

*Full Length Research Paper*

# Critical factors influencing the project success amongst manufacturing companies in Malaysia

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The purpose of this study is to investigate the critical factors that influence a successful project among manufacturing companies in Penang, Malaysia. In addition, this study is also aimed to explore if project change control play a role in moderating the relationship between the independent variables and dependent variable identified in this research. Through the literature review process, it was found that project mission, top management support, client consultation, technical task, personnel competency, client acceptance, trouble shooting, project plan monitoring and effective communication are among the critical factors identified. From the 79 respondents who responded to 79 successfully completed projects, this study revealed that project success in the manufacturing context was in two dimensions which this study classified as micro and macro project success. This study also demonstrated empirically that project personnel competency and project mission are critical factors influencing the micro project success and as for macro project success, top management support and project mission are two main critical factors.

**Key words:** Critical factors, project success, Malaysia.

## INTRODUCTION

Project management as a management discipline under-pins much economic activity. In industries as diverse as manufacturing, projects drive business. Project management, therefore, is emphasized as the process of making decisions and operationalising certain strategies and tactics to bring the project to success. According to Mobey and Parker (2002), to increase the chances of a project succeeding it is necessary for the organization to have an understanding of what are the critical success factors, to systematically and quantitatively assess these critical factors, anticipating possible effects, and then choose appropriate methods of dealing with them. Once identified, the success of the project can be achieved.

Large-scale engineering and construction projects have traditionally dominated the subject of project management and implementation. According to Pinto (1986), the project implementation process is complex, usually requires extensive and collective attention to a broad aspect of human, budgetary and technical variables. In

addition, projects often possess a specialized set of critical success factors in which if addressed and attention given will improve the likelihood of successful implementation. On the other hand if these factors were not taken seriously might lead to the failure of the project. Business today is operating under high level of uncertainty, projects implementations are open to all sorts of external influence, unexpected events, ever-growing requirements, changing constraints and fluctuating resource flows. This clearly shows that if projects are applied and steps are not taken in order to manage them effectively and efficiently, the chances of failure are high. Based on the statistics published by Malaysian Industrial Development Authority (MIDA) in August 2006, the number of approved manufacturing projects has increased by over 15% since year 2001. This approved manufacturing projects amounted to a total capital investment of over RM31 billion in 2005 and RM46 billion in 2006 from both local and foreign investments, an increase of 8% from the previous year. 51% were successfully implemented and mostly comprised production and machine installation projects, whereas 48.7% was in active planning stage (MIDA, 2006).

As projects are being used widely in the manufacturing

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industry, it is therefore vital to identify factors that contribute to the successful implementation of project. This is also supported by an empirical study conducted by Belassi and Tukel (1996) where manufacturing respondents accounted for 40.7% of the total respondents in which product development projects were most common. Accordingly, this paper is to identify the critical factors that contribute to project success in manufacturing sector in Malaysia. This paper therefore begins with an overview of the project success. Following this overview, an introduction to critical factors for project success shall be discussed. This paper also presents the methodology used in the study. This is followed by the analysis and lastly the discussions and implications shall be discussed.

### **Project success**

Increasingly these days organizations are project based, meaning that the work they do is split into programmes of projects designed to deliver the organization's strategies and add value. Good management of these projects is essential if the organization is going to succeed. Equally important to individual project success is ensuring that the right projects are carried out. As project management guru Bob Buttrick puts it, "Directing the individual project correctly will ensure it is done right". Directing all the projects successfully will ensure we are doing the right projects."Success is an interesting word and a word that is so general and wide in nature that it is difficult to define and obtain mutual agreement when asked from different individual. Jugdev and Muller (2005) in their article mentioned that in order to define what success means in a project context is like gaining consensus from a group of people on the definition of "good art." Project success is a topic that is frequently discussed and yet rarely agreed upon (Baccarini, 1999) . Generally, the views on project success have evolved over the years from simple definitions that were limited to the implementation phase of the project life cycle to definitions that reflect an appreciation of success over the entire project and product life cycle (Jugdev and Muller, 2005).

Organizations have varying levels of expertise in the project management function. Many of these organizations realize that to be successful a better approach to project management is necessary. Project Management Maturity Matrix can help organizations improve the maturity of their project management processes, in terms of an evolutionary path from ad-hoc, disorganized processes to mature, disciplined project management processes. The matrix describes four levels of maturity in project management:

#### **Level 1**

Projects are often delivered through the personal heroics and effort of the project manager and his/her team. They

tend to be delivered in spite of the organization rather than because of it.

#### **Level 2**

Anybody can deliver here not just heroes, because there is an agreed methodology to be followed that helps repeat earlier successes from similar projects. Courses and training can help at this level.

#### **Level 3**

This is not only about delivering projects but also realizing benefits. This involves knowing what benefits are expected and when the project has delivered them.

#### **Level 4**

Is concerned with whether we are doing the right projects and how via those projects we can deliver the business strategy and add value.

### **Critical factors for project success**

Developing or identification of success factors has dominated the field of project management from 1980s to 2000. Many researchers have tried to a certain extent to identify success factors for project management. Among researchers are Kerzner (1987), Pinto and Slevin (1987), Pinto and Slevin (1989), Clarke (1999), Cooke Davis (2002) and Muller and Turner (2003). The following paragraphs are dedicated in reviewing the main contributors in setting the success factors and shall be summarized using Figure 2. To summarize the findings from the literature review, refer to Table 2, which tabulates the success factors that were identified by different researchers (Kerzner, 1987; Pinto and Slevin, 1987; Pinto and Slevin, 1989; Wateridge, 1995; Belassi and Tukel, 1996; Clarke, 1999; Cooke-Davis, 2002; Muller, 2003). The factor lists vary from broad general outlines to specific point of consideration. (Table.1)

From the literature review, it is revealed that Pinto's research in 1986 and his subsequent findings with Slevin on their findings of 10 critical success factors have since become a classic piece of works in this field. Their model is one of the most widely quoted lists of critical success factors (Muller and Turner, 2005). This proposed study will take advantage of this classic work and will further develop it in the context of manufacturing industry. For this reason, the ten factor process model of project management as established by Pinto (1986) shall be adopted for this study. However besides the ten critical success factors adopted from Pinto (1986), this study has also expanded the factor of personnel to cover the leadership style and competency of the project leader, on the project success based on the support of the literature review highlighted in the earlier portion. The following hypotheses have been formulated to test the relationship between both the independent variables and dependent

**Table 1.** Summary of literature reviews on critical factors for project success.

| Success Factors from the Literature   | Pinto(1986) | Kerzner(1987) | Pinto&Stewart<br>(1988) | Belloc&Turker<br>(1989) | Wateridge(1995) | Belout(1998) | Clarke(1999) | Cook-Davies(2002) | Muller(2005) |
|---|-------------|---------------|-------------------------|-------------------------|-----------------|--------------|--------------|-------------------|--------------|
| Corporate understanding   |             | X             | X                       |                         | X               |              |              |                   |              |
| Common understanding with stakeholders on success criteria  |             |               |                         | X                       |                 |              |              |                   |              |
| Executive commitment  | X           | X             | X                       |                         | X               |              |              |                   |              |
| Organizational adaptability   |             | X             |                         |                         |                 |              |              |                   |              |
| Communication   | X           |               | X                       |                         |                 |              | X            |                   |              |
| Project manager selection criteria  | X           | X             | X                       |                         | X               |              |              |                   | X            |
| Project manager leadership / empowerment  | X           | X             | X                       |                         | X               |              |              |                   | X            |
| Environment   |             |               | X                       |                         |                 |              |              |                   |              |
| Commitment to planning & control  | X           | X             | X                       |                         |                 |              | X            |                   | X            |
| Project mission / common goal / direction   | X           |               | X                       |                         |                 |              | X            | X                 |              |
| Top management support  | X           |               | X                       |                         | X               |              |              |                   |              |
| Client consultation / acceptance  | X           | X             | X                       |                         |                 |              |              |                   |              |
| Monitor performance and feedback  | X           |               | X                       |                         |                 |              |              | X                 | X            |
| Personnel / teamwork  | X           | X             | X                       |                         | X               | X            |              | X                 | X            |
| Technical task ability  | X           | X             | X                       |                         |                 |              |              |                   |              |
| Trouble shooting / risk management  | X           |               | X                       |                         |                 |              |              | X                 |              |
| Project ownership   |             |               |                         |                         |                 |              |              | X                 | X            |
| Urgency of project  |             |               | X                       |                         | X               |              |              |                   |              |
| Duration and size of project  |             |               |                         |                         | X               |              | X            | X                 |              |
| Remarks: "X" success factor(s) that is determined by the researcher either on a conceptual or empirical basis |             |               |                         |                         |                 |              |              |                   |              |

**Table 2.** Type of project and position held by the respondents.

| Type of project          | Frequency | Percent | Cumulative Percent |
|--------------------------|-----------|---------|--------------------|
| New product development  | 26        | 32.9    | 32.9               |
| New process introduction | 14        | 17.7    | 50.6               |
| Quality improvement      | 9         | 11.4    | 62.0               |
| Operational improvement  | 9         | 11.4    | 73.4               |
| Project transfer         | 8         | 10.1    | 83.5               |
| Others                   | 7         | 8.9     | 92.4               |
| Technology transfer      | 6         | 7.6     | 100.0              |
| Total                    | 79        | 100.0   |                    |

variable:-

**H1:** A clear project mission is positively related to project success in manufacturing

**H2:** High support from the top management is positively related to project success in manufacturing.

**H3:** A detail project schedule/plan and effective use of the plan is positively related to the project success in

manufacturing.

**H4:** Frequent and high client consultation is positively related to project success in manufacturing

**H5:** Competent project personnel is positively related to the project success in manufacturing

**H6:** The availability of technical tasks force is positively related to the project success in manufacturing.

**Table 3.** Rotated factors and factors loading for dependent variable.

| Items   | Factors     |             |
|---|-------------|-------------|
|   | 1           | 2           |
| S4 The project was used by its intended clients.                                  | <u>.828</u> |             |
| S3 The project that has been developed works.                                     | <u>.774</u> |             |
| S7 Important clients, directly affected by the project, made use of it.           | <u>.684</u> |             |
| *S5 The project has directly benefited the intended users.                        | <u>.508</u> | .460        |
| S12 The results of the project represented a definite improvement in performance. |             | <u>.789</u> |
| S10 The project has directly led to improved decision making or performance.      |             | <u>.779</u> |
| S11 The project has made a positive impact on those who make use of it.           |             | <u>.630</u> |
| *S6 The project seems to do the best job in solving the intended problem          | .485        | <u>.558</u> |
| Eigenvalue  | 3.39        | 1.42        |
| Percentage of Variance  | 37.65       | 15.76       |

\* Cross loading.

**H7:** High client acceptance is positively related to the project success in manufacturing

**H8:** Frequent monitoring and feedback activity is positive related to the project success in manufacturing

**H9:** Effective and sufficient communication is positively related to the project success in manufacturing.

**H10:** Capability in trouble-shooting is positively related to the project success in manufacturing

### Research design

This study was carried out using structured questionnaire. As quoted by (Sekaran, 2003), "questionnaire is a popular method of collecting data because researchers can gather information fairly easily and the questionnaire responses are easily coded". The questionnaire used is adopted from Pinto's Project Implementation Profile (P.I.P), which has been verified to be reliable and valid (Pinto, 1986). The questionnaires were distributed in three ways. The first way was through electronic mail where a total of 97 electronic mails were sent to individuals working in manufacturing firms. Secondly, a total of 246 hardcopies questionnaires were mailed to 82 manufacturing companies. The manufacturing companies targeted were from various industries namely fabricated metal product, electronics, machinery, paper-based Industry, plastic-based industry, textile and garment and rubber-based industry. Lastly, a total of 52 faxes were sent to the Human Resource department of manufacturing firms to seek for permission and their interest to participate in the questionnaire. The unit of analysis of this study is a project, which has been completed and classified as a successful project in the manufacturing organization of the respondents.

The dependent variable for this study is project success in a manufacturing environment. This dependent variable is measured using 12 items adopted from the Project Implementation Profile (P.I.P) by Pinto (1986). All items would be rated using a 5-point Likert scale with 1 representing strongly disagree to 5 representing strongly

agree. The 10 independent variables are each measured using items adopted from the Project Implementation Profile (P.I.P) by Pinto (1986). All items are also rated using a 5-point Likert scale with 1 representing strongly disagree to 5 representing strongly agree.

### Respondent's profile

A total of 395 questionnaires were distributed using three major means which were electronic mails (97), mailing of self-addressed copy of the questionnaire (246) and fax (52). The first follow-up notice was sent to all respondents through electronic mail and fax three weeks after the questionnaires were distributed, the second and third reminder was sent one and two weeks respectively after the first reminder notice. A total of 79 respondents responded to the questionnaire and a response rate of 20% was obtained. 80% failed to respond out of which 3% stated the questionnaire was not applicable and the reason for the remaining non-respondents was unknown.

### Goodness of measures

Factor analysis was performed on the dependent variable, which is project success and 10 independent (table. 3) variables. The varimax rotation method was used to determine any underlying components for each variable. The project success was divided into two main dimensions. Firstly the project success was measured based on its ability to function and satisfy the direct users. The second dimension of project success was measured based on the benefits realized by the organization. As a result Factor 1 was relabeled as Direct Project Success and Factor 2 relabeled as Indirect Project Success. Direct project success because success is measured by the value the project delivers to its direct end users and indirect project success because success is measured by the value the project delivers to the indirect users which is the organization itself.

Factor analysis also was performed on the 10 independent variables. Factor 1 which was project plan monitoring comprised 4 items (Q13, Q14, Q22, Q40) with factor loadings ranging from 0.551 to 0.699, factor 2 which was client consultation comprised 5 items (Q15, Q16, Q17, Q18, Q19) with factor loadings ranging from 0.644 to 0.834. Factor 3 which was technical tasks consist of 3 items (Q30, Q32, Q33) where factor loadings ranging from 0.593 to 0.801 followed by factor 4 which was top management support with 5 items (Q6, Q7, Q8, Q9, Q10) with factor loadings from 0.620 to 0.823. Factor 5 which was personnel comprised 3 items (Q23, Q27, Q28) and the factor loading ranged from 0.517 to 0.791. Factor 6 was project mission and consists of 3 items (Q3, Q4, Q11) with factor loadings from 0.546 to 0.802. Factor 7 was client acceptance with 4 items (Q25, Q36, Q37, Q39) and the factor loadings ranged from 0.626 to 0.671. Factor 8 (trouble shooting) comprised 2 items (Q49, Q50) with factor loadings of 0.637 and 0.652 and lastly factor 9, which was communication, comprised 2 items (Q42, Q43) with factor loadings 0.601 and 0.735, respectively (Table 4).

Based on the factor analysis for the dependent and independent variables, two factors had been extracted from the dependent variable and from the initial ten factors of the independent variables, nine factors had been extracted. As a result the initial theoretical framework and hypotheses have to be revised to the following (Figure 1).

### Reliability analysis

Reliability test was performed on all variables to ensure that the items measuring each variable were in the same group and successfully measuring what they were intended to measure. Reliability test was also performed to test the consistency of respondents' answers to all the items in measure. Cronbach's alpha was observed and all the variables were accepted based on the alpha value more than 0.60. Summary of the reliability test's results was shown in Table 5.

### Hypotheses testing

#### Regression analysis for hypotheses H<sub>1,2,3,4,5,6,7,8,9a</sub>

Observation from the model showed that personnel had significant relationship with direct project process at 0.10 significance level and the relationship was positive (Beta = 0.258,  $p < 0.10$ ). Additionally, project mission also demonstrated a significant positive relationship at 0.05 significance level with direct project process (Beta = 0.322,  $p < 0.05$ ). However all other variables were found not to have any significant relationship with micro project success, with these findings, it was therefore concluded that H1a and H5a are supported. Table.6

#### Regression analysis for hypotheses H<sub>1,2,3,4,5,6,7,8,9b</sub>

The model showed that top management support and project mission have significant relationship with macro project process and the relationships were both positive (Beta = 0.268,  $p < 0.05$  for top management support and Beta = 0.243,  $p < 0.10$  for project mission). All other seven variables were found not to have any significant relationship with macro project success. It was therefore concluded that H1b and H2b were supported at 0.10 and 0.05 significance level, respectively (Table 7).

## DISCUSSION

### Project success

From the statistical results it was found that project success is not in one dimension, this is in line with previous researchers' findings such as Shenhar (1997), Pinto (1986) and Atkinson (1999). This study has identified two main dimensions of project success, the first dimension is success measured by the impact on the end user or clients. A successful manufacturing based project was measured by the usage level of its intended clients, the clients' adoption in their daily tasks and the perception of the clients that the developed project works. The second dimension is success measured by the impact on the organization. These impacts can be in the form of improved organizational performance and decision making process at the organizational level and plus, the positive impact that the project has on the stakeholders of the project. It was also found that the traditional measures of success such as time and budget were found to be not significant in this study. Therefore, it further supported previous findings by Tukul and Rom (2001) that the criteria to measure project success has extended beyond these two traditional measures to cover clients, stakeholders and the project's ability to prepare the organization for the future.

The statistical results demonstrated that a clear project mission is positively related to both direct and indirect project success. This finding correlates with Pinto and Slevin (1989) findings, which revealed that project mission is the most important factor related to project success across the entire project life cycle. Initial clarity of goals and direction of the project are vital elements for successful projects in the manufacturing sectors. It is important that the goals of the projects are in line with the general goals of the organization and is made clear to the project team. Therefore, project team is well aware and able to identify the beneficial consequences of the project to the organization.

The findings showed that top management support is positively related to indirect project success in manufacturing which is in line with the findings of Kerzner (1987) that a project is likely to be successful if visible support and commitment are present from the top and executive management. This finding is also supported by Belassi

**Table 4.** Rotated component matrix for independent variables.

| Items                          | Factors     |             |             |             |             |             |             |       |       |       |
|--------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------|-------|-------|
|                                | 1           | 2           | 3           | 4           | 5           | 6           | 7           | 8     | 9     | 10    |
| <b>Project Plan Monitoring</b> |             |             |             |             |             |             |             |       |       |       |
| Q14                            | <u>.699</u> | .225        | .010        | .197        | .263        | .129        | .006        | .133  | .106  | .200  |
| Q13                            | <u>.691</u> | .083        | .226        | .156        | .097        | .091        | .197        | .139  | .093  | .057  |
| *Q20                           | <u>.663</u> | .084        | .077        | .269        | .153        | .202        | .025        | .084  | .391  | .160  |
| Q40                            | <u>.581</u> | .164        | .169        | .190        | .044        | -.019       | .174        | .201  | .243  | .204  |
| *Q12                           | <u>.558</u> | -.030       | .106        | -.007       | .219        | .106        | -.025       | -.009 | .066  | .523  |
| Q22                            | <u>.551</u> | .193        | .290        | .081        | .185        | .057        | .272        | .121  | .045  | .008  |
| <b>Client Consultation</b>     |             |             |             |             |             |             |             |       |       |       |
| Q17                            | .053        | <u>.834</u> | .123        | .081        | .148        | .086        | .033        | .019  | .048  | .046  |
| Q18                            | .034        | <u>.791</u> | .121        | -.003       | .078        | -.120       | .198        | -.242 | .215  | .106  |
| Q16                            | .262        | <u>.775</u> | -.089       | .141        | .030        | .111        | .097        | .168  | .017  | -.111 |
| Q19                            | .072        | <u>.774</u> | .202        | .028        | .200        | .150        | -.012       | -.144 | -.030 | .262  |
| Q15                            | .245        | <u>.644</u> | -.101       | .073        | .122        | .026        | .129        | .243  | -.137 | .077  |
| *Q44                           | -.187       | <u>.550</u> | .041        | .015        | .067        | .160        | .158        | .431  | .229  | .208  |
| <b>Technical Task</b>          |             |             |             |             |             |             |             |       |       |       |
| Q32                            | .135        | -.051       | <u>.801</u> | .064        | .023        | .084        | .166        | .104  | -.037 | -.010 |
| Q33                            | -.070       | .223        | <u>.740</u> | .191        | .195        | .101        | .158        | -.034 | .190  | .119  |
| Q30                            | .270        | -.030       | <u>.593</u> | .083        | .146        | .146        | -.003       | .287  | .213  | .203  |
| <b>Top Management Support</b>  |             |             |             |             |             |             |             |       |       |       |
| Q9                             | .159        | -.030       | -.006       | <u>.823</u> | .018        | -.051       | .161        | .119  | .060  | -.070 |
| Q8                             | -.011       | .053        | -.023       | <u>.797</u> | .200        | .159        | .076        | .156  | .050  | -.017 |
| Q10                            | .246        | .087        | .174        | <u>.726</u> | .085        | .131        | .252        | .037  | .001  | .147  |
| Q6                             | .070        | .226        | .172        | <u>.627</u> | .099        | .213        | -.059       | -.054 | .078  | .308  |
| Q7                             | .259        | .104        | .269        | <u>.620</u> | .099        | .202        | -.237       | .131  | .123  | .015  |
| <b>Personnel</b>               |             |             |             |             |             |             |             |       |       |       |
| Q27                            | .105        | .129        | .095        | .074        | <u>.791</u> | .032        | .076        | .085  | .317  | -.091 |
| *Q38                           | -.047       | .180        | .012        | .004        | <u>.631</u> | .412        | .361        | .093  | .213  | .084  |
| Q28                            | .242        | .009        | .303        | .246        | <u>.631</u> | .045        | .044        | .114  | -.001 | .222  |
| *Q26                           | .188        | .076        | .107        | .123        | <u>.583</u> | .162        | -.016       | .160  | .537  | .097  |
| Q23                            | .263        | -.013       | .060        | .241        | <u>.517</u> | -.035       | .285        | .128  | .138  | .102  |
| <b>Project Mission</b>         |             |             |             |             |             |             |             |       |       |       |
| Q3                             | .045        | -.031       | .062        | .214        | .022        | <u>.802</u> | .091        | .053  | .084  | .003  |
| Q4                             | .001        | .078        | .107        | .066        | .220        | <u>.635</u> | .134        | .296  | .102  | .205  |
| *Q5                            | .044        | .126        | .247        | .260        | .382        | <u>.581</u> | .059        | .150  | -.011 | .126  |
| Q11                            | .300        | .263        | .244        | .001        | .052        | <u>.546</u> | .039        | .314  | .205  | .033  |
| *Q1                            | .212        | .098        | .196        | -.007       | .044        | <u>.542</u> | .356        | -.243 | -.142 | -.094 |
| *Q2                            | .292        | .129        | -.075       | .168        | .044        | <u>.508</u> | .104        | .005  | -.054 | .451  |
| <b>Client Acceptance</b>       |             |             |             |             |             |             |             |       |       |       |
| Q35                            | .208        | .012        | .122        | .233        | .013        | .116        | <u>.671</u> | .025  | .196  | .109  |
| Q36                            | .053        | .088        | .199        | .167        | .275        | .137        | <u>.671</u> | .018  | -.051 | .185  |
| Q37                            | -.026       | .220        | -.020       | -.139       | .269        | .164        | <u>.637</u> | .153  | .059  | .093  |
| Q39                            | .261        | .258        | .112        | .087        | -           | .102        | <u>.626</u> | .264  | .095  | -.137 |

|                         |      |      |      |      |      |      |      |             |      |      |
|-------------------------|------|------|------|------|------|------|------|-------------|------|------|
|                         |      |      |      |      | .047 |      |      |             |      |      |
| <b>Trouble Shooting</b> |      |      |      |      |      |      |      |             |      |      |
| Q50                     | .272 | .026 | .064 | .186 | .159 | .089 | .165 | <u>.652</u> | .296 | .055 |

**Table 4.** Continued.

|                        |       |       |      |       |      |       |       |             |             |             |
|------------------------|-------|-------|------|-------|------|-------|-------|-------------|-------------|-------------|
| Q49                    | .158  | -.002 | .348 | .228  | .136 | .199  | .021  | <b>.637</b> | .125        | .078        |
| *Q48                   | .283  | .039  | .434 | .277  | .294 | -.018 | .189  | <b>.550</b> | -.002       | .014        |
| **Q25                  | .182  | .048  | .008 | -.024 | .126 | .042  | .278  | .144        | <b>.803</b> | .077        |
| *Q29                   | .160  | .040  | .424 | .242  | .297 | .021  | -.136 | -.025       | <b>.586</b> | .194        |
| <b>Communication</b>   |       |       |      |       |      |       |       |             |             |             |
| Q42                    | .198  | .202  | .161 | .079  | .013 | .117  | .107  | .065        | .059        | <b>.735</b> |
| Q43                    | .177  | .187  | .096 | .088  | .210 | .009  | .224  | .308        | .291        | <b>.601</b> |
| Eigenvalue             | 15.07 | 3.32  | 2.55 | 2.37  | 2.11 | 2.01  | 1.87  | 1.56        | 1.44        | 1.24        |
| Percentage of Variance | 30.75 | 6.78  | 5.21 | 4.83  | 4.30 | 4.10  | 3.82  | 3.19        | 2.94        | 2.53        |

\*Cross loading; \*\* Single factor within a factor; \*\*\* Factor loading less than 0.30 is not displayed.

and Tukul's findings (1996) where 21% of the project managers from manufacturing sector rank top management support as the second most important factor for project success. Top management support is normally in the form of providing sufficient resources for the success of the project, sharing responsibilities with project team, communicating with project team authorities and responsibilities and supporting the project team in times of crisis or at unexpected situations.

Statistical results demonstrated that project plan monitoring is not related to project success. The results do not support earlier researchers' findings (Kerzner, 1987; Clarke, 1999) which reveal that commitment to early project planning, execution and control over the project strongly influence the success of a project. An observation from the descriptive analysis showed that majority of the type of project (32.9%) is new product development. In this study, it was found that client consultation is not relevant to project success in manufacturing. However this finding contradicts with researcher like Urban et al. (1993) which stated that the most important factor in the success of new product development is to understand the voice of the customer. It was found that client consultation is more influential in service-oriented projects such as information technology (Tukul and Rom, 2001) and marketing based projects. This could explain why client consultation is not a significant factor to project success in this study because the main project types in this study are not service-oriented.

The findings of this study revealed that competent project personnel are significant to direct project success. A competent project team comprised a project leader with its members, who are specifically selected, trained and possessed the required skills, knowledge and experience to handle the demands of the project. When the project is completed and later being introduced to the clients or end users, the ability of the team members to convince and sell the benefits of the project is important to ensure that the project are readily accepted by the clients.

The results from this study is also in line with Cooke-Davies (2002) who pointed out that people are involved in

every process and human dimensions exist in nearly all critical factors related to the project success including the duty to determine the adequacy of each process that has been carried out. Thus, the competency of project personnel contributes significantly to project success in manufacturing. This is also supported by the results obtained from an empirical research conducted by Belassi and Tukul (1996) where project managers' skills are the most critical factors in manufacturing projects.

The availability of technical tasks was found not to be related to project success in manufacturing. This is not in line with the findings of Pinto and Slevin (1989) that indicated the availability of a team with relevant technical skills and the availability of the required technology are vital for new product introduction projects. The possible reasons for such outcomes in this study where availability of technical tasks was not a significant factor could be due to the majority of the respondents from this study (40.5%) are from large multi-national organization. The statistical result showed that client's acceptance was not related to project success. The reason was the respondents comprised project leaders and members, therefore does not represent the voice of the clients in which the project was designed for. In addition, majority of the respondents were responding to technology based project where time to market is normally the major concern.

Effective communication by itself was found not related to project success. One of the reasons for this finding could be that this element is already embedded and weaved in the success factors. Let us look at project mission where clear project objectives and directions are made known to the project team through some form of communication. Besides that, top management also demonstrates support through communication to the project by responding to the resource needs requested by the team. The communication element is also present in the personnel and client acceptance factor, success factors such as project mission, top management support, personnel competency and client ted to project success in manufacturing. An examination on the respondents' profile showed that the largest group of respondents (36.7%)

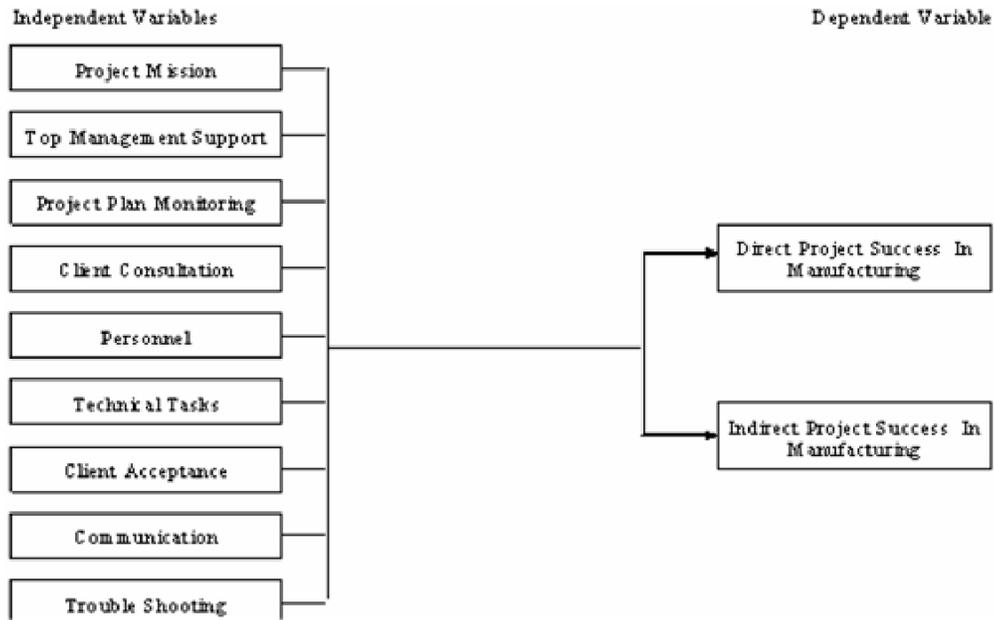


Figure 1. Revised theoretical framework.

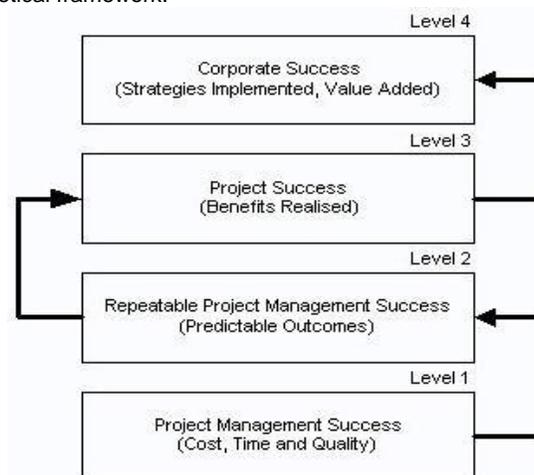


Figure.2: The Four Level of Project Success. Source: <http://www.projectsmart.co.uk/pdf/four-levels-of-project-success.pdf>

Table 5. Reliability test for dependent variables, independent variables and moderating variable.

| Variable                 | Cronbach's Alpha | Number of items |
|--------------------------|------------------|-----------------|
| Direct project success   | 0.7481           | 3               |
| Indirect project success | 0.6892           | 3               |
| Project mission          | 0.6843           | 3               |
| Top management support   | 0.8568           | 5               |
| Project plan monitoring  | 0.7741           | 4               |
| Client consultation      | 0.8622           | 5               |
| Personnel                | 0.7089           | 3               |
| Technical task           | 0.7392           | 3               |
| Client acceptance        | 0.7557           | 4               |
| Communication            | 0.7154           | 2               |
| Trouble shooting         | 0.7352           | 2               |

**Table 6.** Regression Analysis for Hypotheses H<sub>1,2,3,4,5,6,7,8,9a</sub>.

| Independent Variables   | Standard Beta |
|-------------------------|---------------|
| Project plan monitoring | -0.029        |
| Client consultation     | 0.002         |
| Technical task          | -0.091        |
| Top management support  | 0.029         |
| Personnel               | 0.258*        |
| Project mission         | 0.322**       |
| Client acceptance       | 0.150         |
| Trouble shooting        | -0.082        |
| Communication           | -0.016        |
| R <sup>2</sup>          | 0.254         |
| R <sup>2</sup> Change   | 0.204         |
| Significant F Change    | 0.053         |
| Durbin-Watson Index     |               |

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01.

**Table 7.** Hierarchical Regression for Hypotheses H<sub>1,2,3,4,5,6,7,8,9b</sub>.

|                         | Standard Beta |
|-------------------------|---------------|
| Project plan monitoring | -0.106        |
| Client consultation     | 0.051         |
| Technical task          | 0.080         |
| Top management support  | 0.268**       |
| Personnel               | 0.003         |
| Project mission         | 0.243*        |
| Client acceptance       | 0.130         |
| Trouble shooting        | 0.044         |
| Communication           | -0.024        |
| R <sup>2</sup>          | 0.334         |
| R <sup>2</sup> Change   | 0.240         |
| Significant F Change    | 0.011         |
| Durbin-Watson Index     |               |

\*p<0.10 \*\* p<0.05 \*\*\* p<0.01.

has worked more than 5 years in the organization and 43.0% of them are from the Engineering and Technical related department. This may explain why trouble shooting ability was found to be insignificant to project success as majority of the respondents may already possessed the relevant expertise in handling projects in their organization and if problems do arise, they already know where to turn to for assistance. Organizations with long serving employees and who are then selected as the project leaders or members stand a higher chance to better control their projects and the probability of facing crises and major problem will be lower.

This study also demonstrates the empirical support for earlier researchers' theoretical work on factors that affect successful project implementation and management such

as studies by Belout (1998), Clarke (1999), Cooke-Davies (2002) and Bin and Heiser (2004). The factors which are empirically supported are top management support, project mission, project team competency, client acceptance and effective communication.

### Implications for managers

This study also reveals three main implications for managers handling projects in the manufacturing sector. Firstly, the criteria used to measure the outcome of a project where a more wholesome approach should be used instead of the traditional effectiveness indicators such as time and cost. Managers should also look into the values that the project delivers specifically to the direct end users or clients and the organization in terms of preparing the organization to face the challenges ahead.

The importance of top management support by being active stakeholders and the clarity of goals throughout the project management and implementation stage are found to be strong factors that must be present to ensure a successful project outcome. The managers also need to be aware of the importance of the project team's competency as often the human factor is neglected and the competency is normally expected from the selected team, often times external factors were blamed for a poor implemented project but when really look into the root cause, it all boils down to the basic which is recruiting, selection and equipping of the leader and members of the team. This study also finds that even though factors such as project plan monitoring, client consultation, availability of technical task and trouble shootings are not significant to the project success in manufacturing, but perhaps these key factors do not stand alone rather they are inter-dependent, so ruling out of these factors altogether is not encouraged.

### Limitations of the study

The first limitation observed from this study is the total variance explained, from the two regression model, the total variance explained only accounted for 25.4 and 33.4%, respectively, there is still a large proportion of the total variance left unaccounted and therefore implies that additional significant independent and moderating variables of project success in manufacturing may not be included in this study. Secondly, majority of respondents came from one particular group which is the Engineering and Technical department (43%), from one main type of project which is new product development (33%) and from large organizations where the headcount is more than 200 (41%). As a result, the findings obtained from this study may only represent the voice of this dominant group.

Another limitation of this study is the unit of analysis, which emphasized on a completed successful project. As the project has already completed, the project may be

long overdue and respondents may not be able to recall completely their experience with the project, this was observed where most of the respondents failed to fill in the duration of the project handled and as a result the variable was dropped from the analysis. Lastly, the final limitation observed during this study is the literature review material on success factors for manufacturing projects was limited and majority of the literature found only confined to a general review of the success factors in various general industry particularly in the field of construction and information technology.

## Conclusion

This study demonstrated that success factors have indeed evolved according to the type of project and the environment that the project is operating. This is due to the dynamic business environment that organizations are operating nowadays. While success factors have evolved over time, the three factors identified two decades ago still play significant roles in ensuring project success in manufacturing sector. These three factors are top management support, clear project mission and competency of the project team.

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**Appendix:** Sample of questionnaire.

| <b>No</b>   | <b>Statement of Project Success</b>  |
|---|--|
| 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8.<br>9.<br>10.<br>11.<br>12. | The project has completed on time.<br>The project has completed according to the budget allocated.<br>The project that has been developed works.<br>The project was used by its intended clients.<br>The project has directly benefited the intended users either through increasing efficiency or employee effectiveness.<br>Given the problem for which it was developed, the project seems to do the best job of solving that problem.<br>Important clients, directly affected by the project, made use of it.<br>I am satisfied with the process by which the project was implemented.<br>The project has no or minimal technical start-up problems because it was readily accepted by its intended users.<br>The project has directly lead to improve or more effective decision making or performance for the clients.<br>The project has made a positive impact on those who make use of it.<br>The results of the project represent a definite improvement in performance over the way clients used to perform these activities. |
| <b>A</b>  | <b>Project Mission</b>   |
| 1.<br>2.<br>3.<br>4.<br>5.  | The goals of the project were in line with the general goals of the organization.<br>The basic goals of the project were made clear to the project team.<br>The results of the project benefited the parent organization.<br>I am enthusiastic/confidence about the chances for success of the project.<br>I was aware of and can identify the beneficial consequences to the organization of the success of the project.  |
| <b>B</b>  | <b>Top Management Support</b>  |
| 1.<br>2.<br>3.<br>4.<br>5.  | Upper management was responsive to the requests for additional resources, when the need arises.<br>Upper management shared responsibilities with project team for ensuring the project's success.<br>I agreed with upper management on the degree of my authority and responsibility for the project.<br>Upper management supported me in a crisis.<br>Upper management has granted us the necessary authority and has supported our decisions concerning the project.   |
| <b>C</b>  | <b>Project Schedule / Plan</b>   |
| 1.<br>2.<br>3.<br>4.  | We know which activities contain slack time of slack resources which can be utilized in other area during emergencies.<br>There was a detailed plan (including time, schedules, milestones, manpower requirements, etc.) for the completion of the project.<br>There was a detailed budget for the project.<br>Key personnel needs (who, when) were specified in the project plan.   |
| <b>D</b>  | <b>Client Consultation</b>   |
| 1.<br>2.<br>3.<br>4.<br>5.  | The clients were given the opportunity to provide input early in the project development stage.<br>The client (intended users) was kept informed of the project's progress.<br>The value of the project has been discussed with the eventual clients.<br>The limitations of the project have been discussed with the clients (what the project is not designed to do).<br>The clients were told whether or not their input was assimilated into the project plan.  |
| <b>E</b>  | <b>Personnel</b>   |
| 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.                                  | Project team personnel understood their role on the project team.<br>There was sufficient manpower to complete the project.<br>The personnel on the project team understood how their performance will be evaluated.<br>Job description for team members have been written and distributed and were understood.<br>Adequate technical and /or managerial training (and time for training) was available for members of the project team.<br>The project leader possessed adequate technical skills.<br>The project leader possessed adequate interpersonal skills.   |

**Appendix:** Sample of questionnaire(continues)

|          |   |
|----------|---|
| 8.       | The project leader possessed adequate administrative skills.  |
| 9.       | The project leader maintained a high profile (is visible and involved) on the project team.   |
| 10.      | The project leader has the ability to motivate team members and maintain a cohesive project team.   |
| <b>F</b> | <b>Technical Tasks</b>  |
| 1.       | Specific project tasks were well managed.   |
| 2.       | The project engineers and other technical people were competent.  |
| 3.       | The technology that is being used to support the project worked well.   |
| 4.       | The appropriate technology (equipment, training programs, etc.) has been selected for project success.  |
| 5.       | The people implementing the project understood it.  |
| <b>G</b> | <b>Client Acceptance</b>  |
| 1.       | There was adequate documentation of the project to permit easy use by the clients (instructions, etc.).   |
| 2.       | Potential clients have been contacted about the usefulness of the project.  |
| 3.       | An adequate presentation of the project has been developed for clients.   |
| 4.       | Clients knew who to contact when problems or questions arise.   |
| 5.       | Adequate advanced preparation has been done to determine how best to "sell" the project to clients.   |
| <b>H</b> | <b>Monitoring and Feedback</b>  |
| 1.       | All important aspects of the project were monitored, including measures that will provide a complete picture of the project's progress (adherence to budget and schedule, manpower and equipments utilization, team morale, etc.) |
| 2.       | Regular meetings to monitor project progress and improve the feedback to the project team were conducted.   |
| 3.       | The results of project reviews were regularly shared with all project personnel who have impact upon budget and schedule.   |
| <b>I</b> | <b>Communications</b>   |
| 1.       | The results (decisions made, information received and needed, etc.) of planning meetings were published and distributed to applicable personnel.  |
| 2.       | Individuals/groups supplying input have received feedback on the acceptance or rejection of their input.  |
| 3.       | All groups affected by the project know how to make problems known to the project team.   |
| <b>J</b> | <b>Trouble-Shooting</b>   |
| 1.       | The project leader was not hesitant to enlist the aid of personnel not involved in the project in the event of problems.  |
| 2.       | "Brain storming" sessions was held to determine where problems were most likely to occur.   |
| 3.       | In case of project difficulties, project team members knew exactly where to go for assistance.  |
| 4.       | Problems that arised were solved completely.  |
| 5.       | Immediate action was taken when problems came to the project team's attention.  |