An exploratory investigation on the determinants of successful collaborative projects in the Malaysian construction industry [version 1; peer review: awaiting peer review]

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Abstract

Background: Project management is a critical business discipline for an organization to create a competitive edge as well as a prominent tool to delivering successful projects. The changes in the current societal, environmental, economic, and technological horizons prompt a more collaborative engagement in managing projects. Therefore, the traditionally accepted ways of managing projects need to be revisited.

Methods: This research employs an empirical approach to identify the determinants of successful collaborative project management in the construction industry. The exploratory stage of this research aims to identify the variables of collaborative projects and to understand the relationships among the variables. The research uses qualitative methods to understand factors of project success by conducting interviews with project practitioners in the construction industry. Data from the interviews was transcribed word-by-word and the content was analyzed manually using a thematic content analysis.

Results: The findings show that project management maturity, decision-making process, knowledge management, and coordination can contribute to the success of managing a collaborative project.

Conclusions: The results of the study can be applied in managing a construction project. It also contributes to the body of knowledge regarding project management.
Keywords
Coordination, collaborative project management, construction, knowledge management, business decision making, project management maturity

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Introduction

Project Management (PM) is a significant factor in improving performance and accelerating the competitive advantages of an organization. In a business, PM is considered a significant consideration in planning and decision making. However, the changes in social, economic, and technological trends demands a shift from traditionally accepted ways of managing projects.

The advancement of computing and communication technology, and rapid transformation of our economies into digital economies have led to an increase in collaborative work management. Globalization and collaborative technologies led to increased attention on virtual teams and networked organizations. As such, PM needs to evolve to adjust to the emerging trends. Construction project managers aware of the emergence of disruptive technologies such as smart-home automation, prefabrication, and immersive solutions has prompted the reevaluation of the practicality of existing PM tools and techniques.

Collaboration is essential in the construction projects as sharing knowledge and information are critical for successful contractual relationships. Task interdependence and member distribution across time, distance, and technology prompted adoption of Collaborative Project Management (CPM) over traditional PM. Unfortunately, the rate of project failure is still high; in 2018, large global projects were completed but had issues with timing (65%), cost (67%) and scope (75%). In Malaysia, abandoned housing projects in 2019 alone involved 15,041 houses. The failure of projects, especially in the construction industry affects the property developers, the financial institutions, the contractors and the buyers who will be financially and emotionally burdened by the project failure. Thus, it is important to understand collaborative project management to better ensure project success.

This research aims to document and evaluate the gaps of the factors in interdisciplinary collaboration in managing the deliveries of diverse component construction projects. The main objective is to develop a framework for successful CPM within the context of the Malaysian construction industry. The research questions are: 1) how can we ensure a successful CPM within the context of the Malaysian construction industry, and 2) what are the factors impacting CPM?

Methods

This research focuses on the epistemological aspect of research philosophy as the study concerns on the origins and limits of human knowledge in addressing the research questions. The multidisciplinary context of PM means different knowledge representations (numerical, textual, and visual data) and knowledge sources (interpretations and narratives) can be considered legit to formulate the research findings. This exploratory research aims to identify success factors of collaborative works and their relationship in explaining the nature and situational factors of collaborative projects from the perspective of a property developer. The unit of analysis of this research is the home construction projects in Malaysia. This research analyzes and prioritizes the details of the project success criteria using data derived from actual construction projects from a property development company in Malaysia.

The study used the approach suggested by Saunders and Creswell by reviewing past literature and conducting interviews with project practitioners. The objective of the interview is to gain in-depth responses regarding the experiences, perceptions, and feelings of the success factors in managing collaborative project. A semi-structured interview was chosen as it allowed the interviewer to explore broader research context and venture into other areas of discussion within the scope of the study. The interview was conducted by the researcher (JJ) who is a certified project manager with over 21 years in managing projects. The researcher holds an MBA degree and is working for a construction company, but he was not managing any of the projects. The education and work background provided the researcher with capability to conduct highly technical interviews with project personnel.

A total of 12 interviews were conducted with project practitioners of a Malaysia property developer. The company has projects in Malaysia and globally, with an annual gross development value of over USD500 million. The researcher had worked with the interviewees in various stages of the projects prior to the research, and they (interviewees) were willing to participate in the study since they believe practical contribution of the research could assist them in addressing the many issues of project deliveries. The interviewees are senior male (9) and female (3) staff, with ages ranging from 45 to 58 years old. Their job titles included managing director, program director, strategic planner and clerk-of-work. The interview is based on phenomenology approach by focusing on the meaning and significance of actual experiences in project deliveries. Since the target of the interview is to capture a wide spectrum of project deliveries, the interviewees were selected based on the positions and roles in the organization. A convenience sampling was used to request permission for the interviews and the selected participants are based on the availability. A total of 20 targeted interviews were approached via email and personal calls but eight of the targeted respondents had to decline the interview due to work commitment and conflicting schedules. The interviews were conducted one-on-one, in person, for the duration of
60 to 90 minutes, during working hours using an iPhone as a voice recorder and paper notebook as note-taking tool during the interview. Reserved meeting rooms and closed rooms were used to ensure privacy during the interview. A list of questions based on the research objectives were prepared to guide the interviewer (see Extended data for specific questions). Face validity of the questionnaire was carried out with subject matter experts via consultation. Although a list of questions was prepared, the flow and construct of questions are based on responses provided by the participants. Follow-through question based on the answer provided by the interviewees allows for a deeper investigation of the subjects in discussion.

Quantitative data analysis is complicated and less standardized, using codified common sense, compared to the statistical analysis of quantitative data. There is no single widely accepted approach of qualitative data analysis, but Thematic Content Analysis (TCA) is considered the most common method. The concept behind TCA is collected interview data is manually analyzed in terms of the principal idea of themes so that key ideas can be structured and interpreted for easy comparison and grouping. Clarke and Braun recommended a six-step TCA process: 1) familiarization with the data, 2) coding the response, 3) searching for relevant themes, 4) reviewing the final themes, 5) defining and naming the themes, and 6) writing up the findings. In this research, the qualitative data analysis (carried out manually) makes sense of the interviewee’s views and opinions on project success, and consolidates the corresponding patterns, themes, categories, and similarities, as suggested by Cohen. Interview conversations were transcribed verbatim at the end of the interview to ensure a complete capture of the interviewees’ intended messages. The transcribed documents were analyzed manually using 'open coding' by the authors to identify summary statements or category of words for the elements discussed in the interviews. The coding of data was discussed and finalized with the authors of this research for clarity and acceptance. The result forms the CPM model as the objective of the research.

Ethics statement
The research project and report were ethically approved by the Research Ethics Committee (Multimedia University, Malaysia) (Approval No.: EA2292021). Interviewee acceptance on the interview invitation was considered as consent to participate and collect data. This implied consent was deemed sufficient by the ethics committee. The consent was reiterated before starting the meeting and when recording the conversation. However, the interviewees were guaranteed anonymity of the responses and only aggregated data can be shared to the public.

Results
The diverse background, function, and responsibility of the interviewees resulted in 42 relevant components related to project management. Planning, communication, and PM skills are the most recurring components mentioned by the interviewees. The aggregated interview responses are available in Underlying data. Table 1 also lists the codes derived from the interviews in no particular order.

| No. | Codes               | Definitions and inclusions                                                                 |
|-----|---------------------|-------------------------------------------------------------------------------------------|
| 1   | Work Priority       | Scheduling, priorities of works                                                            |
| 2   | Tools               | Software, application, or processes used for project management planning, execution, and monitoring of project activities |
| 3   | Goal and Objectives | Goals and objectives of the company                                                         |
| 4   | Skilled Workers     | Workers trained in the project management or construction skills                           |
| 5   | PMO                 | Project Management Office that assists in preparing guideline and monitoring of project task |
| 6   | SOP                 | Standard Operating Procedures that define how each task to be completed by the assigned team |
| 7   | UAT                 | User Acceptance Test or any kind of test with the relevant stakeholders to denote acceptance of the completed product |
| 8   | Monitoring & Control| Process, tools, or evidence of completion of monitoring and controlling of a project task  |
| 9   | Cost Planning       | Planning of construction cost based on the Bills of Material                               |
| 10  | Contract Contents   | The extend of detail of terms and condition of the contract between the property developers and all service providers, and the contract between two service providers |
| No. | Codes                        | Definitions and inclusions                                                                 |
|-----|------------------------------|-------------------------------------------------------------------------------------------|
| 11  | Project Execution            | Methods of delivery and list of activities related to the delivery                         |
| 12  | PM Skills                   | Development of Project Management (PM) from training, work/on-site experience, or hands-on upon appointment |
| 13  | Scope Management            | Managing inclusion and exclusion of required works                                          |
| 14  | Plan B                      | Alternative to standard planning                                                           |
| 15  | Dedicated Team              | The assigned team, as opposed to as-and-when, required the appointment of staff            |
| 16  | Risk Management             | Managing component that might have an impact on project deliveries                         |
| 17  | Roles & Responsibilities    | Managing defined roles and their associated responsibilities of each staff/team           |
| 18  | Cost-Benefit analysis       | Analyzing business cases in comparing the ratio of benefit as opposed to cost              |
| 19  | Procurement Strategy        | Approach to acquire product critical to project delivery                                    |
| 20  | Communications              | The approach took to convey and receive a message from all channel of communicators       |
| 21  | Planning Input              | Data and information used to plan the project                                              |
| 22  | Team Member                 | The staff of the same group working for the same objective                                |
| 23  | Planning                    | Activities related to strategizing activities to meet the desired objective                |
| 24  | Proper Design               | The detail and complete drawing of the home                                                |
| 25  | Dynamic Plan                | Plan which allows and accommodate change as new information or requirement surface        |
| 26  | Accurate Info               | Availability of information that is precise to help in making a decision                  |
| 27  | Lesson Learned              | Capabilities of the organization to learn from previous projects                            |
| 28  | Knowledge Retention         | Capabilities of the organization in storing and using information, experiences, and work process of the previous project |
| 29  | Requirement Definition      | Documented and accepted a list of wants in meeting the project objectives                   |
| 30  | Product & Solutions         | List of components considered as output, or end product of the project                     |
| 31  | Management Involvement      | Level of involvement and commitment of top management in the planning and execution of the project |
| 32  | Support and Maintenance     | Components of post-implementation works to ensure continuous workability of the completed products |
| 33  | Rewards                     | Positive reinforcement used by the organization to induce positive behavior                |
| 34  | Layers of Management        | The number of levels in the organization separated the lowest level to the top level      |
| 35  | Relationship Among Stakeholders | The extend of formal and informal communication, respect, authority, and friendship forged among those in the project |
| 36  | Resource Availability       | The pool of internal and external team member who can be assigned to a project            |
| 37  | Dependencies                | Relationship of the importance of one resource to another                                  |
| 38  | Motivation                  | The extend of factors that contribute to the inducement of desire to deliver the projects  |
| 39  | External Factors            | Factors that attributed or derived outside from the project environment and cannot be directly controlled by the project team |
| 40  | Certification               | Official acknowledgment of completion of attaining a certain level of project management capabilities |
| 41  | Coordination                | The extend of diversifying project team work together to achieve the project objective     |
| 42  | Culture                     | The process, customs, and social behavior of the project team and the organization in related to project activities |
The codes were processed further by categorizing them into identified patterns or themes of data. Related codes were grouped into a theme based on commonly known generalization and definition of project issues. Table 2 lists the final coding of the data category in no particular order. The study found that PM maturity, knowledge management, decision-making system, certification, coordination, and culture are essential components of PM success.

**Table 2. Categories in thematic code.**

| Themes                        | Codes                                      | Codes                                      |
|-------------------------------|--------------------------------------------|--------------------------------------------|
| Project Management Maturity   | Work Priority                              | Plan B                                    |
|                               | Tools                                      | Dedicated Team                            |
|                               | Goal and Objectives                        | Risk Management                           |
|                               | Skilled Workers                            | Roles & Responsibilities                  |
|                               | Project Management Office                  | Cost-Benefit Analysis                     |
|                               | Standard Operating Procedures              | Procurement Strategy                      |
|                               | User Acceptance Test                       | Planning Strategy                         |
|                               | Monitoring & Control                       | Planning Input                            |
|                               | Cost Planning                              | Team Member                               |
|                               | Contract Contents                          | Planning                                  |
|                               | Project Execution                          | Proper Design                             |
|                               | Scope management                           | Dynamic Plan                              |
| Knowledge Management          | Accurate Info                              | Requirement Definition                    |
|                               | Lesson Learned                             | Product & Solutions                       |
| Decision Making System        | Management Involvement                     | Resource Availability                     |
|                               | Support & Maintenance                      | Dependencies                              |
|                               | Layers of Management                       | Motivation                                |
|                               | Management Involvement                     | External Factors                          |
|                               | Support & Maintenance                      | Relationship Among Stakeholders           |
| Certification                 | Certification                              | Project Management Skills                 |
| Coordination                  | Coordination                               | Communication                             |
| Culture                       | Culture                                    | Rewards                                   |

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**Discussion**

A further literature review was conducted to validate the relationship of the six identified categories of project management success in the construction industry. Project Management Maturity (PMM) is the state of an organization’s effectiveness in performing PM activities and influencing PM success.27–29 Currently, there are over 30 PMM models available; all of them are based on the concept that organizations achieve maturity by advancing through the stages of process capability.30 Social Cognitive Theory explains the direct relationship between PMM and project success. The theory suggests that the behavior of stakeholders in any organization exists in a reciprocal relationship with personal and environmental factors that operate as interacting determinants and influence each other.31

The main factor for project failure stems from human contribution, and the biggest culprit is the project manager.5,32–34 Hence, the skills and qualifications of the project manager are critical for project success. Any recognized PM certifications or organization-specific internal certifications demonstrate that a project manager has the experience, education, and competency to lead and direct projects successfully.35 The interviewees unanimously agree on the value of certification for a project manager but have differing opinions on the criticality of a certificate in managing a successful project. The responses are aligned with Natchayangkun’s36 study in Indonesia which found that certified project managers are more focused and more knowledgeable in improving project performance, leading to project success. The study suggests that PM certification has a direct impact on PM success. Certification also amplifies the capability of a matured organization in PM to deliver a successful project; the lack of proper PM training and certification is a determinant of low PMM.37

One of the main objectives of PM is to address interdependencies within the constraint of the project which leads to the realization of project goals.38 Coordination has a similar purpose since it manages dependencies between activities to achieve the project’s objective.39 Most of the interviewees emphasized the importance of proper and well-documented coordination among various parties. A complex project like home construction requires the project manager to manage
the dependencies and increase the interaction between the stakeholders. The uncertainty of unmanaged projects related to ambiguity in terms of requirements, assumptions, and dependencies will pose a challenge for the success of the project. Past studies indicated that the collaboration and consistency between project owners and vendors can effectively improve project delivery. Coordination Theory is used widely in PM to analyze organizational contingencies and transactional characteristics to explain the choice of coordination mechanisms.

A study by Mannan, Haleem, and Jameel is aligned with the interview outcome of this study by stating that the coordination factor has a deep influence on the success or failure of KM initiatives. The interviewees also mentioned that coordination components like trust and communication play a significant role in how the organization retains the vast knowledge of construction deliverables and the project manager’s level of autonomy. The findings make sense since the growing complexity of the project increases the social interface and adoption of knowledge and experiences from everyday work. Project team members establish ties with those they can exchange valued resources. However, the motive is not altruistic as it is more on reciprocal relationship.

The construction industry operates in a dangerous, dirty, and difficult environment. Hence, the industry is not appealing for most Malaysian job seekers; it is dependent mostly on foreign labor. This situation has led to a high resource turnover rate. Employee turnover in construction has been and will continue to be a significant concern in the construction industry. Only organizations that can retain skilled employees would have a more substantial competitive advantage. The alternative is to have a system and process to collect, retain, and distribute knowledge derived from past experiences. Documentation of lessons learned from completed projects is essential in improving PM practice. When asked about the importance of knowledge retention and distribution by the project team, the interviewees agreed on the importance of retaining and distributing project knowledge. However, the interviewees acknowledged that retaining knowledge alone does not contribute to project success. Coordination through communication and knowledge sharing are key elements for a successful knowledge management. Project team members expect their organization to develop both formal and informal channels to support organizational learning from past projects.

Coordination provides control and maintains effective communication, which is critical for effective decision-making and distribution of information in the construction project. Those are the major differentiating factors between collaborative and traditional PM. The coordination unequivocally benefits the project team in terms of controlling perspectives by allowing more authority at the working level while having a constant view of the project dashboard for the management. Effective communication within a culture of high collaboration can develop a much more adaptive and realistic plan.

The interviewees acknowledged the autonomy of the project manager and project director on the construction site to decide within the confined work scope. Project success has a positive relationship with timely decisions and actionable information. One of the interviewees repeatedly stressed on the need to have a ‘Plan B’ as mitigation for any contingency. The top management and staff engagement in decision-making are critical for project success. The interviewees suggested that an open horizontal and vertical communication within the project team is the key success factor for a high autonomy of the on-site project team in making decisions. In addition, the coordination of parties from the planning to the close-out phase must be established to ensure a unanimous decision is made by the parties involved.

An essential component of an organization’s decision-making system is the organization’s culture. Norms, beliefs, principles, and behaviors are the organizational culture that defines a particular characteristic of an organization. A strong culture can shape an organization’s decision pattern and collaboration practices as well as guide actions and drives. Since the interviewees come from two different companies that are consolidated into one organization via business merging, they (the interviewees) stressed the importance of having a unified, collaborative culture to ensure project success. While traditional construction projects suffer from mistrust, adversarial relationships, and ineffective communication, collaborative construction projects are based on trust, cooperation, effective communication, and teamwork. Past studies on organizational culture showed that the communication and collaboration of teams can lead to satisfaction among team members and eventually, toward project success.

The relationship of the six components of collaborative PM is depicted as the Collaborative Project Management model in Figure 1 below.
Conclusions
This study suggests that PM maturity, business decision management, and knowledge management are the variables required for the delivery of a successful project, whereas the organizational culture and PM certification may impact the linkage of the variables toward the successful project. Coordination is expected to explain the relationship between the decision-making system and knowledge management in PM success. The framework will be tested and validated in the subsequent confirmatory stage using questionnaires. The result of the study can be applied in managing a construction project and contributes to the body of knowledge in PM.

Data availability
Underlying data
All data underlying the results are transcript data resulting from recordings of 12 interviews. Due to the sample size and nature of the conversations, the data cannot be sufficiently anonymized by redaction for uploading to a general data repository. Thus, the transcript data cannot be shared for ethical and privacy considerations as well as the guarantee given to the interviewees to maintain anonymity of the interview. The interviewees did not consent to the storing of the interview data on a public repository. A reader or reviewer may apply for access to the data by contacting the corresponding author (kamarulzaman.aziz@mmu.edu.my) directly. Access will be granted upon considering the request and permission received from the interviewees.

Figshare: Determinant of Success for CPM - Interview Data.pdf. https://doi.org/10.6084/m9.figshare.19314164.v1.54

This project contains the following underlying data:

- Determinant of Success for CPM - Interview Data.pdf (aggregated responses from interviews with project practitioners in the construction industry in Malaysia).

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

Extended data
Figshare: Determinant of Success for Collaborative Project Management - Interview Questions. https://doi.org/10.6084/m9.figshare.19435649.v1.55

Figure 1. Proposed collaborative project management framework.
This project contains the following extended data:

- Determinant of Success for CPM – Interview Questions.doc.

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