity based plan for all parties to reveal the work progress, accomplished activities and tasks |
| Shared understanding and knowledge transfer | Need for secure common work place to store and achieve work products/ share information/ knowledge | difficulties to handle disorganized work products, communication traffic, members' panic and stress | Provide a common work place to store and achieve work products/ information/ knowledge |
| Relationship building | Need interaction among team members to complete tasks, Need to reveal the relations of collaborative parties | Lack of understanding rules of collaboration | Reveal roles and responsibilities, engagements and relations of collaborative parties |
| Effective communication | | | |
| Tools of communication | Need to determine utilization of communication tools | Time and data loss caused by using several primitive tools | Determine the tools to be utilized at specified situations, make communication channel available to all collaborative parties |
| Motivation to communicate | Need two way communication | Confusions and delays of asynchronous communication | Enhance synchronous communication between collaborative teams to make them know each other |

| | | | |
|--------------------------------|--|--|--|
| Level of project communication | Need for a communication plan | Ineffective communication links and scheduled activities for communication | Propose clear definitions in the initialization phase, define the roles, responsibilities and engagements of parties and teams in collaboration, determine schedules and working hours of parties, teams and actors, determine meeting schedules, determine use of ICT support |
| | Need for a communication leader, or a team dedicated to communication activities | Communication traffic, rework which is caused by ineffective communication links, extra communication work load on project managers and team leaders | Provide a initiative communication leader to coordinate events and flows of communication, or provide a team dedicated to communication activities |



5.3 LIMITATIONS OF THE STUDY

Every research conducted has limitations of its own nature because of resource limitations, time constraints and many more. This study also has certain limitations of its own. Firstly, as found in the results of the pilot survey, respondent were reluctant to mention the names of their organizations due to the sensitivity of the information on their projects/ organization. Therefore, such information was excluded from the survey questionnaire. Further, some organizations were reluctant to provide information on their current and past projects and they refused to face for interviews/conference calls on the same. Therefore, extra effort has been put to gather information through the personal contacts to make the study a success.

Further, due to lack of previous literature or information published on Sri Lankan software industry, difficulties were faced in determining the sample size. There was no proper information published on virtual software teams, in any source. It was

achieved mostly through the personal contacts by finding out whether the selected organizations has involved in virtual software developments.

The study will have implications for practice since the study has focused on multiple companies in virtual software development. Even the categorization of sample companies has a right balance, it still need to be considered some other disciplines as size, dynamism, personal and culture In the theoretical side the present work will eventually establish an empirically defined set of factors that affect virtual software development processes as observed in multiple companies. For example, Boehm and Turner (2003) suggest that five factors should be considered when finding a right balance between agility and discipline of a software development process: size, criticality, dynamism, personnel, and culture.

5.4 DIRECTIONS FOR FUTURE RESEARCH

Virtual teams and global software development is a new, promising and interesting but a challenging phenomenon, which is in the early stages of its investigation. Hence significant work to understand the organizational forms of future still remains undone. This study was distinctive from the other researches, since it investigated the factor influenced to one specific area, which is decision making in virtual software development teams. Therefore, to better understand the phenomenon, more analysis should be executed with different types (duration, size, people, design, structure of collaboration etc.) of teams, organizations and software projects. In other words, the studies should more specifically focus on the issues such as; appropriate size of the projects for any distributed setting, skills to approach different size of projects, relations with team design variables, distance and speed, effectiveness of practices in different development settings etc. Finally, this study showed that more research work is required on organizations which having effective project management practices and mature development processes to differentiate the specific needs of distributed settings from the general issues of project management practices.

5.5 CONCLUDING REMARKS

This study focused on the decision making in a virtual software development team environment. The purpose of this exploratory investigation was to examine the links between key determining factors such as team autonomy, management of socio emotional factors and effective communication with effective decision making and finally the link of those with project success.

Using data from the field and provided by project management representatives, it was found that the effective decision-making is strongly associated with team autonomy and management of socio emotional factors and moderately associated with effective communication. The data suggested that the effects of autonomy and impact of managing socio emotional factors have almost same level of significant relationship with effective decision making.

Then it was proved that there is a strong relationship exists between decision making effectiveness and project success with more than 50% of explanatory power. It was a good indicator for the project management representatives that, they have to be more effective in their project decisions in order to make the project success.

Virtual teams are fast becoming more the rule than the exception in organizations. It's time to stop thinking of them as a special case and start developing strategies for dealing with the new challenges they create. Virtual teams need the same things all teams need a clear mission, an explicit statement of roles and responsibilities, communications options which serve its different needs, opportunities to learn and change direction. The job of the manager of a virtual team is to help the team learn how to be a virtual team and, most of all, to create ways to make the working of the virtual team visible to itself.

As the number of virtual teams is constantly rising in most software development firms today, there is certainly a requirement to understand how project management processes need to be adapted. In the case of decision-making processes, there is a shortage of studies despite the fact that decisions are central to carrying out projects. It is hoped that more studies like this one will contribute to a better understanding of the issues involved, and provide relevant insights for future managers.