Competencies of a project manager

FLUOR®

TU Delft

(This page is intentionally left blank)

DELFT UNIVERSITY OF TECHNOLOGY

MASTER OF SCIENCE THESIS

CONSTRUCTION MANAGEMENT AND ENGINEERING

Competencies of a project manager in executing a lumpsum contract

Ayesha A Rehman | 4623487

Graduation thesis | CME 2000 | 2019

Faculty of Civil Engineering and Geosciences

Colophon

AUTHOR

Name	Ayesha Anjum Rehman
Student number	4623487
E-mail	r.ayesha1025@gmail.com
Telephone number	+31 6 83075039

GRADUATION THESIS

University	Delft University of Technology
Faculty	Faculty of Civil Engineering and Geosciences (CiTG) Stevinweg 1 2628 CN Delft
Master	Construction Management and Engineering (CME)
Course	CME2000 Graduation Thesis

GRADUATION COMMITTEE

Chairman	Prof. Dr. Ir. M.H. (Marleen) Hermans Faculty of Architecture and Built Environment (BK)
Supervisor	Dr. ir. LHMJ (Louis) Lousberg Faculty of Architecture and the Built Environment (BK)
Supervisor	Dr.L. (Laurens) Rook Faculty of Technology, Policy and Management (TPM)
Company supervisor	J.H. (Hans) Hilke Fluor B.V.
Company supervisor	Susanne Hamer Fluor B.V.

COMMISSIONED BY

Company	Fluor B.V. Taurusavenue 155 2132 LS Hoofddorp

Acknowledgements

It feels immense pleasure in penning my final thoughts on completion of this research. It concludes the journey of my master's in construction management and Engineering, at Technical University of Delft. It has been an enriching experience. Times of both hardships and joy. Memories, I will cherish for time to come.

I would like to sincerely thank Prof. Dr. Ir. M.H. (Marleen) Hermans, Dr. ir. LHMJ (Louis) Lousberg, Dr.L. (Laurens) Rook, J.H. (Hans) Hilke and Susanne Hamer, without whose support this research would have not been possible. The weekly meetings, discussing the tiniest of the detail be it in the survey or interview questionnaire, research design, methodology etc. Thank you for believing in me. I am thankful to J.H.K.M.Burghardt Hodes, Sandra Schuchmann-Hagman, and Wendy Kaasenbrood for helping me out during the entire process.

I would like to thank my friends, Sweta for being a constant source of support and love through thick and thin. Sagar, Saurabh and Pranay for patiently listening to all my worries and helping me through the way out. Sanjeev, Nithya, Navneet and Salman for motivating and encouraging me to strive to finish. A special thanks to Ana, Mary, Polina, Demetris and Henoc for their insights and help in improving my skills. Thank you for all the warmth and care. It's because of you that I miss home a little less.

My family has been the pillar of strength. Without them none of this could have been possible. Their undying faith in me is what keeps me going. Ashu, Mummy and Daddy this is for you, hope I have done you proud.

Ayesha A Rehman
Delft, 2019

(This page is intentionally left blank)

Executive summary

Project failure rate is astonishingly 70%. This cause for the failure can vary from poor project management, to poor engineering, external factors like environment etc. This research particularly aims at identifying the competencies needed by project managers, with a aim that it will eventually reduce the failure rate.

This research was carried out to investigate the relevance of competencies with respect to contract type, specifically cost reimbursable and lump sum contract and its variations with the project phases. Eventually also identifying the effect of competencies on project success. This will cater to the problem definition *what kind of competencies can project managers adapt to execute a lump sum contract*. In order to understand lump sum, we also need to study cost reimbursable that is the extreme opposite of lump sum contract. Encompassing all the above the following research question was formulated:

"What are the critical competencies of a project manager needed at different phases of a lumpsum project to ensure project success?"

The main research objective is to understand the importance of competent project managers. The research was divided into three phases.

In the first phase a thorough literature review was done to get insights on competencies, yielding a set of fifteen competencies that will be studied against the phases of a project. FLUOR B.V., has five stages of a project, which will be considered for the research purpose. Two sets of project success factors were identified through literature, one being at macro view point and the other being micro view point.

The second phase was all about data collection and analysis. Survey was conducted to identify the variations in competencies through different phases of a project. Interviews were conducted to recognise the relationship between contract type and competencies, and competencies' impact on project success. Since both the methods addressed different hypotheses. Data collection is followed by the analysis. Frequency charts were made to identify the most preferred competencies.

The final phase was to put the results to use. A competency-based scorecard was designed to suitably hire and appoint project managers. This was based on phases of a project. Only the top eight competencies per phase was chosen for the scorecard. Competencies that are most affected during a lump sum contract are added to an existing leadership model, it's a matrix of leadership levels and competencies. The competencies affecting the project success can also be useful in allocating project managers to different projects. This could be directly implemented in projects.

Table of Contents

1. Research design

2.1 Introduction

Research design is one of the crucial steps in the entire process of research. This chapters describes the research approach. For any successful research the ground work is very necessary, a direction is a must otherwise it is very easy to get lost in the ocean of knowledge. The research objective is clearly stated, followed by research question, research scope, and a reading guide.

Brophy and Kiely propose that competency models are effective tools to redirect employees' attention to identify means to succeed in today's competitive world. Hence, employees acquiring these competencies result in the organisation being successful. Hence, they can aid in measuring performance management and development functions. (Brophy & Kiely, Competencies: a new sector, 2002). These competencies may vary over different sectors and at different organizational levels. Identifying and segregating the competencies is necessary for successful project completion.

The Project Management Institute (PMI) described project management as "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements" and characterized "high quality projects [as those that] deliver the required product, service, or result, within scope, on time, and within budget" (PMBOK, 2004)

Interest in project management is growing significantly. Yet, projects continue to fail at an astonishing rate. Hence, it is imperative to analyse one's understanding of project management education and think about how we develop project managers to deal with the increasing level of complexity, disorder, and uncertainty in project environments (Thomas & Mengel, 2008). To maintain their professional competency, practising project managers in construction adapt to this changing industry environment by relying on knowledge and skills acquired through training and experience. (Edum-Fotwe & McCaffer, 2000). The competencies of people working on a project has a great influence on a project performance. This area of competencies and project performance indicators will be researched on.

A recent survey by Cox and Osguthorpe (2003), professionals spend *more* time involved in managing and administrating projects (35%). This emphasizes the importance of project management. In order to have successful projects, one must have holistic project managers. The need to have better management skills. Identifying and nurturing such traits will then become very essential.

This research will focus on sorting and prioritizing of the competencies in relation to the project performance indicators and particularly for a lumpsum contract. The identification of a competency profile for superior project managers could therefore form an important step in the development of improved HRM approaches in the industry, especially given the key importance in managing people at the operational level. (Cheng & Dainty, 2005).

From the beginning of the 1990s the business climate in the construction industry has witnessed unprecedented dynamics as organisations respond to increasing competition within a stagnant or declining market (Gretton, 1993). The industry's procurement methods are changing with clients allocating greater risks to contractors (Bedelian H. , 1996). Often due to the dynamic nature of project, a project manager is confronted with complexities more than anticipated. Every individual may deal with it differently, but the competencies may be related. Therefore, identifying them is necessary for an improved decision making. One must adapt to these changing circumstances.

One can use professional and personal competencies to leverage complexity, whether as a team member, project manager, program manager, or portfolio manager. Establishing, maintaining, and using competency profiles especially at the portfolio level enables executives to better match competencies to program and project needs or demands. (Ginger, 2014)

This thesis will hence focus on identifying and profiling the key competencies of project managers at FLUOR BV and deduce a relationship between the competencies and the phases of a project, in the execution of a lumpsum contract.

2.2 Research objective

The aim of this research is to deduce the competencies needed at different phases of a lumpsum project to ensure project success.

In a wider context this research contributes to project management by helping in assigning of projects to the suitable project manager with the required competencies. For example, project managers A and B are doing X and Y jobs respectively while they can be doing a better job if it were reversed. The research may also help an organisation in the hiring process of project managers.

Identify Critical competencies that fit for purpose and are of relevant quality

The method of Behavioural Event Interviews (BEIs) is widely held to represent the most effective way of identifying the behaviour that underlies effective performance in management roles. BEIs result in a list of core competencies of superior managers, and a range of corresponding behavioural indicators. They require informants to identify and describe critical situations they have encountered within their jobs, from which the most important skills and competencies can be derived (Cheng & Dainty, 2005).

The competencies relevant to project type will be identified through literature study. The data obtained will be benchmarked against the interview findings.

Influence of competencies through different phases of a project and the variations due to the type of contract (lumpsum contract)

In a lumpsum contract often the risks lie with the contractor, hence a different approach is required when dealing with projects with different contract type. This research will identify the competencies required to tackle a lumpsum contract.

Lumpsum contract will be studied thoroughly. Questions like, how does lumpsum differ from other contracts (cost reimbursable) and how can one make profits in lumpsum contract will be investigated. Significant parameters at different phases of a project influencing the success of a project affected by project manager's competencies will be researched. The roles and responsibilities of a project manager specific to a lumpsum contract will be studied in order to deduce the competencies in relation with phases of a project.

One measure of a contract's efficiency and effectiveness is its ability to clearly assign risks between contracting parties. Clear risk assignment means that both contracting parties have the same understanding of risk apportionment and risk management accountability. Contracting parties who do not have an identical understanding of risk accountability may mismanage a risk event by assuming the event or its consequences are not their responsibility. Mismanaged events cause project inefficiencies and make contract relationships adversarial. The resulting impacts on project execution ultimately increase project costs. (Hartman, 1993). Hence a project manager must be aware of the risk distribution from the initial phases to the final phases of a project. literature.

Expected Results:

The thesis has three specific areas of research project manager competencies, project phases, and lumpsum contract. Both hard and soft competencies will be identified. Recommendations will be provided regarding hiring of new managers based on competencies and whether training is necessary for the current managers

2.3 Research question

The following research question will be addressed during the thesis project:

"What are the critical competencies of a project manager needed at different phases of a lumpsum project to ensure project success?"

To answer the research question, the following sub questions will be scrutinized.

1. Identify the competencies of a project manager described in literature and phases of a project?
   The competencies identified during the literature review will form the basis for further data collection and data analysis.

2. What are the competencies needed in different phases of a project?
   Competencies relevant to the project phases will be identified, in order to make necessary changes to the project teams for better performance.

3. What are the competencies specific to lump sum contract?
   Lump sum contract will be studied by comparing it with cost reimbursable contracts. Eventually a list of competencies specific to lump sum contract will be identified.

4. What key performance indicators are affected by the competencies?
   After identifying the set of competencies relevant to lump sum contract, the performance indicators affected by these competencies will be identified. This will enable one to gauge the importance of the specific competencies. Cost and time are often the main success indicators, but in this research performance indicators at micro and macro levels will be considered. Macro level is the project as a whole (analogous to a forest) and micro level are intermittent project goals at different stages (analogous to trees).

2.4 Research scope

A scope is necessary to define the limits of the research, what is included in the research and what is excluded. The research investigates the competencies at global level (literature study) validated through survey and at organization specific level (interviews). Then recommendations will be provided based on both the analyses.

The research's main area of focus is the project phases and lumpsum contract. The stakeholder most affected with changes in this regard is the contractor (organisation executing the project). Hence the research will be carried out in a contractor's perspective. The competencies related to soft and hard skills will be researched.

In this research, phases of a project and the contract type are chosen that are specific to the organisation. While the project performance indicators are chosen from a generalized global perspective. The competencies that will be studied is individual specific (project managers). This is represented in fig-1.

Fig 1 – Illustration of research scope

2.5 Case description, Fluor B.V.

The research was carried out with collaboration of TU Delft and Fluor B.V. Amsterdam. Fluor provides engineering, procurement, construction, maintenance and project management services. Predominantly Fluor focusses on energy and chemical sector and infrastructure sectors. This thesis was in the E&C sector. At Fluor, projects are divided into four categories based on the sizes.

- Small projects (MPG – Multi project group): projects value less than 100 million
- Medium project: project value 100 – 400 million
- Big projects: project value 400 – 800 million
- Mega projects: project value Above 800 million

Often E &C projects are big or mega projects. Hence, the higher the project value, the higher the profits, the higher the risks. In a span of four to five years, 70% of the project will be lump sum, hence more research in this area is needed. Majority of the lump sum projects are either drastically over budget or exceed time. This thesis is a step towards identifying the role of competencies in project success. The context is the project managers from E&C departments across Fluor Amsterdam. New Delhi, and Farnborough offices.

2.5 Reading Guide

This chapter will aid in understanding the chronology of the research. It will also help relate the methodology of the research with the thesis report. The outline of the research will help the reader understand the cohesiveness of the research. The outline is as follows:

Chapter 1 **– Research design**
This chapter explains the research objective, the scope of the research and mainly the research questions that will guide the entire process of the research.

Chapter 2 **– Methodology**
This chapter details the research methods to address the hypothesis, it's a mixed method approach making use of survey and interviews. The details about the methods and the way in which the analysis was carried out is described in detail. It also has a standardised flow chart of the research to make the research reproducible.

Chapter 3 **– Literature study and theoretical framework**
This chapter describes the literature review, the details about competencies, contract type, etc. As in why a particular set of competencies, specific two contracts, or particular performance indicators were chosen. It is followed by a theoretical framework, which is relational diagram consisting of competencies (variable), contract type and project phases (constants) and project success (end means). This paves the path to three research hypotheses. The first is based on competencies and phases of a project, second is about competencies and contract type, and the third is competencies and project success.

Chapter 4 **– Relation between competencies and phases of a project**
This chapter answers the hypothesis, "*At different stages of a project, the competencies needed by a project manager are different".* This is carried out by means of a survey, project phase specific competency type and competencies are identified.

***Chapter 5* – Relation between competencies, lump sum contract and project success**

This chapter answers the hypothesis, "*The crucial competencies required to execute a lumpsum contract differ from that of a cost reimbursable contract"*. This was carried out based on three perspectives, the project directors (the ones who appoint the project managers), project managers, and team leads. This chapter also answers the hypothesis "*If a project manager lacks certain competencies, then the project success will be affected in a respective manner".* The data collection was through interviews and the analysis based on frequency charts. Eventually identifying the competencies affecting both the parameters.

***Chapter 6* – Competency based model and framework for project managers**

A framework based on the results of chapter 4, was designed. It consisted of a scoring card, which would help in the hiring process of project managers at FLUOR. B.V. and also in allocating project managers to the different projects. This can also help make changes to the team based on requirements specific to the phases of a project.

The latter part of the chapter makes use of the results of chapter 5, and adds competencies based on lumpsum contract to an existing leadership model.

***Chapter 7* – Discussion and Validation**

This chapter discusses the academic quality of the research and the process of research in itself. The process of how one tackled the hypothesis. It also explains the validity of the research. The thesis was done at FLUOR. B.V., how valid it is for other organisations and sectors. What modifications can be made to suit to different organisations.

***Chapter 8* – Conclusion and Recommendation**

This chapter marks the concluding remarks the thesis. It is done by answering all the research sub questions subsequently answering the key research question. It is followed by providing recommendations to FLUOR.B.V. and for further research.

2. Methodology

2.1 Research methodology

The main purpose of this chapter is to elaborate the research procedure. Its prime focus will be on the process of data collection, and its analysis. (Kallet, 2004)

The approach for the research is of a mix method, a combination of qualitative and quantitative research. It is an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks. The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone (Creswell, 1997)
Competency school perspective is used since it is the most recent form of trait school of leadership. The research procedure mainly consists of literature review, data collection (interview, q-sort, survey), data analysis and results. The research paper "Leadership competency profiles of successful project managers" by Ralph Muller, Rodney Turner will be used as a basis for the research process. It will be replication study but with respect to managers at FLUOR. It will consist of three domains namely, competencies, project performance indicators and contract type.

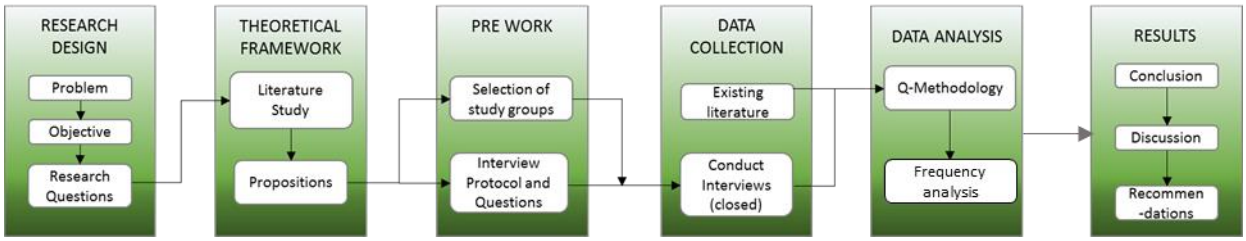


Fig 2 – Research flow

Research methodology is described in figure 3. It represents the general path for the research. It starts with the research design in which the problem statement, research objectives, research methodology and other prerequisites needed at the onset of a research project.

The research includes the literature study and formulation of hypothesis. There are three major areas of the study, namely project management competencies, lump sum contract, and key project performance indicators. Following the literature study, a standard would be deduced in order to compare it with the managers at FLUOR. Pre-work includes selection of study groups and finalising the interview protocol and questions. The next step is data collection; interviews will be the prime source of data collection. Data analysis will include the interpretation of all the data gathered during the literature review, pre-work, and data collection. Based on these results will be inferred and conclusions will be drawn. This will be followed by discussion and recommendations.

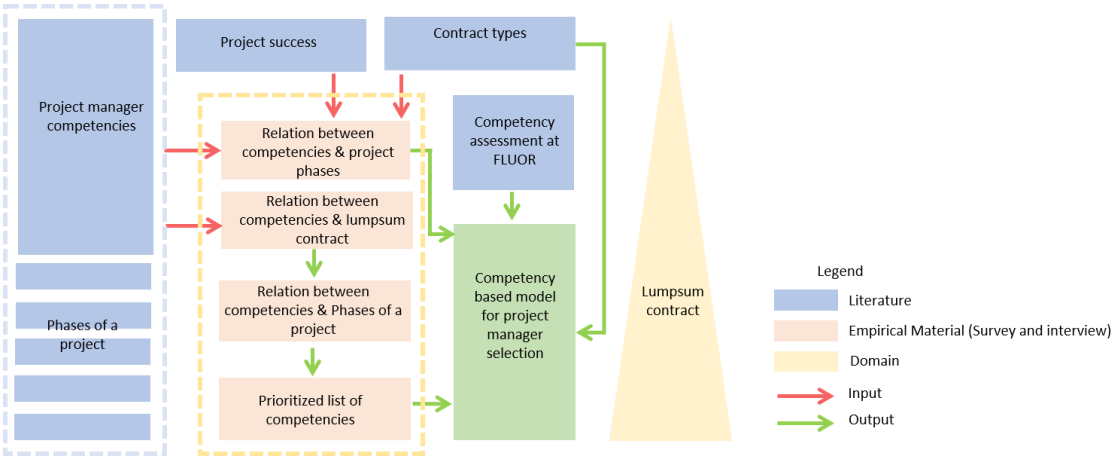


Fig 3 – Schematic research methodology (own illustration)

2.6 Research method description

The research includes the following methods and tools:

Literature study: To identify the competencies (Prioritize them) of a project manager needed for further research and a thorough understanding of contract type and performance indicators is a must. It helps to determine whether the topic is worth studying, and it provides insight into ways in which the researcher can limit the scope to a needed area of inquiry. It provides a framework for establishing the importance of the study as well as a benchmark for comparing the results with other findings (Creswell, 1997). It relates a study to the larger, ongoing dialogue in the literature, filling in gaps and extending prior studies (Cooper, 2010) (Marshall & Rossman, 2011)
The questions and hypotheses formulated during this phase help in structuring of the research and help focus on the targeted research area.

Survey: A survey is a type of research during which over a period of time/space the researcher tries to gain an overall picture of a complete phenomenon.(Verschuren & Doorewaard, 2010). It is characterised by:

1. a substantial domain, consisting of a *large number* of research units; In my research 40 responses were analysed.
2. *extensive* data generation; A total of 630 answers were analysed.
3. more *breadth* than depth;
4. a *random* sample rather than a strategic sample; but in my case it was a strategic sample, project managers across three Fluor offices were targeted.
5. an assertion which consists of variables and the relationships between these variables;
6. preferably *remote, closed* data generation;
7. *quantitative data* and *quantitative data-analysis.*

Interviews: Conversation is a basic mode of human interaction. Research interviews serve the purpose of generating knowledge or explain a particular theory (Kvale & Brinkmann, 2008). A In this research face to face interviews were conducted. A questionnaire plays a very important role during an interview. One must ensure that all the information needed for the research purpose should be gathered. A questionnaire also helps streamline the process. Since, it is a one to on conversation it is quite possible to deviate from the intended topics to be spoken about, hence questionnaires play a vital role. In this research three kinds of professionals namely project directors, project managers, and team leads were interviewed, the questionnaire was modified accordingly.

Q-Methodology: Q-methodology is a mixed research methodology. It combines the strengths of both qualitative and quantitative methods. The instrumental basis of Q methodology is the Q-sort technique, which conventionally involves the rank-ordering of a set of statements from agree to disagree. Usually the statements are taken from interviews, hence are grounded in concrete existence. It is generally followed up by a factor analysis. In my research, the statements were basically the competencies that were obtained from literature study, the analysis was through frequency charts.

In order to study people's viewpoint, opinions, beliefs, etc. all which are subjective matters, Q-methodology forms the basis.(Brown, 1993). In Q-methodology, there are a set of questions or statements about a particular subject called the Q-set and there are a set of respondents called the P-set. Based on individual viewpoint, preconceived notions and past experiences the respondents are asked to rank the statements in order of their priority (Exel, 2005). By Q sorting people give their subjective meaning to the statements, and by doing so reveal their subjective viewpoint (Smith, 2001) or personal profile (Brouwer, 1999).

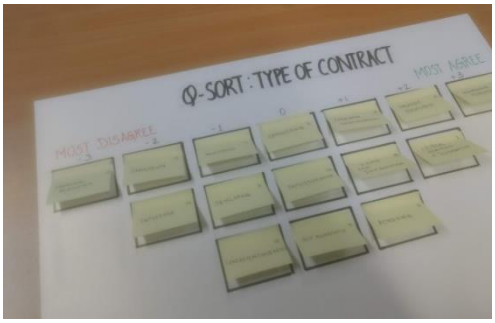


Fig 4 – Example of a q-sort (own picture)

3.6.3 Standardisation of the research

This is essential in order to make the research cohesive. This will also make it possible for the research to be reproduced. For, instance the standard procedure can be followed by different companies to identify a specific list of competencies suited to their company profile. Since the project managers and the phases of the project were specific to FLUOR, the results are also specific. But since the competencies and project performance indicators were generic, the results can be applied to similar organisations who construct energy and chemical refineries. They can always generate their specific list by reproducing the process mentioned in fig-5.

Also, if the research is conducted on the same people, the results are the same. To ensure this, the procedure must be standardized. It is as follows:

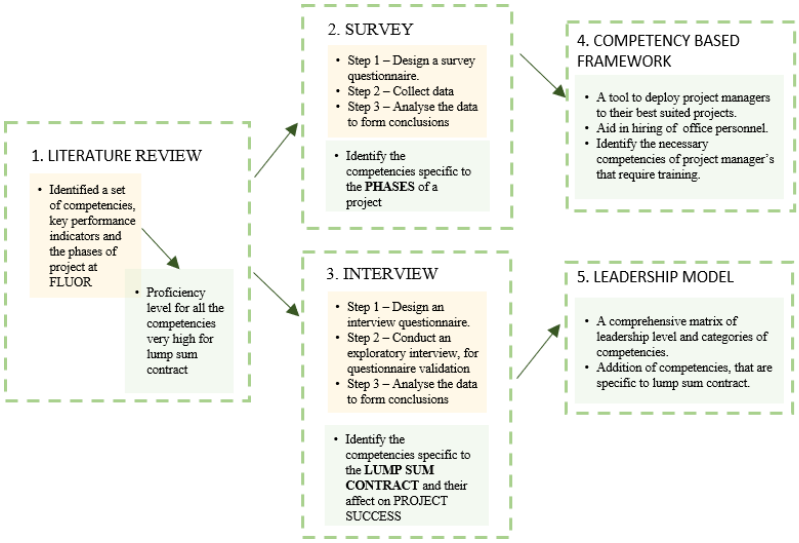


Fig 5: Standardised research process (own illustration)

3.Theoretical framework

3.1 Introduction

This chapter briefly outlines all the necessary outcomes from the literature study and deduce a theoretical framework. The research focus is on identifying the competencies needed to successfully execute a lumpsum contract in a project's life cycle. Since, there was no literature directly linking competencies with phases of a lump sum project and its success, they were independently researched. The topics are competencies of a project manager, lump sum contract, phases of a project, project success, following the study few prepositions were made.

3.2 Competencies of a Project Manager (PM)

Traditionally, project management was merely using the right tools and techniques for successful outcomes, irrespective of a project manager's match of personality with project type (PMI, 2004). With ever-increasing complexities and demands, a project manager must be holistically developed. One of the most studied aspects of human behaviour is leadership (Dulewicz,V., & Higgs, M. J., 2000)

According to Project Management Institute, competency is defined as: "a cluster of relevant knowledge, skills, attitudes and other personal characteristics" (PMI, 2004). One's job is majorly affected by competencies and it is often related to job performance. There are certain standard means of identifying and measuring them. They can also be improved by various methods of training and development (PMI, 2004). Competencies are a specific combination of knowledge, skills and personal characteristics. (Muller & Turner, 2010). Often projects are affected by the competency levels of a project manager which cannot be measured or quantified. For instance, we cannot exactly pin point the cause of a failure of project to the lack of a specific competency. Therefore, this research was conducted to identify the competencies specific to a project phase and lumpsum contract. Subsequently identifying the effect of competencies on project success. This will help in better allocation of project managers and in the hiring process of project managers.

The most prominent and recognized project-based industry is the construction industry. Construction projects are inherently distinct. The projects are unique, but the processes in realizing it may be standardized (Loosemore, Dainty, & Lingard, 2003). Project management is a complex process directed towards numerous results. Project management competency is just as complex, which involves the need for diverse knowledge and skill set across various fields of expertise like instructional technology, management, information technology, engineering, and manufacturing. If the employees have a wide array of core competencies, then the organisation will tend to be more successful. They also help in strengthening the development functions and performance management (Brophy & Kiely, 2002). Often project performance indicators such as completion on time, within budget are used to measure project managers' performance. In such a crude method it is tough isolate individual's contribution. According to Fletcher and Baldry, a mix of evaluation by senior in line, junior in line, equals and self will give a more thorough review of the performance. It is more rational and consistent (Fraser & Zarkada, 2003).

Project managers play a vital role in bringing out the best in their team, it says a lot about their leadership qualities. To be successful, a project manager needs effective communication and the ability to bring out the best in the team. Compared to normal production industries, construction projects have unpredictable environments (Loosemore, Dainty, & Lingard, 2003). Hence, one must carefully plan the projects in case of lumpsum contract.

Often in a construction organisation a team of individuals work on specific projects and then are reorganized and deployed elsewhere (Atkins & Gilbert, 2003). This redistribution is based on the

suitability and availability of personnel, if this selection also embodies the competencies (characteristics, behaviours, and traits) then there will effective job performance. The competencies of top members of team does affect the overall performance of the organisation (Kakabadase, 1991). If used effectively, competency assessments can help in personnel selection and make better project planning models.

Often traits and competencies tend to have overlapped areas of definition. Traditionally, traits were understood to be innate or heritable qualities of the individual in the early leadership scientific research tradition. This perspective, assuming traits to be immutable properties that were present at the birth of a prospective leader (Galton, 1869). Lately traits are defined as "relatively stable and coherent integrations of personal characteristics that foster a consistent pattern of leadership performance across a variety of group and organizational situations". This definition includes "a range of stable individual differences, including personality, temperament, motives, cognitive abilities, skills, and expertise" (Zaccaro, Kemp, & Bader, 2004). It is important here to clarify that this definition includes both personality traits and other personal characteristics not necessarily related to personality. Competencies on the other hand are typically a mix between behaviours and skills. If you have strong leadership competencies, it's understood that you may have behaviour patterns that are strengthened by certain skills you have developed over time. Generally, competencies are measures of how well you do certain things, taking into consideration your knowledge, skills and attributes. Competencies are generally behaviours that are easily identified and measured. (Koolen, n.d.)

When it comes to leadership studies, there are different schools of thought. There are many schools of thought on leadership such as trait school, visionary school, contingency school and behaviour school (Muller & Turner, 2010). All these have been developed over different periods of time, most recent being the competency school. Trait school emphasised on a leaders' characteristics such as physical appearance, capabilities and personalities. Behaviour school studied the styles embraced by leaders for their duties. The new basic assumption of this school was that leadership can be learned and is not a trait people are born with. According to the contingency style, different leadership situations demand different leadership styles. The personal characteristics of a leader should correspond with the leadership situation. The visionary school came in 1980's and focussed on organizational change. It had a clear distinction between transformational and transactional leadership styles. The competence school embodies all the earlier schools. It includes a specific combination of knowledge, skills and personal characteristics (Boyatzis, Crawford). Study on competencies has increased rapidly in recent times. According to Muller and Turner there are three different styles of leadership (Muller & Turner, 2010):

Engaging: It's a style based on empowerment and involvement in highly transformational context. This leadership style is focused on producing radical change through engagement and commitment.

Involving: It's a style for transitional organizations which face significant, but not necessarily radical change of their business model or way of work.

Goal oriented: It's a style focused on delivery of clearly understood results in a relatively stable context

There have been many competency frameworks put into practise by project management associations and institutes (AIPM, 2008; IPMA, 2006; PMI, 2007). These frameworks suggest competency mapping in both hard and soft skills but focus on hard skills. Nevertheless, the number of studies with an emphasis on soft skills is increasing (Cheng & Dainty, 2005). Project managers must adapt to the changing environment of construction industry to maintain the professional competency. This can be achieved by developing skills through training and experience. Training not only helps project managers to successfully adapt to changing demands but also aid in making better management and general

manpower development policies (Edum-Fotwe & McCaffer, 2000). Hence competencies play a very crucial role for better decision making.

The role of project managers is widely impacted, with the shift in procurement methods from traditional options of open competitive tendering to more of design-and-construct contracts. In the latter, the risks lie greater with the contractors (Bedelian H. , 1996). Adding to this, the ever-increasing levels of quality, productivity and performance expected from projects in many organisations, specially the construction companies tend to question the traditional management processes and business practices. (Hayden, 1996). In order to meet the new demands, the role of construction manager is no longer restricted to traditional engineering knowledge, one must complement it with soft skills and non-engineering knowledge. This makes it very important to study competencies in the light of lump sum contract and that is what this research aimed at.

Management of relationships can be aided by engineering and technology principles. Nevertheless, the very essence of relationships is non-technical and often social-oriented skills. Many managers do reflect these when carrying out their duties and functions. Yet, some fail to do so hence such skills need to be imbibed (Edum-Fotwe & McCaffer, 2000). Identifying the necessary competencies to ease the process of relation building is necessary. Getting business from a client is good but sustaining it and getting future projects is also important. That marks the difference between a good and a better project manager. In this case it's all about far sightedness.

In construction industry, each project has a substantial percentage of contribution to the company's overall success. The failure of one project can lead to a failure of the company. Hence, there is a need to aim for improving the competencies of project managers. The right blend of theoretical education with training and skills developed through experience will result in a professionally competent project manager. Much of the knowledge needed to manage construction project is unique to project management (such as critical path analysis and project cash flow forecast) (Kangari, 1988)

Though educational programmes pertaining to project management cover significant portion of the defined knowledge areas, in practice the knowledge required is much more than the scope covered in these programmes. Modern project management practice therefore, demands other general and management knowledge, coupled with skills that extend beyond the technical aspects of traditional engineering

However, more than often the knowledge gained from one type of project helps the project manager in two ways, first in acquiring skills specific to that project are enhanced and secondly these skills can translate to a more generic form applicable to other industries. These can also apply to other areas of construction or different projects within the same sector, this can be called as "project learning". These general skills are usually form the groundwork for development of project management skills. Recognising these skills is necessary. Identification of these, skills and description of a person is known as profiling. Profiling provides the idiosyncratic combination of behavioural, temperamental, emotional and mental attributes of a leader, to derive a person's particular leadership style.

A particular type of leadership known as transformational leadership has significantly greater impact on the organization than transactional leadership. As the name suggests it is a more dynamic approach. The idea of this research, to identify the competencies over different phases of a project stems from this concept. It is the blend of competency and character that possibly yields leaders that are apt to the situation. This combination of competency and character has not been specified anywhere and depends on an individual. Goffee and Jones suggested that it's all about "being yourself, with the skill". Competencies can be developed or even taught, whereas personal characteristics remain as they are. Environment also has a very important influence on determining leadership success.

Category	Competences	References
Project management processes	Integration management; scope management; time management; costs management; quality management; human resource management; communication management; risk management; contract management; environmental management; safety and health management	IPMA (2006), PMI (2007), and AIPM (2008)
Personal	Leadership; communication; opening; relationships; team building; teamwork; development of others; conflict resolution; holistic view; systemic view; assertiveness; problem-solving; ethics and integrity; commitment; self-control/work under pressure; relaxation; uncertainty; creativity; negotiation; emotional intelligence; commitment to the organisation; reliability; attention to detail; delegation; search for information; analytical thinking; conceptual thinking; flexibility	Edum-Fotwe and McCaffer (2000), Dainty et al. (2005), IPMA (2006), Brill et al. (2006), PMI (2007), Rose et al. (2007), AIPM (2008), Clarke (2010a, 2010b), Muller and Turner (2010), Skulmoski and Hartman (2010), Akogbe et al.(2013), Ahsan et al. (2013), and Jaafar and Othman (2013)
Technical	General technical overview; technical vocabulary; technical challenges; search for innovative technical solutions; technical solution assessment; technical risk assessment; technical trade-off decisions; relationship between technologies; design (project); technical drawing	Thamhain and Wilemon (1978), Cleland and King (1983), Bloom (1989), Grant et al. (1997), Edum-Fotwe and McCaffer (2000), and Rose et al. (2007)
Context and business	Organisation's profitability; strategic alignment; customer relationships; customer satisfaction; forces of industry (organisation, customer and suppliers); legislation; finance; continuous management improvement	Rose et al. (2007), IPMA (2006), Dainty et al. (2005), and Brill et al. (2006)

Table 1 – Categories of competencies

Competencies have been widely studied for decades now. In a research by Mei I Cheng and Andrew R.J. Dainty, 12 core behavioural competencies lead to effective project management performance which is specific to construction industry. One of the most dynamic and complex (many interfaces) project-based industrial sectors (Cheng & Dainty, 2005). They are as follows, achievement orientation, initiative, information seeking, focus on client's needs, impact and influence, directiveness, teamwork and cooperation, team leadership, analytical thinking, conceptual thinking, self-control, and flexibility (Cheng & Dainty, 2005). All these competencies were studied on two groups, 'superior' and 'average' managers. While this research focusses specifically on project managers (Cheng & Dainty, 2005).

Another recent study in 2014 by Silvia Mayumi Takey, Marly Monteiro de Carvalho had four categories of competencies, project management processes, personal, technical, and context and business. They also identified relevant competencies needed for financial planning, and scheduling planning. The matrix can be seen in table 2. A competence performed by a junior professional in a less complex context (for example, a small-size project) may not be performed with the same proficiency in more complex scenarios (Mayumi Takey & Monteiro de Carvalho, 2015)

Most important competences for respondents of financial planning and scheduling planning.

Category	Financial planning	Scheduling planning
Project management processes	Cost; term	Scope; term
Personal	Flexibility	Communication
Technical	Technical vocabulary	General technical overview; technical drawing
Context and business	Continuous management improvement; strategic alignment; customer relationships; legislation	Customer relationships; continuous improvement; strategic alignment

Table 2 – Financial and Scheduling competencies

Another study by Fotwe and McCaffer, identified four essential project management skills, relevant to construction project manager namely **communicating, problem solving, negotiating and leading**. They also studied the primary and secondary knowledge and skill elements for developing PM competency, which included a list of twenty plus skills in each of the primary and secondary groups.

The PMI lists four important competencies regarding leadership. They are **general leadership** (Communicating the vision and inspiring the team to achieve it to get work accomplished through others), **adaptability** (Recognizing change and complexity and adjusting to it), **creativity** (Seeking a more effective way to generate ideas, alternatives, and possibilities), and **collaboration** (Fostering solutions to build winning relationships and working toward a common goal) (Ginger, 2014)

Another Web-based Delphi study identified around 78 trainable competencies for project management success. The top ten competencies that were identified are: know the **goals** of the project, know the **scope** of the project, conduct **business ethically**, know the **mission** of the project, **know how project success is measured**, **listen** effectively**, share credit for success**, know the **available resources** (funds, equipment, people and the like), have **strong verbal communication** skills, be able to **recognise a**

problem. This study was not specific to construction industry hence, this set of competencies were not considered.

Two articles, "Do Project Managers' Leadership Competencies Contribute to Project Success?" and "Leadership competency profiles of successful project managers" conduct their studies on set of 15 competencies that were segregated into 3 categories, **namely intelligent quotient, managerial quotient, and emotional quotient**. The latter paper is an industry specific study, i.e. it compares engineering & construction, Information & telecommunication technology, and organisational change projects.

The two main reasons for selecting this set of competencies are:

- The research was specific to construction industry.
- This is the only research, among all the one's that I studied that related competencies and type of contract.
- It also covered three varied aspects, intelligent, managerial, and emotional quotient.

n		Application type			Contract type		
		Engineering & construction	Information & telecommunication technology	Organizational change	Fixed price	Remeasurement	Alliance
		19	89	65	56	41	12
IQ	Critical thinking	High	High	High	High	High	High
	Vision	Low	Medium	High	High	Low	Medium
	Strategic perspective	Medium	High	High	High	Low	Low
MQ	Managing resources	Medium	High	High	High	High	High
	Communication	Medium	High	High	High	Medium	High
	Empowering	Low	High	High	High	Medium	Medium
	Developing	High	High	Medium	High	High	Low
	Achieving	Medium	High	Medium	High	Low	High
EQ	Self awareness	Medium	High	High	High	High	High
	Emotional resilience	Low	High	High	High	High	Medium
	Intuitiveness	Low	Medium	Medium	Medium	Medium	Low
	Sensitivity	Medium	High	High	High	High	High
	Influence	High	High	High	High	High	High
	Motivation	High	High	High	High	High	High
	Conscientiousness	High	High	High	High	High	High

Table 3 – The selected set of competencies

In this particular study, the research was based on competencies and fixed price (lump sum) contract, the levels of excellency needed is high for most of the competencies, except for intuitiveness which is medium. While cost reimbursable has a mix of low, medium, and high. It is clear that to execute a lump sum contract, all the competencies require a higher degree of expertise. This research is intended to move one step ahead and identify the order of priority within each of the contract types, i.e. what competencies are of utmost importance for a lumpsum contract. The result can be seen in the conclusion chapter section 6.4xx. This research also identifies the necessary competencies in each of the phases of a lump sum project. A particular set of competencies were chosen for the study. The reason for choosing this set of competencies is because this was the research in which the competencies were studied in relation with the lumpsum contract. The leadership competencies are as follows (Muller & Turner, 2010).

A.1. Intellectual competencies

1. Critical analysis and judgment: Muller and Turner define it as, "The leader gathering relevant information from a wide range of sources, probing the facts, identifying advantages and disadvantages. Sound judgements and decisions making, awareness of the impact of any assumptions made" (Muller & Turner, 2010).

2. Vision and imagination: According to Muller and Turner a leader is imaginative and innovative if: "He or she has a clear vision of the future and foresee the impact of changes on implementation issues and business realities" (Muller & Turner, 2010).

3. Strategic perspective: According to Muller and Turner, "a leader is aware of the wider issues and broader implications. He or she balances short and long-term considerations and identifies opportunities and threats" (Muller & Turner, 2010).

A.2. Managerial competencies

4. Resource management: According to Muller and Turner resource management is if: "the leader organizes resources and co-ordinates them efficiently and effectively. He or she establishes clear objectives and converts long term goals into action plans" (Muller & Turner, 2010).

5. Engaging communication: Muller and Turner proposed that "a leader must engage others and win their support through communication tailored for each audience. He or she is approachable and accessible" (Muller & Turner, 2010).

6. Empowering: Muller and Turner suggested that a leader must be empowering: "gives direct reports autonomy and encourages them to take on challenges, to solve problems and develop their own accountability" (Muller & Turner, 2010).

7. Developing: According to Muller and Turner "a leader encourages others to take on ever more-demanding tasks, roles and accountabilities. He or she develops others' competencies and invests time and effort in coaching them" (Muller & Turner, 2010).

8. Achieving: Muller and Turner defined achievement: "leader shows an unwavering determination to achieve objectives and implement decisions" (Muller & Turner, 2010).

A.3. Emotional competencies

9. Self-awareness: Muller and Turner's definition: "leader is aware of his or her own feelings and able to recognize and control them" (Muller & Turner, 2010).

10. Emotional resilience: According to Muller and turner, "a leader must be able to maintain consistent performance in a range of situations. He or she retains focus on a course of action or the need to obtain certain results in the face of personal challenge or criticism" (Muller & Turner, 2010).

11. Intuitiveness: Muller and Turner propose that "a leader arrives at clear decisions and is able to drive their implementation in the face of incomplete or ambiguous information by using both rational and 'emotional' perceptions" (Muller & Turner, 2010).

12. Interpersonal sensitivity: Muller and Turner's definition: "leader is aware of, and takes account of, the needs and perceptions of others in arriving at decisions and proposing solutions to problems and challenges" (Muller & Turner, 2010).

13. Influence: According to Muller and Turner Influence is defined: “a leader can persuade others to change a viewpoint based on the understanding of their position and the recognition of the need to listen to this perspective and provide a rationale for change” (Muller & Turner, 2010).

14. Motivation: Muller and Turner’s definition, “the leader has a drive and energy to achieve clear results and make an impact” (Muller & Turner, 2010).

15. Conscientiousness: Muller and Turner propose, “a leader displays clear commitment to a course of action in the face of challenge and matches ‘words and deeds’ in encouraging others to support the chosen direction” (Muller & Turner, 2010).

3.3 Lumpsum contract

In the simplest terms, a contract is a guarantee or agreement that the law will enforce. With regard to construction, a contract involves a promise of providing services or materials by one party to another.

Lump Sum: The contractor agrees to perform the stipulated work in exchange for a fixed sum of money (Clough 1981). This lump sum commonly includes all labour, materials, project overhead, company overhead, and profit.

In a lump sum contract, the contractor is provided with a fixed price by the owner to do all the work stated in the agreement. A precursor for execution of lumpsum contract is the clear understanding of the scope by all the parties involved. In this type of contract, the owner has the best protection with respect to the price paid for the work. On the other hand, it is a very risky contract for the contractor (Kaplanogu & Arditi, 2009).

One of the most used fixed price contract is the lumpsum contract, where the total price of the project is estimated at the bidding stage (Hinzie, 1993). Ideally the cost of the finished project must equal the cost stated in the contract, but most of the times it’s not the case. Having a well-defined scope in the initial stages is tough, forecasting all the risks is a very difficult task. The contractor assumes most of the risks, hence a project manager must be better equipped to deal with a lump sum contract.

Risk allocation is primarily considered when deciding the type of contract. Amongst all the risks, financial risk is considered important when assessing the project risks. Therefore, proper assessment, allocation and management of risks can lead to cost optimization. There must be a balance of risks between the owner and the contractor in order to utilize the incentive value of bearing risk while minimizing a contingency charged for accepting the risk.

A company's efficiency in handling risk is based on its power to control the risk, its possible reward for controlling the risk, and its financial position to assume risk. When planning, project managers often rely on previous experiences and use the lessons learned to resolve problems during contract execution.

If both the parties have “win/win” frame of mind seeking mutual benefit, it will help come up with solutions satisfying all involved. “Win/win” centres on the paradigm that there is plenty for everybody, and that one person's success is not achieved at the expense or exclusion of another person.

Synergy implies that the whole is greater than its parts. Teams are composed of different personalities. Though there are differences, multiple opinions, one must share insights and open their minds and form a cohesive team. Most of the contractors believe that objective-uncertainty is higher on lump sum projects than cost-plus projects. Even on smaller lump sum projects, managers may face major objective-uncertainty.

3.4 Phases of a project

The research was conducted at FLUOR.B.V. Amsterdam. The results of this research are specific to the energy and chemical sector. It was a logical step to consider the project phases demarcated by them, since the research was conducted at FLUOR. The competencies and the project success indicators were chosen separately. FLUOR does not have an existing list of competencies in relation to lumpsum contract hence, it was selected based on literature study.

According to PMI, project management has five phases namely project conception and initiation, definition and planning, launch or execution, performance and control, and project close. These are very much comparable to the project phases at FLUOR as follows:

- Project conception and initiation phase is similar to Proposal/final contract negotiation and project kick off combined.
- Definition and planning phase is similar to project set up phase.
- Execution phase combined with performance and control phase is in line with the execution phase.
- Project close is similar to closeout phase.

The reason for choosing project phases to relate with competencies is as follows, Studies often provide with a list of competencies to ensure project success. But mastering every competency in real world situation is impractical. Hence, segregating the competencies phase wise resulting in a smaller list of competencies, make it easy for a project manager to achieve the desired goal. The results are more tangible and easier to implement.

The following phases of a project were considered for the research:

- Proposal/final contract negotiation
- Project kick-off
- Project set-up
- Execution
- Closeout

Each of the above phases have a set of activities as shown in the figure 6.

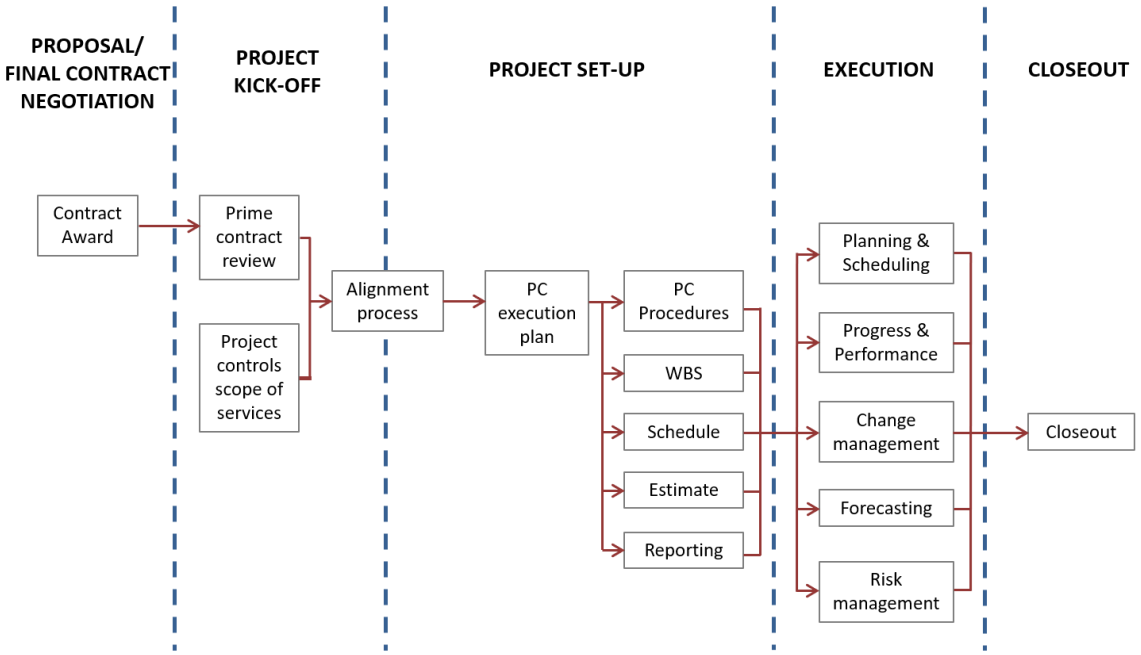


Fig 6 – Phases of a project specific to Fluor (Fluor hand book)

3.5 Project success

Project success is often measured by performance indicators. Research carried out in this field is enormous. For a project to be successful traditionally three factors needed to be in balance, cost, time, and scope. This is known as the iron triangle. It has quality as the central focus. Performance indicators such as safety, efficient use of resources, effectiveness, satisfaction of stakeholders, and reduced conflicts and disputes are increasingly becoming important (Toor & Ogunlana, 2010). Project success is a function of project-related factors, project procedures, project management and they are interrelated and interrelated (Chan, Scott, & Chan, 2004). Chan, Scott and Chan the key performance indicators (KPI) of project success are cost, time, health and safety, participants' satisfaction, User expectation/satisfaction, environmental performance, commercial profitable value, quality (e.g. technical specification). The purpose of key performance indicators is to measure a project and organisational performance. KPI's focus on critical aspects of outputs or outcomes. Some indicators like cost, time, etc. cam be objectively measured while some like quality, performance, etc. are based on subjective opinions (Chan & Chan, 2004). During the interviews, a list of competencies affecting the lump sum contract are identified and each of the project manager pin points at the performance indicators affected by those specific competencies (the detail study is in section 6.5 and appendix E). For the research purpose a set of key performance indicators based on study by C S Lim and M Z Mohamed were selected. They are as follows.

From a macro view point:

1. Time
2. Utility
3. Operation

From a micro view point:

1. Time
2. Cost
3. Quality
4. Performance
5. Safety

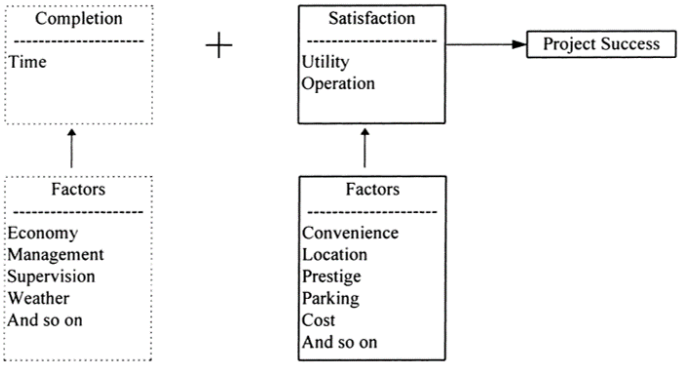


Fig 7 – KPI based on macro view point

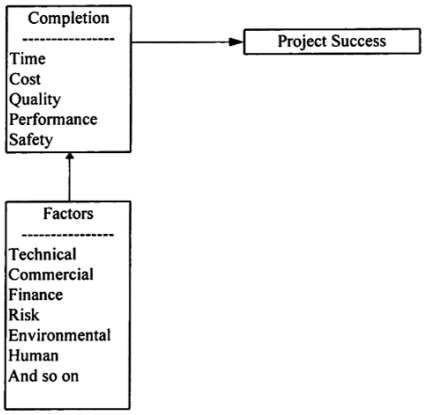


Fig 8 – KPI based on micro view point

Macro view point considers the project as a whole, this is known only during the operational phase. This is related to the main stakeholders and the end users. Micro view point deals with smaller component levels (Lim & Mohamed, 1999). Achievements at intermediate stage gate levels. Micro view point considers the work at the sub-contractor level. In this research following a q-sort of competencies and lump sum contract. The project managers were asked to be fill a check list of project performance indicators affecting the competencies identified in the q-sort.

	MICRO VIEW POINT					MACRO VIEW POINT			
	TIME	COST	QUALITY	PERFORMANCE	SAFETY	TIME	SATISFACTION	UTILITY	OPERATION

Fig 9 – The check list of competencies and performance indicators

3.6 Theoretical Framework

Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that can hold or support a theory of a research study (Abend, 2008) (Swanson, 2013)

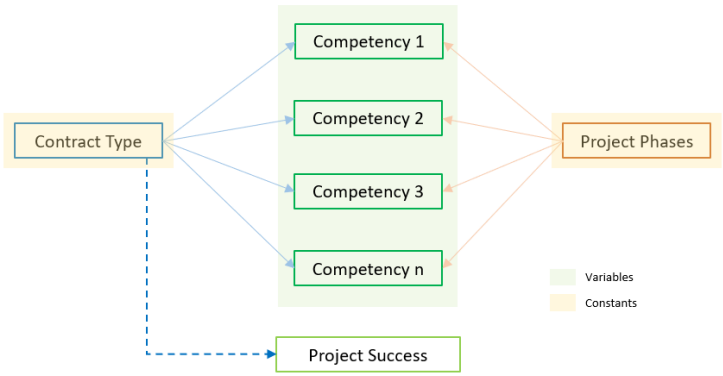


Fig 9 – Phases of a project specific to Fluor

Fig - 9 shows the theoretical framework of the research. The aim of the research is to find the variations in the competencies based on project phases and contract type (lump sum and cost reimbursable contract). The framework is an attempt to establish the relation between the four components namely contract type, competencies, project phases and project success.
The research is to identify the variables i.e. competencies when juxtaposed with contract type and project phases which are constants. The arrows represent the relation flow.

3.7 Research hypothesis

Hypothesis 1: *At different stages of a project, the competencies needed by a project manager are different.*

This hypothesis is researched with the help of a survey, subsequently the competencies required in different phases of a project were identified and a prioritized list was formulated.

Hypothesis 2: *The crucial competencies required to execute a lumpsum contract differ from that of a cost reimbursable contract*

This hypothesis is researched with the help of the data gathered through interviews. A Q-Sort was performed independently for cost reimbursable and lump sum contract, and the resulting competencies were analysed.

Hypothesis 3: *If a project manager lacks certain competencies, then the project success will be affected in a respective manner.*

This hypothesis is researched with the help of interviews. Competencies affecting a set of chosen key performance indicators were identified. For example, if a project manager does not a have a “x” competency, then performance indicators “a”, “b”, etc. are affected.

4. Relationship between competencies and phases of a project (survey)

4.1 Introduction

Competencies relevant to different phases of a project will be identified in the coming sections. This chapter answers hypothesis one i.e. *"At different stages of a project, the competencies needed by a project manager are different."* The conclusions were made based on survey responses of project managers. The expected outcome will aid in making appropriate changes to the project teams based on the competencies necessary in that phase of a project.

In this chapter the data gathered through survey will be evaluated, following which the trends and variations in the competencies through the phases of a project will be analysed based on the results obtained in the survey. Possible reasoning for these trends and variations will be backed up by relevant literature and the knowledge obtained through interviews conducted at FLUOR B.V. Amsterdam. Finally, the most relevant competencies needed in different phases of a project will be identified, which will form a part of the competency-based matrix model for project managers.

4.2 Survey design

The survey was undertaken by project managers working at FLUOR B.V., Amsterdam, Farnborough, and New Delhi offices. The survey focussed on identifying the varied competencies needed in different phases of a lump sum project.

4.2.1 Survey procedure

A thorough literature study was done before finalizing the set of competencies that will be used for the research purpose as explained in section 3.1. The competencies chosen were of three categories namely intellectual, managerial, and emotional competencies. Though the list of competencies was taken from the literature, the research paper stated that the level of competencies to execute a lumpsum contract is high. There was no distinction within the list of competencies in terms of importance level. Hence, this research helped rank these competencies with respect to project phases. The results can be seen in conclusion of this chapter, i.e. the results of the survey were integrated in the framework that was formulated in the previous chapter.

This ensured that most of the domains were covered. The five phases of a project chosen for the survey was as follows, proposal/final contract negotiation phase, project kick-off phase, project set-up phase, execution phase, and close out phase. The competencies were finalized in consultation with the academic committee and the phases of a project was finalized with the help of company supervisor (FLUOR). The questions were then formulated based on the above two aspects. A total of 21 questions were included in the survey. Most of the questions required the respondents to rank the competencies with respect to the phases of a lumpsum project. Resulting in a set of prioritised competencies, i.e. in order of importance.

The survey was designed on a web-based platform, SurveyMonkey. Along with the survey link, an introduction document and a document with definitions of all the competencies were sent to the respondents. The data was collected for the following one and half months. Reminder mails along with the link to the survey was sent in order to improve the response rate.

4.2.2 Survey respondents

The survey was sent to project managers at three offices. A total of 40 responses were received and the results of which were analysed. Since the survey was aimed at project managers, and project directors it was a given that all the respondents had significant work experience. Therefore, the quality of the data obtained was from expertise in the field. On an average people spent 24 minutes on the survey.

4.3 Analysis method

The questionnaire consisted of ranking based questions, related to competencies and phases of a project. The result of these questions will be represented as bar charts with weighted average scores. When using the weighted average method, the top ranked option is always weighted the highest and the bottom ranked is weighted the lowest. For example, in a question with five options the highest ranked option would have a weight of 5 and the lowest ranked option has a weight of 1.

The ranking question asks respondents to rank the competencies in order of priority specific to certain phases of a lumpsum project. For the analysis of the results, an average ranking is calculated for each answer choice, allowing one to evaluate the most preferred answer choice. A breakdown of how each option was ranked overall can be found in the appendix C. in the form of tables. The total column shows how many people have assigned a ranking for each option. The score column is the weighted average of each option, therefore making it possible to identify the option that was most preferred.

4.3.1 Average ranking

Ranking questions calculate the average ranking for each answer choice, so one can determine which answer choice was most preferred overall. The answer choice with the largest average ranking is the most preferred choice.

To determine the answer choice preferred by the majority, weighted average ranking was adopted. Each of the question had an average ranking, the one with the largest average ranking is the most preferred choice.

The average ranking is calculated as follows, where:

$$\frac{\sum_{i=1}^{n} X_i W_i}{\sum_{i=1}^{n} X_i}$$

Equation 1

W = weight of ranked position
X = response count for answer choice

Weights are applied in reverse. In other words, the respondent's most preferred choice (which they rank as #1) has the largest weight, and their least preferred choice (which they rank in the last position) has a weight of 1.

For example, if a ranking question has 5 answer choices, weights are assigned as follows:

- The #1 choice has a weight of 5
- The #2 choice has a weight of 4
- The #3 choice has a weight of 3

4.4 Analysis of the results

The analysis was be done part to whole, i.e. individual elements will be studied first and then a more generic conclusion was be deduced. The data was gathered using the survey method. The survey questionnaire can be found in appendix-d. The results are analysed phase wise in the subsequent sections. This research identifying the competencies and project phases is specific to lump sum contract. A more detailed analysis of competencies and contract type will be done in the subsequent chapter. In the following sections, the crucial phase wise competencies will be identified. This will enable project directors to make modifications in the teams in terms of competencies.

4.4.1 Competencies in Phase-1 (proposal/final contract negotiation phase)

In a lump sum contract the proposal/final contract negotiation phase is very crucial. The cost of the project needs to be as exact as possible, because the fixed amount paid by the client is decided at this stage. Any alterations or cost of missed work orders in a later stage is at the expense of the contractor, hence there must be precision to the last detail. A project manager must have relevant experience and must be competent to take up responsibilities. According to the survey results the ranking of the competency categories is represented in figure 10.

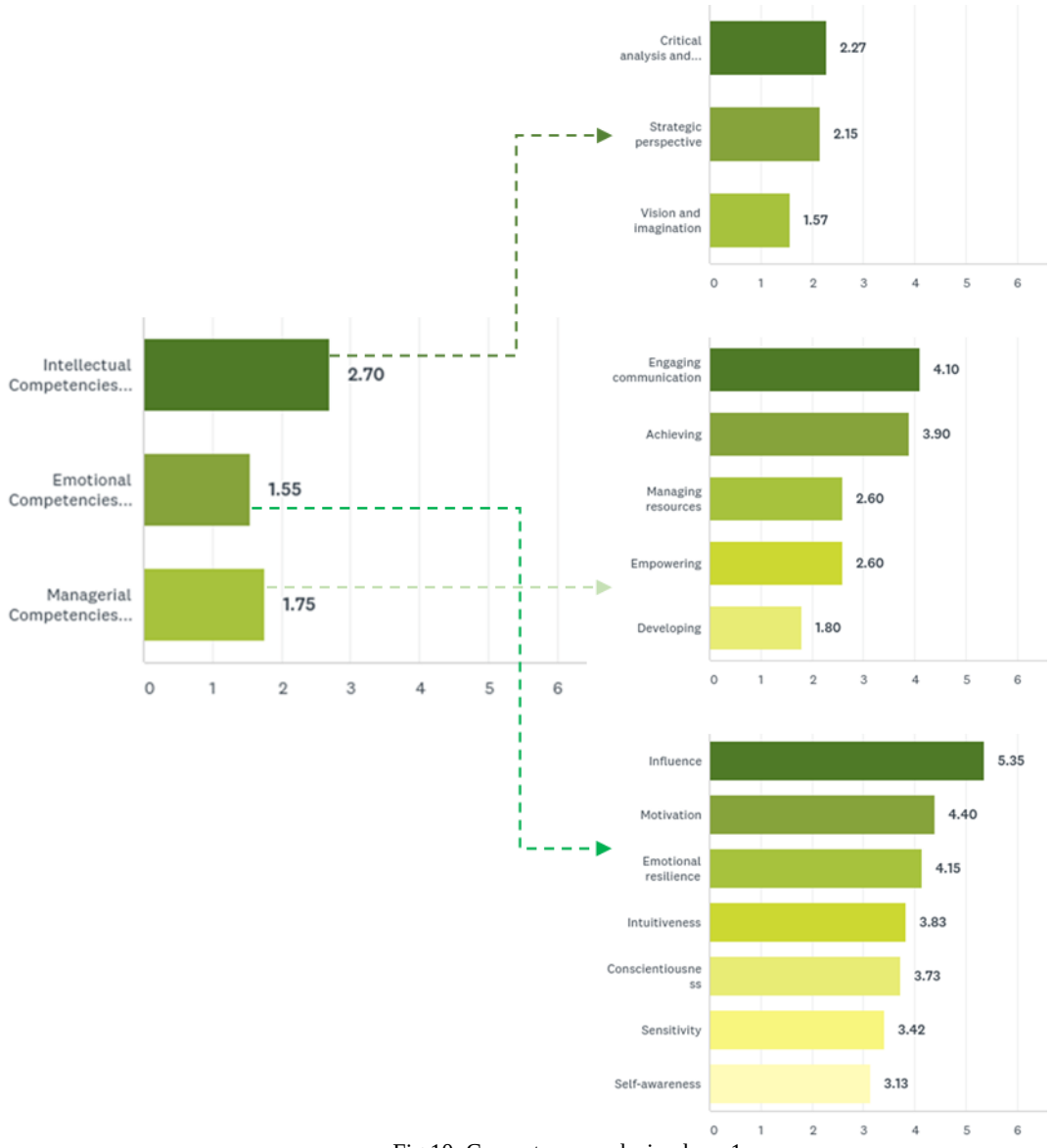


Fig 10: Competency ranks in phase 1

The results show that in the first phase of a lump sum project, intellectual competencies are most important followed by emotional competencies and finally the managerial competencies. The details about the calculation and arriving at the number can be found in section 4.5. We can observe that the difference in the weighted average of intellectual and emotional competencies is 1.15 which is considerably huge. This proves that intellectual competencies are very crucial in the beginning stages of a project. Appointing project managers based on the needs of the project is more apt than merely choosing based on the availability. Thus, identification of these competencies should serve as an important step for developing the skills of potentially competent PMs, who can promote effective management of the whole lifecycle of a project. (Ahadzie, Proverbs, & Sarkodie-Poku, 2014)
In the bigger picture, critical analysis, strategic perspective and vision & imagination are more relevant to proposal/final contract negotiation phase. Carefully analysing the different approaches and critically evaluating them is of utmost priority. Along with it a project manager must have a strategic perspective, to ensure profits for the company. Let alone profits, often lumpsum projects do not even reach the breakeven point and end up as liability to the contractor. Quite often, projects that run beyond schedules and exceed their estimated costs. When it comes to competencies within specific domains, engaging communication and achieving are the key managerial competencies. It is evident with the fact that while drafting a contract, communication is very crucial, the contractor and the client need to communicate their needs and demands clearly to each other.

4.4.2 Competencies in Phase-2 (project kick-off phase)

Phase-2 is project kick-off phase is the time when all the people working on the project both from client and contractor side are acquainted with each other. This is the best time to understand each other's expectations and goals, beyond the scope of the contract. This phase is when both the sides are expected to be at the same page. Competencies relevant to this phase are represented in figure 11.

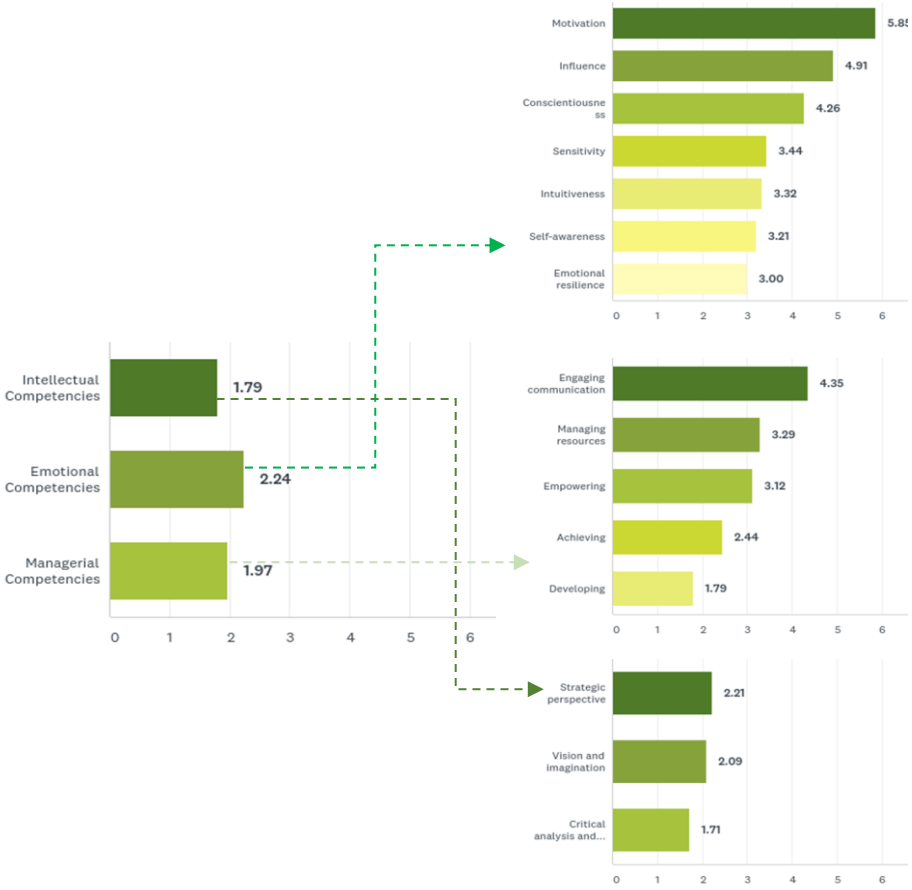


Fig 11: Competency ranks in phase 2

In the project kick off phase, emotional competencies are of utmost importance followed by managerial competencies. This is evident because it is this phase which marks the beginning of the project client relationship. A project manager must have the enthusiasm and motivation to kick start the project with the right mind set. If clients start to have expectations beyond what is stated in the contract, then the project manager must be of influencing nature and not give in to all of clients' new demands. The traits of motivation and influence also help in building up strong ties with the sub-contractors and vendors.

Therefore, in the second phase of a project, emotional competencies are more important to build strong client-contractor relationship.

4.4.3 Competencies in Phase-3 (project set up phase)

During this phase everything needed to execute a project is arranged. This phase is very vital particularly for a lumpsum project because this is where the resource distribution is planned. It is this phase that the ground work for the project is laid out. In case of lumpsum project, it needs to be precise to the last detail. Often small errors in this phase may pose as serious threats in the phases to follow. Competencies relevant to this phase are depicted in figure 12.

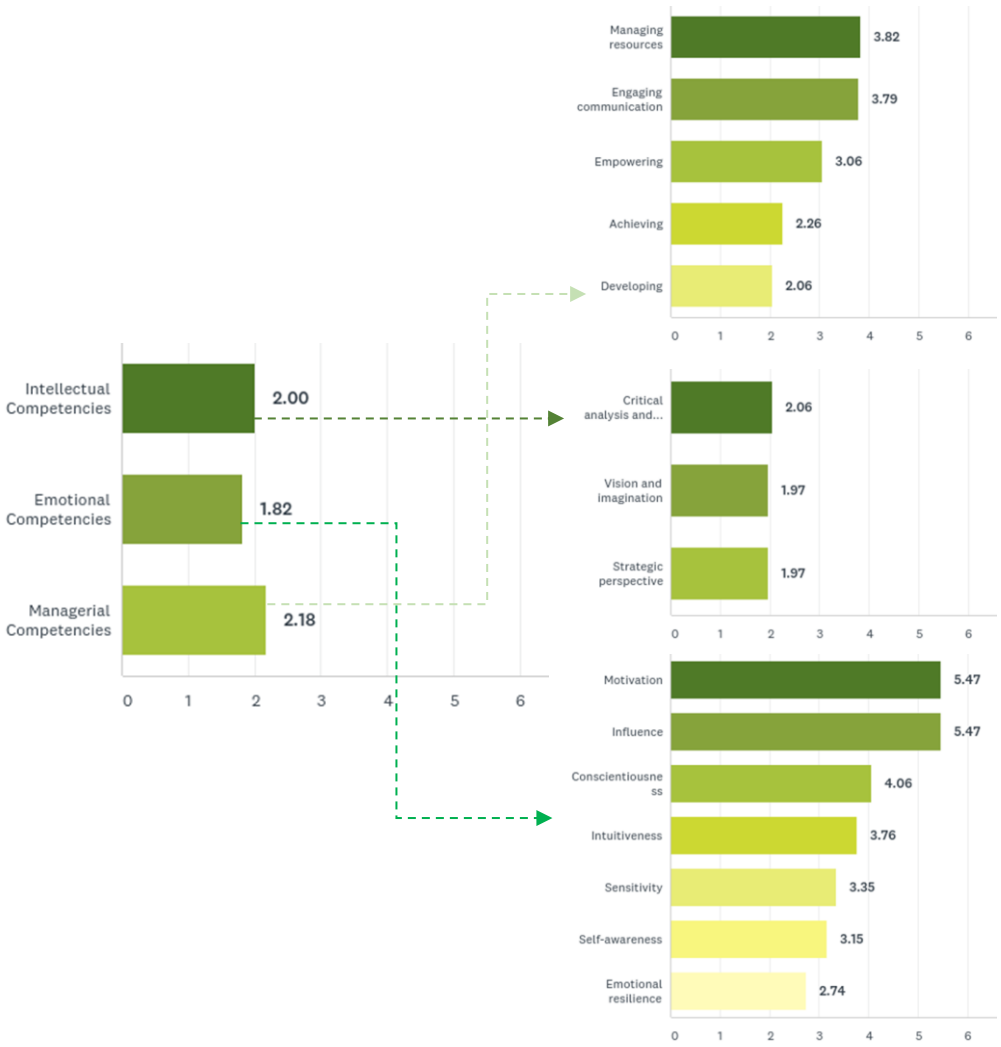


Fig 12: Competency ranks in phase 3

In the project set up phase, managerial competencies are needed the most followed by intellectual competencies, and then emotional competencies. This phase is all about delegation of resources and task forces that justifies the result of the survey. This is the phase when potential subcontractors and suppliers are brought in, schedules are made (planning and control personnel are finalized), the equipment and resources ordered and many other tasks to set up the project are carried out. These tasks require a manager who is skilled at managing resources. One must also excel in communication skills, since there is a lot of interface management.

Therefore, in the third phase of a project, managerial competencies are more relevant to build the right foundation for the project.

4.4.4 Competencies in Phase-4 (execution phase)

Execution phase is when all the plans are realized, often months and years pass by before a project reaches this phase. Though this phase is the longest and many crucial decisions are made in this phase, a lot of its success depends on the level of the project manager's competence. The figure 13 represents the order of competencies specific to the execution phase.

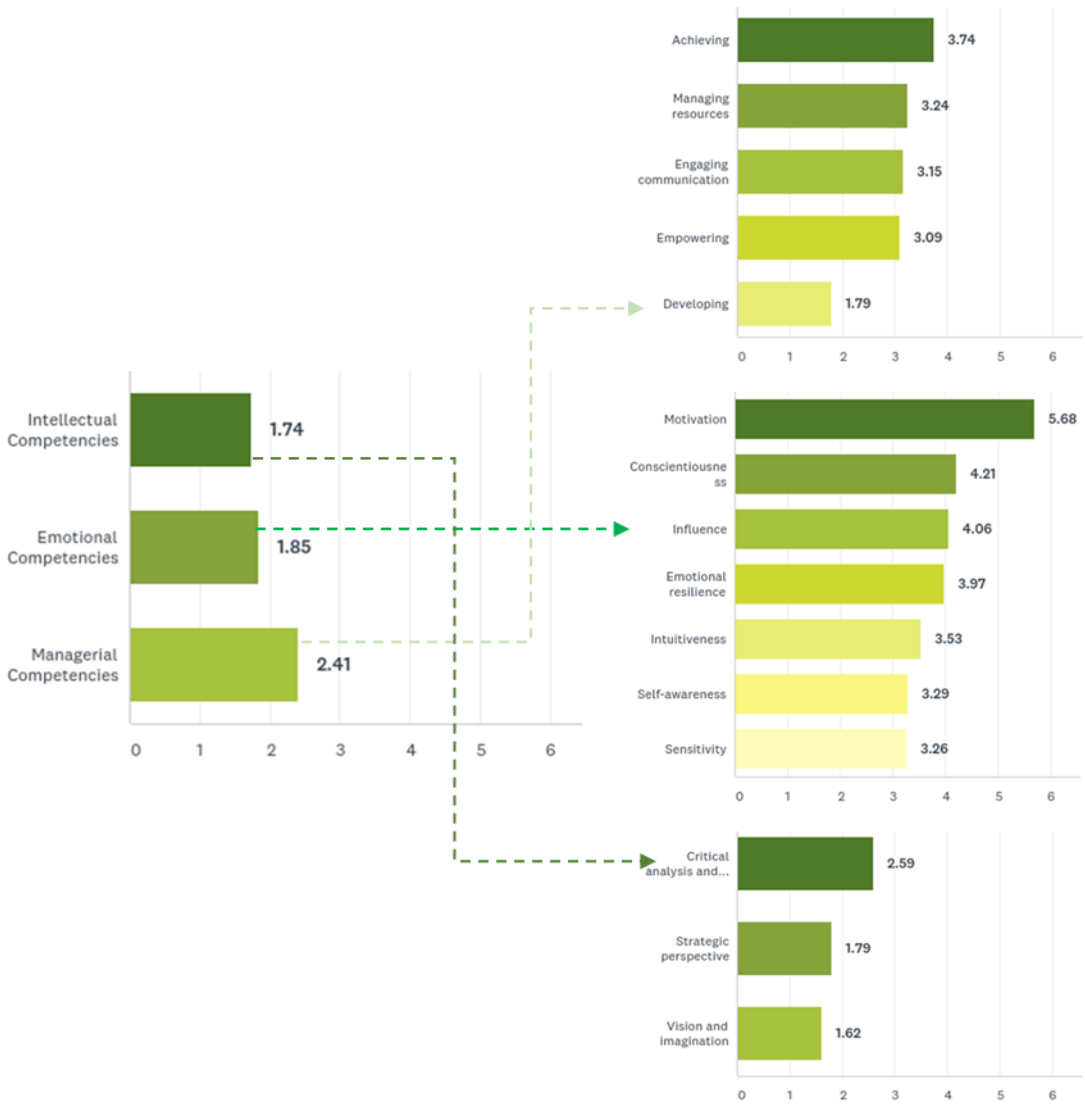


Fig 13: Competency ranks in phase 4

In execution phase one must try to accomplish all the activities planned in the project set up phase in line with the conditions agreed upon in the contract. All of it must be realized within the constraints of the set cost limits, because in a lump sum contract cost over runs are at the expense of contractors. Therefore, a project manager must excel in resource managing and must have a zeal for achieving. It is believed that at FLUOR in the next five years nearly 80% of the projects will be lump sum projects. Hence, project managers must be sufficiently competent to handle lump sum contract.

In the execution phase, managerial competencies take the front seat and steer the course of the project. Particularly one must be focus on achieving the set goals and managing the resources wisely.

4.4.5 Competencies in Phase-5 (close out phase)

Close out phase is when all the deliverables laid out in the contract are completed. A successful close out is very important in terms of finances. 77% of the projects experience some form of schedule overrun, more time means more costs. In case of lump sum, these delays are at the expense of a contractor, hence careful selection of project managers is a key as they are the link between the management and the task force. The relevant competencies for this face are summarized in figure 14.

Fig 14: Competency ranks in phase 5

A close out phase is as important as the set-up phase, the same interfaces are expected. Therefore, one must excel in engaging communication. To keep all the stakeholders satisfied a project manager must have apt communication skills. Often clients demand new work (not mentioned in the contract) and don't abide by the rules of change order and expect it to be paid by the contractor, to avoid such situation clear line of communication is the key. Managing resources is also a key skill at this stage, because it is now that all the payments are made and received.

4.4.6 Overview

A detailed overview of the list of competencies in each phase can be found below.

PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
Critical analysis & Judgment	Motivation	Managing resources	Achieving	Achieving
Strategic perspective	Influence	Engaging communication	Managing resources	Managing resources
Vision and imagination	Conscientiousness	Empowering	Engaging communication	Engaging communication
Engaging communication	Sensitivity	Achieving	Empowering	Empowering
Achieving	Intuitiveness	Developing	Developing	Developing
Managing resources	Self-awareness	Critical analysis & Judgment	Motivation	Critical analysis & Judgment
Empowering	Emotional resilience	Vision and imagination	Conscientiousness	Strategic perspective
Developing	Engaging communication	Strategic perspective	Influence	Vision and imagination
Influence	Managing resources	Self-awareness	Emotional resilience	Conscientiousness
Motivation	Empowering	Emotional resilience	Intuitiveness	Motivation
Emotional resilience	Achieving	Motivation	Self-awareness	Influence
Intuitiveness	Developing	Sensitivity	Sensitivity	Emotional resilience
Conscientiousness	Strategic perspective	Influence	Critical analysis & Judgment	Sensitivity
Sensitivity	Vision and imagination	Intuitiveness	Strategic perspective	Self-awareness
Self-awareness	Critical analysis & Judgment	Conscientiousness	Vision and imagination	Intuitiveness

Table 4 – Cometencies across all the phases

Table-4 has all the competencies in order of priority through all the phases. The green shaded ones are intellectual competencies, while the red shaded ones are managerial competencies, and the ochre shaded ones are emotional competencies.

4.5 Conclusion

It can be safely concluded that in different phases of a project, diffent kinds of competencies play vital roles. In phase- 1 it is the intellectual competencies, because all the ground work needs to be strong. In phase-2 when it comes to major stakeholder management emotional competencies are a key. Phase-3 and phase-5 i.e set up and close out have order of competencies.

When it comes to phase-3,4, and 5 though the most relevant kind of competency are the same but the specific competency needed to execute a lum sum project are different. In case of phase-3 and 5 (set up and close out) managing resources is of highest importance while in phase-4 (execution) Achieving has the highest score.

Phase-1 Proposal Phase	Phase-2 Project kick-off	Phase-3 Project set-up	Phase-4 Execution	Phase-5 Close out
Intellectual competencies	Emotional competencies	Managerial competencies	Managerial competencies	Managerial competencies
Managerial competencies	Managerial competencies	Intellectual competencies	Emotional competencies	Intellectual competencies
Emotional competencies	Intellectual competencies	Emotional competencies	Intellectual competencies	Emotional competencies

Table 5 – Categories of competencies phase wise

The metric data for the above conclusion is as follows: the row is the ranking number and column are the competency categories. Rank 1 has a score of 3, rank 2 has a score of 2, rank 3 has a score of 1. For instance, consider phase one, intellectual competencies, 31 have ranked it no.1 (31x3=91), 6 have ranked it no. 2 (6x2=12), 3 have ranked it no.3 (3x1), therefore a total of 40 respondents have scored it 2.7, ($\frac{91+12+3}{40} = 2.7$). Similarly scores for all the competencies across different phases are calculated.

Phase 1:

It can be observed that the difference in intellectual and managerial competencies is much larger than emotional and managerial competencies, 0.95 as opposed to 0.2. Therefore, intellectual competencies in phase one are far more important than the rest.

	1	2	3	TOTAL	SCORE
Intellectual Competencies	77.50% 31	15.00% 6	7.50% 3	40	2.70
Emotional Competencies	10.00% 4	35.00% 14	55.00% 22	40	1.55
Managerial Competencies	12.50% 5	50.00% 20	37.50% 15	40	1.75

Table 6 – Competency categories in phase 1

Phase 2:

The difference of scores is more or less the same, this proves that there was a mix of opinions and no clear front runner.

	1	2	3	TOTAL	SCORE
Intellectual Competencies	29.41% 10	20.59% 7	50.00% 17	34	1.79
Emotional Competencies	41.18% 14	41.18% 14	17.65% 6	34	2.24
Managerial Competencies	29.41% 10	38.24% 13	32.35% 11	34	1.97

Table 7 – Competency categories in phase 2

Phase 3:
The difference of scores is more or less the same, this proves that there was a mix of opinions and no clear front runner.

	1	2	3	TOTAL	SCORE
Intellectual Competencies	35.29% 12	29.41% 10	35.29% 12	34	2.00
Emotional Competencies	23.53% 8	35.29% 12	41.18% 14	34	1.82
Managerial Competencies	41.18% 14	35.29% 12	23.53% 8	34	2.18

Table 8 – Competency categories in phase 3

Phase 4:
In phase 4, managerial competencies are relatively more important, Since the deviation between managerial and emotional competencies is twice the difference intellectual and emotional competencies.

	1	2	3	TOTAL	SCORE
Intellectual Competencies	23.53% 8	26.47% 9	50.00% 17	34	1.74
Emotional Competencies	11.76% 4	61.76% 21	26.47% 9	34	1.85
Managerial Competencies	64.71% 22	11.76% 4	23.53% 8	34	2.41

Table 9 – Competency categories in phase 4

Phase 5:
In phase 5, managerial competencies are far more important with a deviation of 0.62, while emotional and intellectual competencies do not have a large difference in their score.

	1	2	3	TOTAL	SCORE
Intellectual Competencies	26.47% 9	35.29% 12	38.24% 13	34	1.88
Emotional Competencies	11.76% 4	38.24% 13	50.00% 17	34	1.62
Managerial Competencies	61.76% 21	26.47% 9	11.76% 4	34	2.50

Table 10 – Competency categories in phase 5

Hence, while hiring new project managers or appointing project managers along with other decision factors, the competency need must be considered. Every project manager has different strengths and weakness. Therefore, to harness the maximum potential of a project manager, the appointing personnel must wisely make decisions and always remember that the competency of a leader is very crucial for the team performance.

Competencies are not traits by birth, hence they can be learnt or practised. With the right kind of training and support from the office management project managers capable of handling lump sum projects can be nurtured. The details of these will be explained in recommendations.

5.Relationship between competencies, lump sum contract and project success (interviews)

5.1 Introduction

Competencies needed to execute a specific contract type may be different, the aim of this section is to identify the difference in the competencies to execute a cost reimbursable contract and a lumpsum contract. The hypothesis "*the crucial competencies required to execute a lumpsum contract differ from that of a cost reimbursable contract"* and *"If a project manager lacks certain competencies, then the project success will be affected in a respective manner"* will be addressed in this chapter. The expected results will be based on interviews. Three viewpoints will be considered namely, project directors (people responsible for appointing project managers), project managers, and team leads. The combined results as well as their discrete views will be studied in order to identify competencies specific to contract types.

The competencies needed to execute a lumpsum project will be identified. The key performance indicators that are affected by the lack of competencies will be identified This inference will be based on the data collected through interviews. This chapter elaborates on the interview design, the analysis method, the analysis, leading to identification of the set of competencies and finally the conclusion, i.e. relevant for the competency-based matrix model for lump sum contract.

5.2 Interview design

The interviews were conducted at FLUOR, Amsterdam. The aim of the interview was to help identify the set of competencies relevant to lumpsum contract. In order to understand lumpsum contract, one must also study cost reimbursable, understanding the difference in competencies for both the contract type will lead to a better comprehension of the competencies of lumpsum contract. The interview design includes the explanation of the interview process, and a bit about the interviewee. The interview protocol and questionnaire can be found in the appendix A and B respectively.

5.2.1 Interview procedure

Lump sum contract and competencies were studied in detail as stated in the theoretical framework. Although separately a lot of research has been done on lump sum contracts and competencies, but competencies for lump sum contract is seldomly studied. There is a research paper by turner on competencies that states that level of all competencies required to execute a lump sum project is high, there is no prioritization of those competencies. Hence this research focusses on identifying that ordered list, with the help of knowledge from the experienced, through interviews.

Project success is a very broad subject which could have varied meanings to different people. Hence, narrowing it down to few selected performance indicators is a tricky job. The set must encompass most of the success criteria. Initially the questions relating to project success was open ended question "What effect will a particular competency have on project success?". During the exploratory interview it was analysed that it was a very open-ended question and people's answers were restricted to time and cost.

After extensive literature study a questionnaire was prepared. An exploratory interview was conducted to validate the questionnaire. A total of nine interviews were scheduled, out of which one interview was for questionnaire validation. With every interviewee a short introduction meeting was scheduled to introduce the research topic. This was done a week in advance to the main interview.

In many cases Interviews are a means to obtain qualitative data, but in this particular case the interview was of a mixed approach. There were questions which helped get qualitative data, but also there were sorting and checklist methods to obtain quantitative data, it was later analysed through frequency charts software. The results of which will be presented in the following parts of this chapter.

5.2.2 Interview respondents

The selection of interview respondents is crucial, because the data obtained from these people steers the research. For this research three kinds of staff members were chosen. First the Project directors who are responsible for appointing the project managers to different projects, second, the project managers themselves, and third the team leads who are responsible for implementing the strategies chosen by their project managers. This ensured that the data collected will have knowledge from a broader span of personnel. It will also help in having perspective of three different levels. For this purpose, three different questionnaires were prepared.

It was a closed interview. All the respondents agreed for the conversation to be recorded in order to make the analysis of the interview data easier.

5.3 Analysis method for competencies and contract type

For the qualitative questions the analysis was done with the help of tables and scorecards. Since the number of interviews were eight and there were few qualitative questions, analysis with the help of tables and score cards were adequate.

The analysis of the sorting data was then translated into an excel format which was then analysed in through bar graphs to understand the frequency better.

5.4 Analysis of the results

The aim of the analysis was to identify the competencies needed to execute a lumpsum contract and to find out if the competencies needed a execute a lumpsum contract is different from that of a cost reimbursable contract. Hence the analysis of the result has two main sub parts, competencies for cost reimbursable and competencies for lump sum.

5.4.1 Competencies and cost reimbursable contract

The competencies needed to execute a cost reimbursable contract can be explained in the following table.

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment					1	2	5
Vision and imagination				1	2	2	3
Strategic perspective					1	3	4
Engaging communication					1	3	4
Managing resources			1	1	2	2	2
Empowering				1	2	1	4
Developing			1	2	3	1	1
Achieving					3	2	3
Self-awareness			1	1		5	1
Emotional resilience			1	1	3	2	1
Motivation				1	3	1	3
Sensitivity		1		1	3	1	2
Influence				2		3	3
Intuitiveness	1			1	2	3	1
Conscientiousness		2				5	1

Table 11 – Competencies and cost reimbursable contract

The above table explains, the frequency that the effect of competencies mentioned with respect to cost reimbursable projects. It sums up all the responses of al the eight interviews. Numbers in every row add up to eight. For example, five of the interviewees felt critical analysis and judgement was strongly affects the course of a cost reimbursable project. The data is represented in a bar graph for a quick understanding.

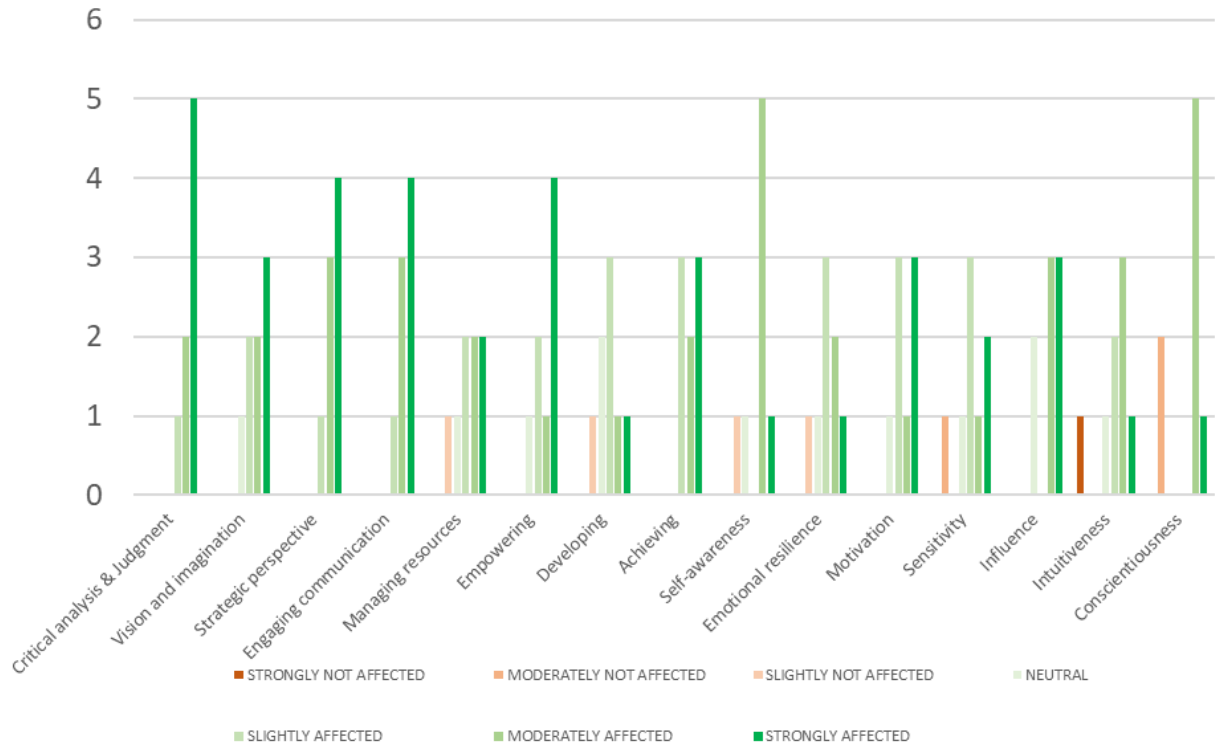


Fig 15: Competency and cost reimbursable contract

It can be observed that majority of them feel critical analysis and judgement, strategic perspective, engaging communication, and empowering are the competencies that strongly affect the success of a cost-reimbursable contract. Self-awareness and conscientiousness are moderately affected in a cost-reimbursable contract.

Fig 16 represents only the strongly affected competencies. The X axis represents the competencies and Y axis represent the number of respondents (project directors, project managers, and team leads). As stated above critical analysis and judgement, strategic perspective, engaging communication, and empowering are the competencies that strongly affected.

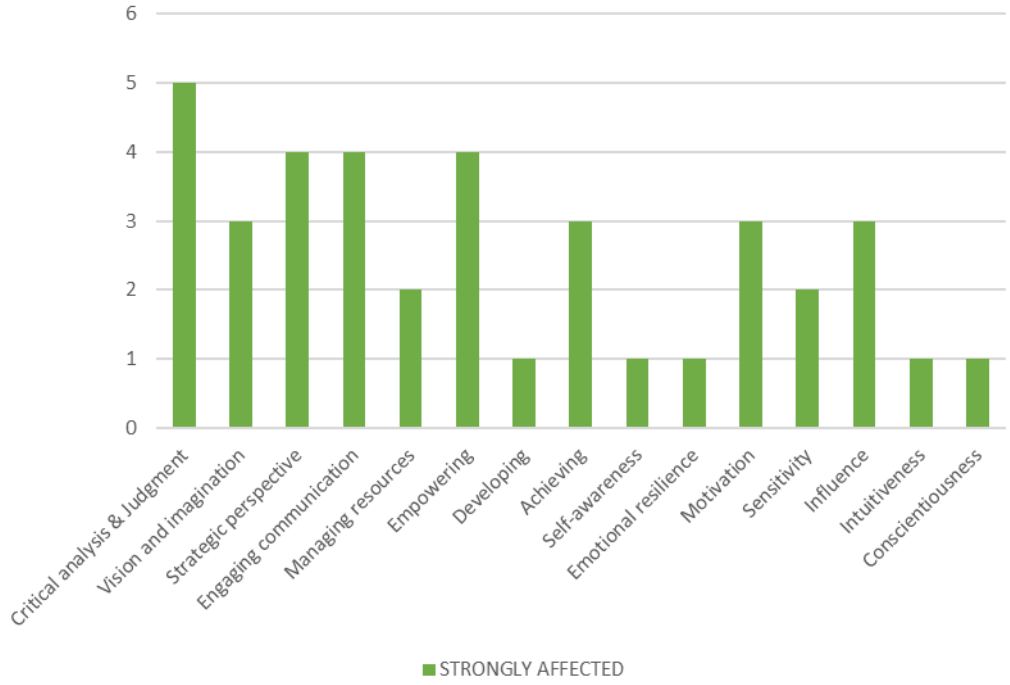


Fig 16: Strongly affected competency and cost reimbursable contract

A brief theory about the important competencies crucial to cost reimbursable (identified in the survey) is given below. The reason it's not a part of the literature review is because this information on what competencies should be studied in detail is based to the results of the survey and it's a step after the survey.

Critical analysis and judgement:

Critical thinking requires a wide range of skills and attitudes. Conventionally project management focusses on efficiency, project time, project costs, and operational performance. They do not suffice in today's competitive and dynamic world (Eisenhardt & Brown, 1998). Ever increasing complexities in a project add to the dynamics. Hence, competency tests in an organisation become very essential. Currently the focus of project managers is merely on getting the job done, instead they should also focus on creating competitive advantage and winning in the market place. (Shenhar, 2004). In order to achieve this, an organisation must pay more attention to the traits of a project manager and their skilfulness in communication. This will also improve the outcome of projects and help the industry to grow in a bigger picture.

Engaging Communication:

Engaging communication is one of the key competencies to carry out a cost reimbursable project. Communication is an important managerial competency that influences project success (Rezvani, Chang, Wiewiora, & Ashkanasy, 2016). Communicating with people is a fundamental part of leadership. The awareness of leadership styles and characteristics and their implementation will help project managers solve communication problems. A project manager must gauge the project requirement, the setting, etc. and adapt a style that is specific to the circumstances (Zulch, 2014).

An ancient example of a situation where communication was an essential skill is presented below. Philip of Macedon almost lost his country, when asked to name his most daunting enemy, he named Demosthenes (384-322BC), an orator and communicator in the Athenian court. Demosthenes received two pieces of advice as a young man; speak with positive intent and prepare your body for effective communication (Oschadleus, 2010). This demonstrates the importance of effective communication.

It is believed that a key coordinator is a must to build an effective line of communication (Miners, 1969). This person must have the authority and must be capable of taking the necessary steps towards the implementation of strategies in all stages of a project be it at the development stage or execution stages. More often than not the project manager is the single point of responsibility for a project. In order to prosper, a project manager must be able to perform a variety of roles and many of these simultaneously (Mabelo, 2011). Project managers who lack such skills are a "common cause of project failure" (Hauptfleisch & Sigle, 2004). Often such causes do not end up in project reports, because they are not quantifiable and are overlooked when auditing. In conclusion, a project manager must possess adequate leadership skills along with management ability (Zulch, 2014). Oral communication is one of the main methods of communication and it is a good practice to record oral communication (Emmitt & Gorse, 2003). A project team must work together (collaborate), share, gather and integrate information and knowledge to realise a project with lesser roadblocks and achieve better results. A better way to achieve effective communication is delegating responsibilities and not just tasks, this will create a sense of ownership towards the job within an employer and aid the project managers to also develop a sense of trust and achievement within the teams (Zulch, 2014).

For instance, in construction management a project manager's method of power accumulation may involve building expert power by focussing on cultivating a reputation as an expert. Along with individual skills, one must have people's skills and communication skills in order to create new sources of power such as information access and credible relationships. Often empowerment approach coupled with good skills of building networks yields accomplished projects. The team must be aware that increased participation and greater power sharing results in greater responsibilities to think bigger and manage better (Newcombe, 1996)

Empowering:

In recent times empowerment or power equalisation is defined as "the delegation of authority and the increased involvement of lower-level employees in the control and distribution of resources (Warner, 1986). Empowering also helps achieve a greater level of democracy and participation in modern-day organisations (Peters, 1987) (Kanter R. , 1992). This will enable a team to have a greater sense of ownership and once the tasks are complete a sense of pride and achievement. It is believed that the only way to run successful organisations with profitable projects in the present and the future is by ensuring that all the teams are given the power decision making in their own rights. This power distribution should be democratic (Kanter R. , 1989). Managers can help the team by conducting training sessions to improve the skills of personal mastery and self-determination (Newcombe, 1996) (Gareth & Gareth, 1994)

5.4.2 Competencies and Lump sum contract

The competencies needed to execute a lump sum contract can be explained in the following table. This is the representation of data from all the interviews at FLUOR.

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment						4	4
Vision and imagination				1	3	2	2
Strategic perspective					2	3	3
Engaging communication					2	2	4
Managing resources			1	1	3	2	1
Empowering				1	4	1	2
Developing			1	3	3	1	
Achieving					2	2	4
Self-awareness			1	1		5	1
Emotional resilience				1	4	2	1
Motivation				1	2	2	3
Sensitivity		1		2	2	1	2
Influence	1			1	1	3	3
Intuitiveness		1			1	4	2
Conscientiousness					1	5	2

Table 12 – Competencies and lump sum contract

The above table represents diverse views about competencies and the levels (strongly affected, moderately affected, slightly affected, etc.) at which each of the competencies effect the execution of a lump sum project.

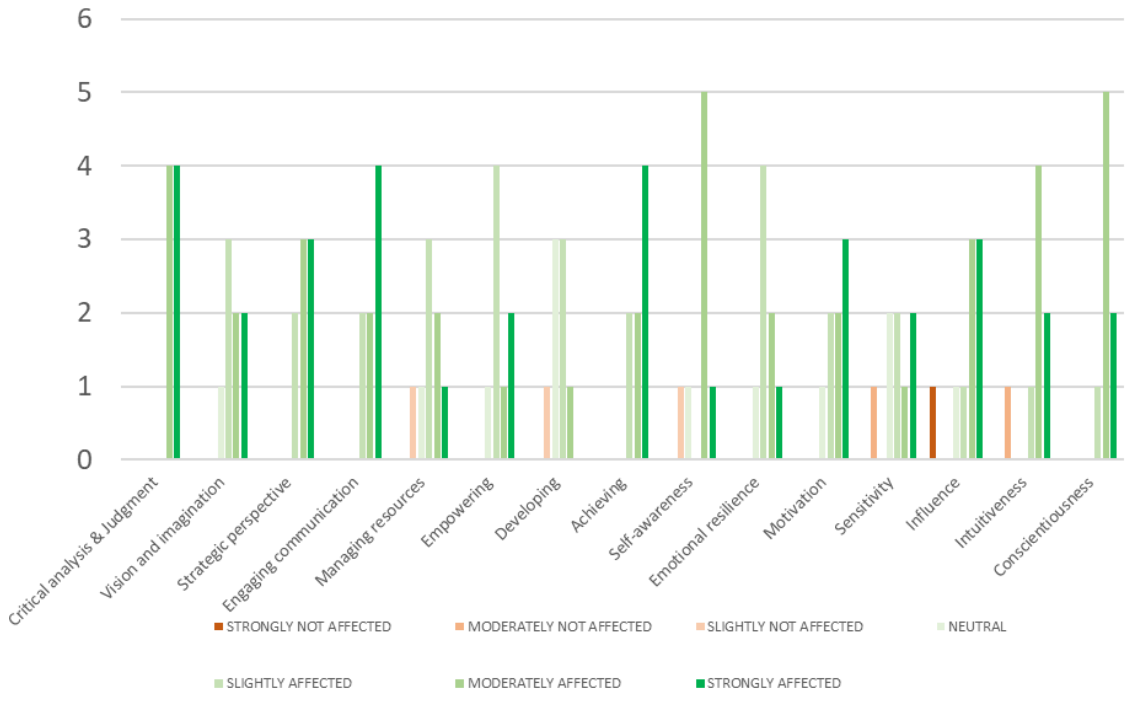


Fig -17: Competency and lumpsum contract

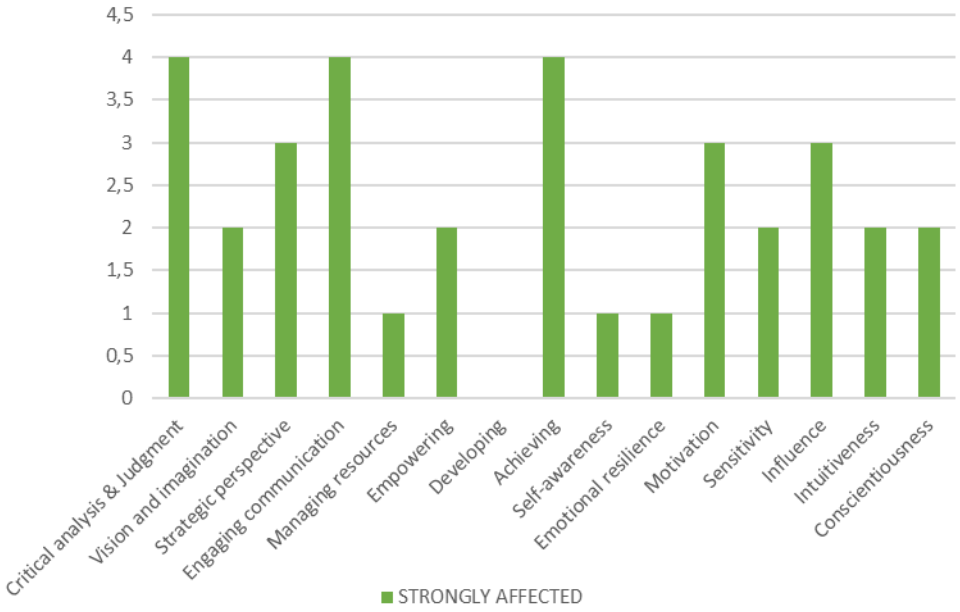


Fig 18: Strongly affected competencies and lumpsum contract

During the survey, when project managers were asked "Should the approach while executing a lump sum contract be the same as the approach towards a cost reimbursable contract?". Binomial test is often done in case of a yes or no questions.

60% of the respondents believed that, yes, the approach towards executing a lumpsum project should be same as the approach towards cost reimbursable contract.

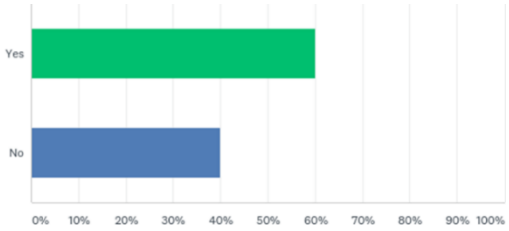


Fig 19: Binomial test in case of a lump sum contract

A concise explanation about the crucial competencies to execute a lumpsum contract is given below. This will aid in better understanding of the competencies required by project managers to execute a lump sum contract. The competencies identified through survey.

Critical thinking:

Critical thinking is a cognitive activity, associated with using mind. To think in critically analytical and evaluative ways one must use mental processes such as attention, categorisation, selection and judgment. Critical thinking is not about natural traits or personality, it involves a certain set of methods aimed at exploring evidence in a particular way (Cottrell, 2017). According to Cottrell, critical thinking requires a wide range of skills and attitudes, which are as follows:

- Recognise other's situations, opinions and deductions.
- Be open to alternative opinions and solutions and be just in doing so.
- One must know the difference between in correct and un fair assumptions. One must look beyond obvious and read between the lines.
- One must be structured, logical, and base decisions on factual evidence or create conclusions based on sound judgements and assumptions if any.
- Not only should he be good at forming opinions but must also convey them to others in order to have more tangible results.

Engaging communication:
One of the inherent elements of leadership is engaging communication. A successful project manager has to carryout numerous roles of different kinds simultaneously. Often project managers who lack skills are a "common cause of project failure" (Mabelo, 2011). A successful project manager requires leadership skills along with management abilities. Communication refers to "the provision of an appropriate network and necessary data to all key actors in the project (Pinto & Slevin, 1989). This influences the level of communication of project managers with external and internal stakeholders.

Often implementation of strategies, making crucial decisions require strong communication skills. Therefore, a project manager must not only himself have sound communication skills but also ensure that his team is equipped with it as well (Zulch, 2014). Often a project manager is involved in speaking frequently in public, hold frequent meetings and sending out statements that motivate and provide guidance to all the employees and by doing so improves communication effectively (Zulch, 2014). This will also motivate the teams to better their communication skills.

Achieving:
Achieving is a very crucial competency for lump sum project. Targets are set in the beginning and the aim is to achieve all of them, if not as much as possible. This is the competency that sets apart from the cost reimbursable contract. In a lump sum project, the zeal to achieve must be in every member on the project. The vision of the project must be shared at a regular basis. Intermittent achievements must be rewarded. If a team has delivered a part of work within time, cost, and ensured safety of all, then appreciation will keep the team motivated and will inspire other teams to achieve the same.
The Goal Question Metric (GQM) approach adopted by NASA to find defects in projects can be adopted by construction industry. It is based on the assumption that for a project to be successful, it must specify the goals at the beginning of a project. The underlying data that defines these goals must also be identified. This will ensure that the organisation has all the data needed, if not then measures can be taken upfront in the beginning of the project (Basili, Caldiera, Dieter, & Dieter, 1994). This model has three level, it is represented in Fig-20, they are as follows:

1. **Conceptual level (GOAL**): There are various reasons to define a goal for an object. These vary in terms of quality and environment. Often Goals are measured in terms of products, processes or resources.

2. **Operational level (QUESTION):** The way goals are assessed or achieved depends on the set of questions. These questions describe the goals (product, process, resource) in terms of quality from a specific perspective.

3. **Quantitative level (METRIC):** Metric is the data underpinning every question so that it can be measured quantitatively. It could be objective or subjective.

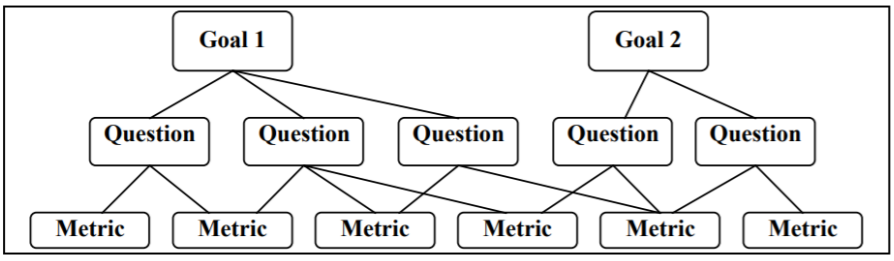


Fig 20: GQM approach

5.5 Analysis of competencies and contract type with respect to different view points

5.5.1 Project Director's (PD) perspective:

Project directors are of the opinion that the approach in terms of competency towards both the contract types is different. Having said that they also believe that in cost reimbursable projects one should still spend the client's money as wise as possible. However, all the decisions are made by the clients. And this guides all the commercial decisions made at the organisation. Whereas in lump sum environment you need to have individuals capable of making all the decisions themselves. In order to achieve this, you need to train your team to make all the decisions from cost perspective and not merely from the service perspective.

Cost reimbursable contract and competencies (PD)

Competencies and their impact on cost reimbursable projects can be seen in fig 21. The x-axis represents the competencies and the horizontal line shows the weighted average scores. According to project directors, strategic perspective is the most important competency to execute a cost-reimbursable contract. In this type of contract people are expected to make right judgements to spend money wisely.

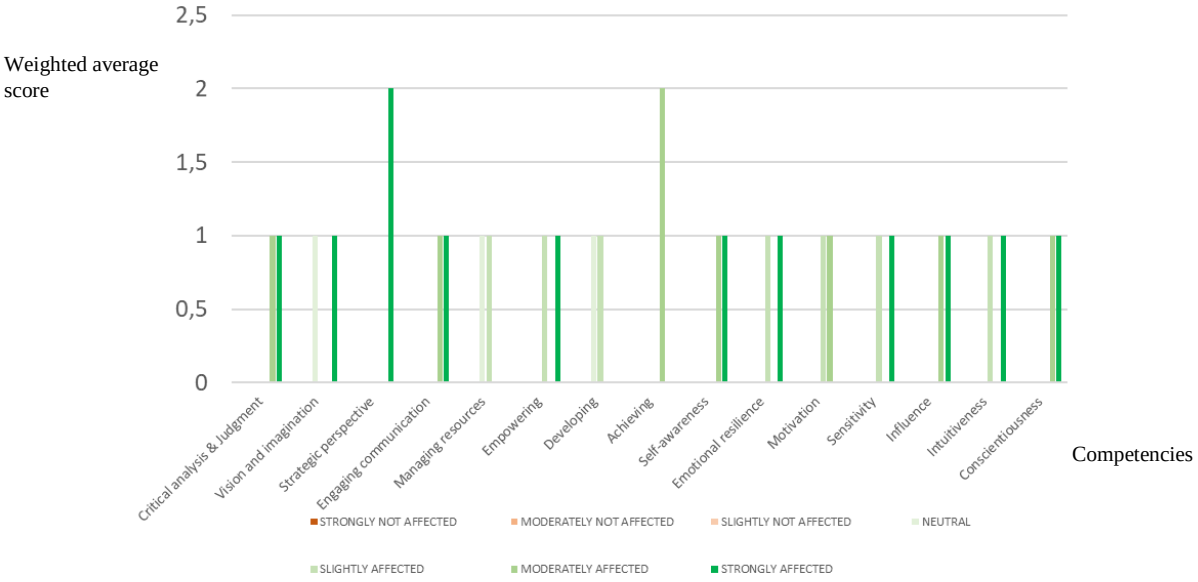


Fig 21: Competency and cost reimbursable contract (PD)

Lumpsum contract and competencies (PD)

Competencies and their impact on lump sum projects can be seen in fig 22. Intuitiveness is the most important competency to execute a lump sum project. How you make the best decision in the given circumstances is the main trick in handling a lumpsum contract.

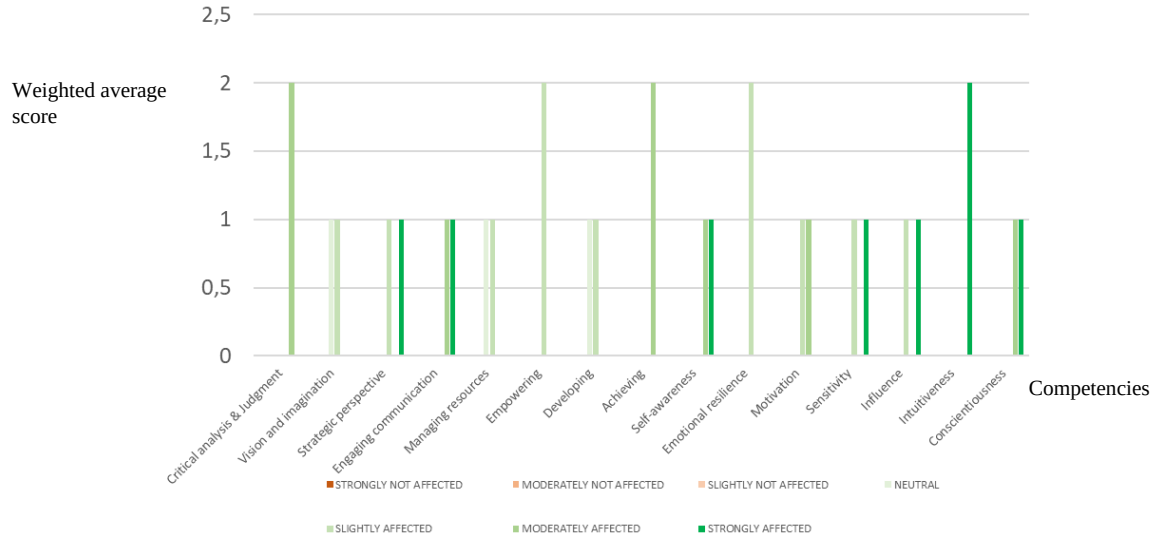


Fig 22: Competency and lumpsum contract (PD)

5.5.2 Project Manager's (PM) perspective:

Project Managers are of the opinion that there are specific competencies for successful execution of projects of both the contract types. Often different teams work on proposals and execution of a project. According to project manager's the team doing the proposal must be executing the project for more successful results. For that the teams must be competent and skilled to do so. One must be able to conceptually, ask questions to self like "What am I trying to do? How might I present this thing? How might I execute it?" at the beginning stages of a project.

Cost reimbursable contract and competencies (PM)

Competencies and their effect on cost reimbursable projects can be seen in fig 23. Managing resources is of utmost importance. The resources are available it's the skill to manage them that sets apart the winning team.

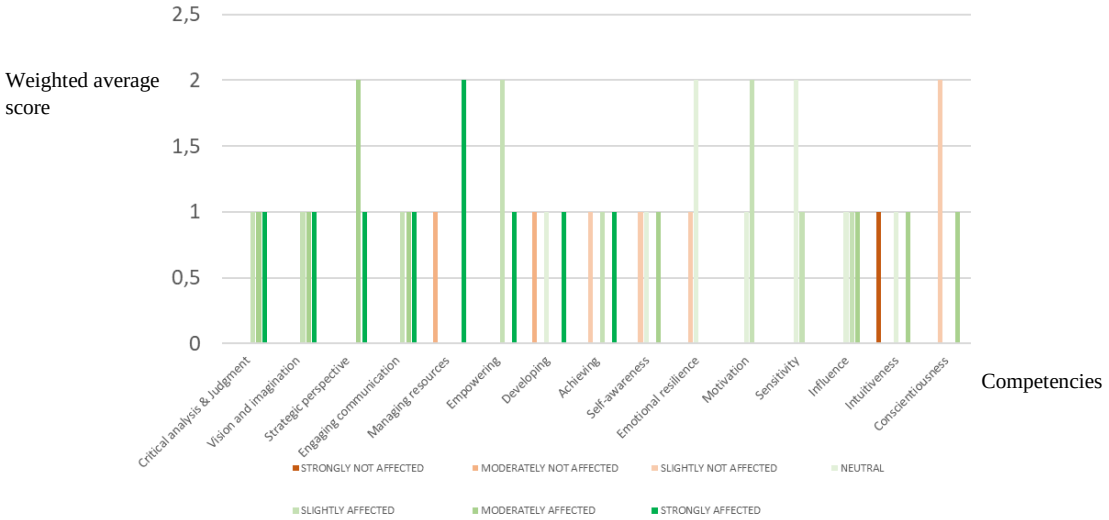


Fig 23: Competency and cost reimbursable contract (PM)

Lumpsum contract and competencies (PM)

Competencies and their impact on cost reimbursable projects can be seen in fig 24. In lump sum projects the biggest advantage is that there is a potential to have larger profits. If we look at the size of the project with a lump sum contract, the size doesn't change the requirement of competency. But for a bigger project the required level of excellency in the competency may be higher. Achieving is the most crucial competency according to the project managers.

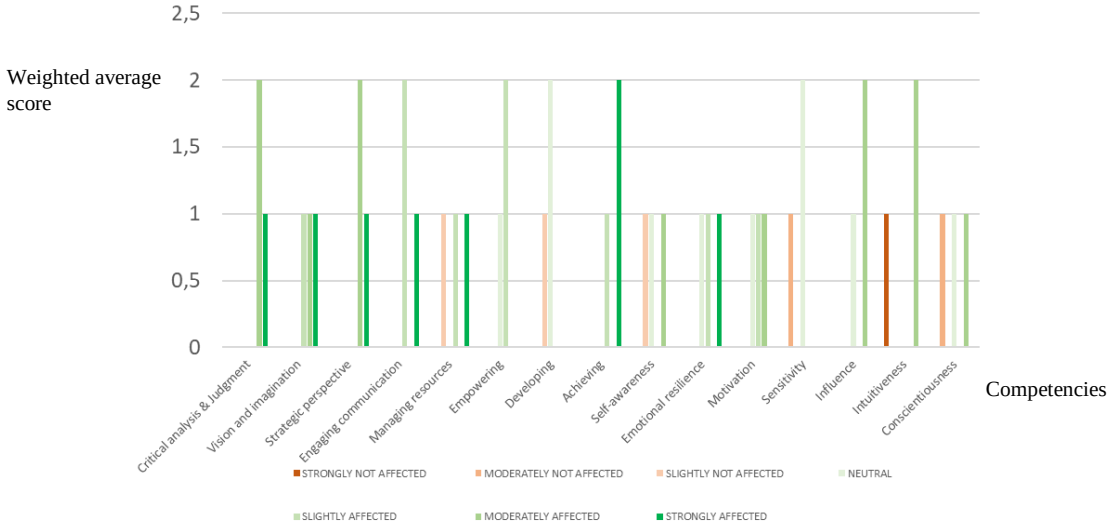


Fig 24: Competency and lumpsum contract (PM)

5.5.3 Team lead's (TL) perspective:

Team leads did believe that competency does play a vital role in a project's success. But according to them the important competencies needed to execute a cost reimbursable contract and a lump sum project are the same. All the competencies and their importance levels can be found in the figure 25.

Contract type and competencies (TL)

According to the team leads the most important competencies are critical analysis and motivation. They were of the volume opinion that, a person should be able to look back at a completed project as a period where they enjoyed working and feel proud on what they did. This often requires a level of motivation during the project phase in order to keep the team together and all the strategies intact.

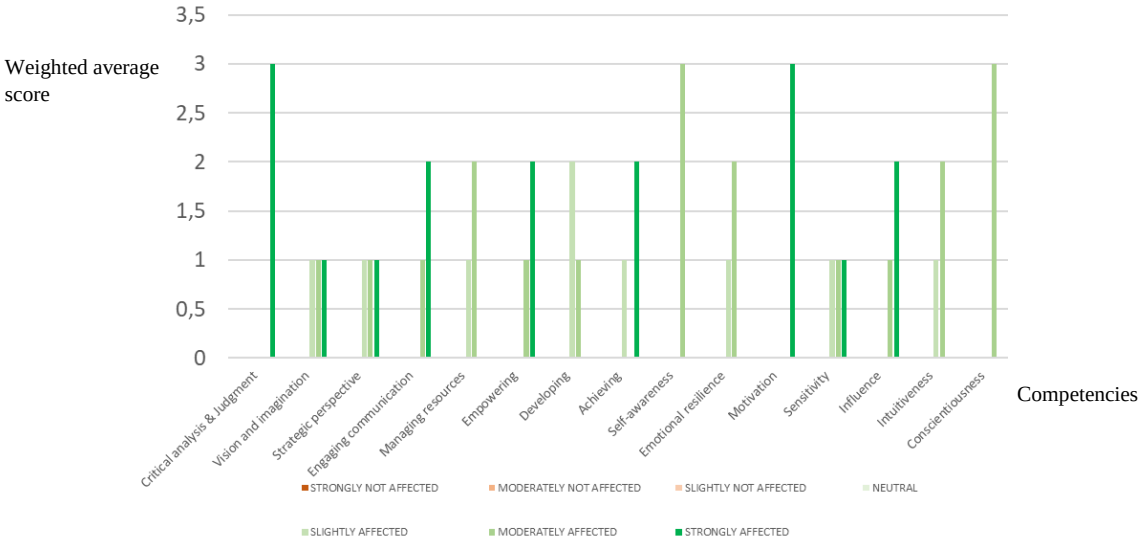


Fig 25: Competency and lumpsum & cost reimbursable contract (TL)

5.6 Conclusion

According to the results of the interviews it is evident that critical analysis & judgement and engaging communication are indispensable to both the type of contracts.

The competencies that set them apart are what will make the difference. While vision & imagination and empowering are what is essential to cost reimbursable on the other hand it is the zest for achieving that ensures success in case of lump sum contract. Therefore, project managers with higher scores on the competency achieving are better suited to execute a lumpsum contract. The framework is modified based on the results of the survey and is represented in fig 26 and 27.

Often Achieving and motivation are used together but there is a slight difference separating the two. Achieving is the zeal to reach the desired objective by effort or skills. Where as motivation is finding a reason to do something. In case of lump sum project, the contract type itself is a reason to be more vigilant. Achieving is therefore one of the most important competencies needed to execute a lump sum project.

In a cost reimbursable contract, four competencies play a major role as shown in the fig 26.

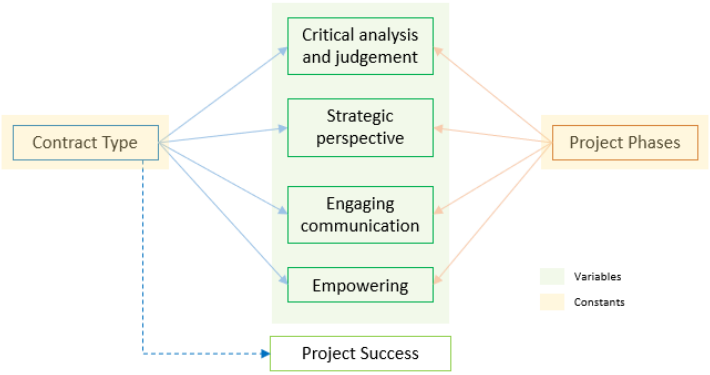


Fig 26: Competency and cost reimbursable contract

In a lump sum contract, three competencies are vital to ensure project success, it is presented in fig 27.

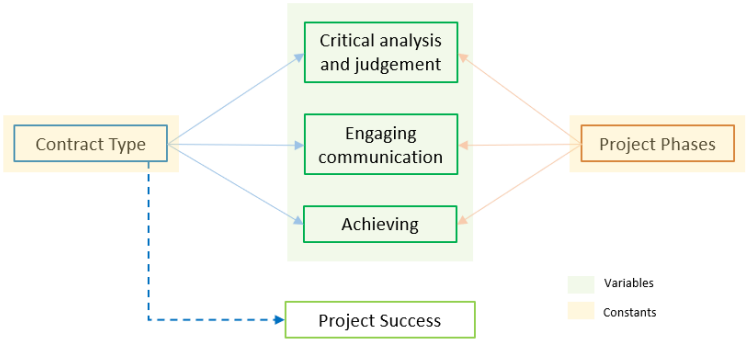


Fig 27: Competency and lumpsum contract

5.7 Data Analysis for relation between competencies and project success

The data for this section was gathered during the interviews. The q-sort aided in identifying the competencies specific to lump sum contract. This was followed by another exercise to identify the effect of these competencies on project success indicators. The interviews had to tick the project performance indicators (boxes) affected by the most crucial competencies identified in their q-sort analysis. Only the competencies with highest scores were chosen for the following step. An example of a checklist can be found in appendix I.

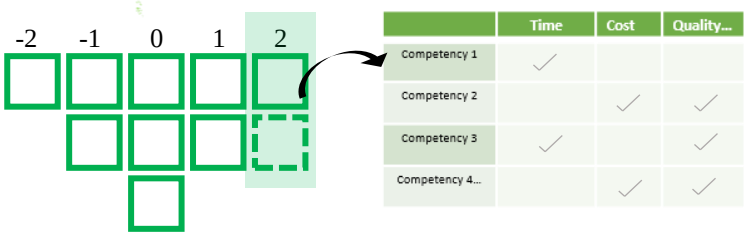


Fig 27: Competency and lumpsum contract

5.7.1 Competencies and project performance indicators

The results and combined opinions of all the interviewees can be found in table-13. In table-13, multiple performance indicators are affected by each identified competency. Also, weightage is provided to understand the magnitude of effect a competency can have on project performance. As a result, several insights can be established.

The competencies are listed along the rows and the performance indicators along the column. The number indicates the frequency of respondents that identify a relationship between the two. For example, 7 members felt if a project manager lacked critical analysis and judgement, it will affect cost parameter the maximum. Each competency affects a certain Performance indicator.

	MICRO VIEW POINT					MACRO VIEW POINT			
	TIME	COST	QUALITY	PERFOR-MANCE	SAFETY	TIME	SATISF-ACTION	UTILITY	OPERATI-ON
Critical analysis & Judgment	4	7	5	3	1	4	3	3	3
Vision and imagination	2	2		2	2	2	2		1
Strategic perspective	3	3		3	2	4	2		2
Engaging communication	3	4	3	4	4	1	3	1	3
Managing resources			1	1	1				
Empowering	2	2	2	3	1		1	1	
Developing									
Achieving	5	4	2	4	2	5	1	2	2
Self-awareness			2	1			1		
Emotional resilience		1	1	2			3		
Motivation	3	3	4	3	3	2	3	2	1
Sensitivity	1	1	1			1	2		
Influence	3	3	2	3	2		1		
Intuitiveness	2	2		1	1	3	1		2
Conscientiousness				1					1

Table 13 – Competencies and project performance indicators

5.8 Conclusion

The table 13 shows the effect lack of competencies have on project success. Below are the three competencies that are most essential for lumpsum contract, based on the analysis in chapter 6.

- Critical analysis & judgement affects the **cost** the maximum, followed by **quality and time**. All at the micro view point except time that is at macro and micro level.
- Engaging communication affects **cost, performance, and safety**. All at the macro view point.
- Achieving affects the **time** (both and micro and macro level), **performance and cost** (micro level).

often each project has a set of main drivers, then while choosing a project manager, one must consider if he has the competencies that affect the performance indicators (success factors)

6. Competency based model and framework for Project Managers

6.1 Introduction

All the information and data obtained in chapter 4 and 5 will be utilised to make a framework based on competencies. The framework is similar to a score card. This can be used while designating project managers to respective projects. It will be followed by addition of competencies to the leadership model based on the competencies necessary to execute a lumpsum contract.

The research is mainly focussed on competencies needed to execute a lumpsum contract through the different phases of a project. After an intensive study which included a survey, and interviews with project managers at FLUOR, B.V Amsterdam, A framework was deduced based on the results and conclusions of the research. It is based on competencies of a project and phases of a project. It is proposed in section 6.2. In section 6.3 additional competencies are added in an existing framework on competencies and lump sum contract, following which additions to the leadership model which is a matrix of competency categories and leadership levels are made, the crucial competencies identified throughout the research process are included. It ends with a conclusion of this chapter.

6.2 Framework based on competencies and phases of a project

The framework is a matrix of phases of a project versus competencies. It is like a scoring checklist of competencies for project managers. The top eight competencies in each of the phases are used in the making of this matrix. In each of the phases, the exact eight competencies in the order of importance are listed in table-14.

PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
Critical analysis & Judgment	Motivation	Managing resources	Achieving	Achieving
Strategic perspective	Influence	Engaging communication	Managing resources	Managing resources
Vision and imagination	Conscientiousness	Empowering	Engaging communication	Engaging communication
Engaging communication	Sensitivity	Achieving	Empowering	Empowering
Achieving	Intuitiveness	Developing	Developing	Developing
Managing resources	Self-awareness	Critical analysis & Judgment	Motivation	Critical analysis & Judgment
Empowering	Emotional resilience	Vision and imagination	Conscientiousness	Strategic perspective
Developing	Engaging communication	Strategic perspective	Influence	Vision and imagination

Table 14 – Competencies and lump sum contract (the first eight, of table-4)

The aim of using this framework is to identify project managers who are best suited for a particular phase. This tool could be a part of assessing the project managers based on their competencies and appropriately appoint them to projects. This could be a fraction of deciding factor. The appointing directors can consider the competency profiles and not just conventional aspects like availability and previous track record. For instance, a particular project may have a very challenging or complex design phase, then managers who are relatively better competent for this phase can precede over other project managers.

The framework is designed in a way that the top most competency is scored the highest i.e. 40 followed by 30 for the second competency, and so on until 5 which is one of the least important (eighth) competencies. Each phase is scored rank wise. This will ensure the scoring of the competency is proportionate to the ranking of the competency in that specific phase. In each phase a project manager can score a maximum of 180. The grand total is out of 900 which includes all the phases of a project. These scores can aid the project directors in appointing their project managers to their suitable projects. This will also help while recruiting new personnel.

The procedure is a two-step process, first the raw data must be obtained followed by filling up of the scorecard using the obtained data. An empty score card is shown in the table 15. The gathering of data can be done with the help of an external agency. Often the competencies that these agencies choose are based on the positions and are seldom custom made to the industry specification or for that matter as specific as lumpsum contract. Hence, a combined effort from the experts in the field and humanities (specifically human behaviour) department would yield better results. This thesis is an initial step towards achieving better results for competency tests.

Often the questionnaire for such tests include opinion and hypothetical situations, as in "what would you do if…", the data collecting could be more proactive, for instance interactive workshops could be organised. More factual than situational scenarios should be presented while deducing the competency profiles.

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Critical analysis & Judgment	40		15		15
Vision and imagination	30		10		5
Strategic perspective	35		5		10
Engaging communication	25	5	35	30	30
Managing resources	15		40	35	35
Empowering	10		30	25	25
Developing	5		20	20	20
Achieving	20		25	40	40
Self-awareness		15			
Emotional resilience		10			
Motivation		40		15	
Sensitivity		25			
Influence		35		5	
Intuitiveness		20			
Conscientiousness		30		10	
Total score	180	180	180	180	180
OVERALL SCORE				900	

Table 15 – Scoring card for competency and phases of a lump sum project

The reason for choosing top eight of the competencies out of the fifteen is to focus on the more important competencies and have more diverse range of competencies for comparison of different phases. In the table-15 it can be observed that in phase one, three and five intellectual and managerial competencies

are more vital. In phase two it's all emotional competencies with an extra competency of engaging communication, In phase four it's a mix of managerial and emotional competencies.

If ranking professionals at work place is derogatory, then this could be done by the top management team and the results of which would be confidential or individual results shared with the respective personnel. Sharing it with the individuals is necessary in order to help them reflect upon their strengths and weakness. This exercise might help them get better results at work and eventually help in successful execution of projects specifically lumpsum contract.

The list can be replicated in offices with similar industries that are project based. But it can also be tailored to the specific working style and needs of the company. Within FLUOR, this research was carried out at energy and chemical division that does engineering, procurement, and construction. The results could have been different had it been the infrastructure division within FLUOR. The list may also vary for a different EPC which deals with energy and chemical sector. Hence, the results are unique, but the procedure could be standardized.

6.3 Framework based on competencies and lumpsum contract

Completing a Lumpsum project requires competent project managers. All the project teams must work like a well-oiled machine, in cohesion. More than often it requires ample amount of soft skills, than one could have thought. It's not just the technical knowledge but also these extra managerial, intellectual, and emotional skills that are very useful in planning, execution, and delivery of projects.

The table-16 indicates the existing and additional (red) competencies for a lumpsum contract at two levels, one at the team level and the other at the level of a lead. The results of this research helped in addition of competencies at the level of leads. The competencies are categorized into operational, interpersonal, personal, and conceptual strength. The underlined competencies are the ones that are not included in the leadership model for FLUOR.B. V Amsterdam provided by an external agency.

LS EPC Competence	Operational strength	Interpersonal strength	Personal strength	Conceptual strength
TEAM	• Performing under pressure • Planning • Result oriented	• Cooperation • Listening skills • Social skills	• Drive • Initiative • Stress resistance	• Analysing and forming opinions • Creative • Innovative
Extra for LEADS Project Mgmt. Commercial Engineering	• Decisiveness • Delegating • Directing	• Creating support • Motivating • Persuasiveness • Teambuilding • Engaging communication	• Commercial drive • Entrepreneurship • Sensitivity • Motivation • Influence	• Situational awareness • Strategic insight • Achieving

Table 16 – Framework for competency and lump sum contract

In total six competencies have been added to the existing framework. Engaging communication is added to the list of Operational strength. Intuitiveness, conscientiousness, and self-awareness are added under

personal strength. Achieving is added to the list of conceptual strength. Critical analysis and judgement are the only competency that was found in the results of this research which was already a part of the existing framework, though named as analysing and forming opinions. These minor changes in the list of competencies may have comparably higher impact on the results.

In the subsequent section 6.4, the details of these six competencies will be elaborated. Moreover, they will also form a part of a matrix model, which will have the separate leadership levels.

6.4 Leadership model

Project Leadership level	Operational strength	Interpersonal strength	Personal strength	Conceptual strength	Thinking level
Senior Leadership	Directing	Creating support	Persuasiveness Influence	Strategic insight Critical analysis & judgement	Academic
Advanced Leadership	Delegating Structuring	Teambuilding Engaging communication	Assertiveness Strategic perspective	Helicopter view Achieving	Professional
Pre-leadership	Decisiveness	Providing feedback	Drive Motivation	Analysing and forming opinions	
Motivation	Realisation Efficiency	Cooperation Respect	Responsibility Success	Analysing	

Table 17 – Leadership model including competencies for lump sum contract

Six competencies are added to the existing leadership model. They are namely, engaging communication, intuitiveness, conscientiousness, self-awareness, critical analysis & judgement, and achieving. It is based on the results obtained.

FLUOR does have a certain set of competencies defined in their leadership model. This was conducted by HFM consultancy. In consultation with them, it was agreed that the competencies could be a part of this model, because both the sets of competencies are based on leadership qualities. The research initially had fifteen competencies, six of which are added to the leadership model. These six are the competencies necessary to execute a lump sum contract.

Engaging communication is added in the interpersonal strength, which is crucial to any project. All the teams must be adequately and timely informed of all the changes that are done, in order to prevent extra work or rework, which could have been avoided in the first place. This is very critical to a lump sum project. Intuitiveness, conscientiousness, self-awareness is added personal strengths.

This will serve as guideline to make sure that a project team consists of project managers that have a diverse range of competencies. Changes to the team composition can be made based on these competency requirements. This will also ensure a fresh perspective on the existing situation.

7. Discussion and Reflection

7.1 Discussion

This section mainly describes the academic quality of the work carried out during the research.

Projects face grave problems like insufficient engineering, business leadership, improper quantification etc. Often when a technical issue arises, deep down the reason for it will most probably have a soft skill involved. For example, omission of quantities in a contract, i.e. improper quantification but the core reason is lack of communication. A project involves so many sectors within it like civil, mechanical, electrical, etc. that interface management becomes very scrutinizing. Hence, project managers must be well prepared and be able to hone the skills of the entire team in the correct direction to achieve the desired results.

In order to understand lumpsum contract, comparisons were made with respect to cost reimbursable contract. The reason for choosing cost-reimbursable for comparison is that, both of them are in most ways on the opposite ends. For instance, in case of cost reimbursable contract the client reimburses the bills while in lump sum a fixed amount is paid to the contractor, hence a contractor must be more vigilant. 60% of project managers say, “one must treat client’s money as his own” and hence the competencies should be the same for both lump sum contract and cost reimbursable contract. This is more of an idealistic situation. While the other 40% of the project managers feel that approach towards lump sum project should be different in comparison with cost reimbursable projects. From an economic point of view, this is more realistic because when there are greater risks, the project managers must be suitably competent and better prepared. This will ensure better odds of project success

There have been many studies on competencies of a project manager for decades now. Project success and key performance indicators have also been studied widely. There is very little or no research on competencies for lumpsum contract. This research is a continuation of a study by turner on competencies, the results of the previous study are in the table-18. A part of this research included the competencies and their effect on contract type. It categorizes the competencies into high, medium, and low category. The details of which can be seen in table-18. One can observe that for lumpsum contract all the competencies score high except for intuitiveness. Hence, it was decided to research on competencies, lump sum contract, and project success in a deeper sense.

n		Application type			Contract type		
		Engineering & construction	Information & telecommunication technology	Organizational change	Fixed price	Remeasurement	Alliance
		19	89	65	56	41	12
IQ	Critical thinking	High	High	High	High	High	High
	Vision	Low	Medium	High	High	Low	Medium
	Strategic perspective	Medium	High	High	High	Low	Low
MQ	Managing resources	Medium	High	High	High	High	High
	Communication	Medium	High	High	High	Medium	High
	Empowering	Low	High	High	High	Medium	Medium
	Developing	High	High	Medium	High	High	Low
	Achieving	Medium	High	Medium	High	Low	High
EQ	Self awareness	Medium	High	High	High	High	High
	Emotional resilience	Low	High	High	High	High	Medium
	Intuitiveness	Low	Medium	Medium	Medium	Medium	Low
	Sensitivity	Medium	High	High	High	High	High
	Influence	High	High	High	High	High	High
	Motivation	High	High	High	High	High	High
	Conscientiousness	High	High	High	High	High	High

Table 18 – Competency level for contract type (same as table-3, put here for comparison)

Identifying the most important competencies for project managers needed to execute a lump sum contract will help FLUOR B.V, Amsterdam in better allotment of project managers to various projects, help in their hiring process, identify the areas that need to be developed and provide suitable training to the personnel.

To the scientific field, a new aspect of the competency studies will be investigated. The effects of these competencies on project success will be identified. Accordingly, the most significant competencies needed for each of the performance indicators vary. This leads to three main areas of focus, competencies, lump sum contract, and project success. Various articles on competencies were studied, the details of which can be found in the chapter 3.

To encompass all these topics, my research question was as follows:

"What are the critical competencies of a project manager needed at different phases of a lumpsum project to ensure project success?"

In line with the research question, the following research hypothesis were made:

Hypothesis 1: *At different stages of a project, the competencies needed by a project manager are different.*
This hypothesis is researched with the help of a survey, subsequently the competencies required in different phases of a project were identified and a prioritized list was formulated. The sub question formulated to identify with this hypothesis is "what are the competencies needed in different phases of a project?"
To answer this question. A survey was sent to project managers, at three locations of FLUOR, Amsterdam, Farnborough, and New Delhi. It is an opinion study. Results of forty respondents were analysed. The conclusions are discussed in the following chapter.

Hypothesis 2: *The crucial competencies required to execute a lumpsum contract differ from that of a cost reimbursable contract*
This hypothesis is researched with the help of the data gathered through interviews. A Q-Sort was performed independently for cost reimbursable and lump sum contract, and the resulting competencies were analysed. The sub question formulated to reach at conclusions for this hypothesis is "what are the competencies specific to lump sum contract?"
To find answers to this, nine interviews were conducted. The interviews of two project directors (who appoint project managers), three managers, three team leads were analysed. The analysis was done using frequency charts and data tables. The end result was a list of competencies, that will be further studied with respect to project success.

Hypothesis 3: *If a project manager lacks certain competencies, then the project success will be affected in a respective manner.*
This hypothesis is researched with the help of interviews. Competencies affecting a set of chosen key performance indicators were identified. For example, if a project manager does not a have a "x" competency, then performance indicators "a", "b", etc. are affected. The sub question framed to answer this hypothesis is What key performance indicators are affected by the competencies?
The data for research was collected from interviews, just like in the case of hypothesis 2. Each competency had effects on certain set of performance indicators, the project performance indicators were chosen at macro and micro level.

In addition to all the above questions, another question was answered, "Identify the competencies of a project manager described in literature and phases of a project?", this forms the basis for all the remaining sub questions and is answered through literature study.

7.2 Reflection

The research was conducted at FLUOR B.V., Amsterdam. It is one of the world's largest engineering, procurement, fabrication, construction and maintenance (EPFCM) companies. Specifically, the research was carried out at energy and chemical sectors. It is responsible of construction of oil rigs, and chemical plants, refineries, etc. The research process can be replicated by identifying a new prioritized order of competencies for another particular company and the framework can be cloned.

This research can be translated to other companies, by using the same survey and interview questionnaire, make changes if necessary to suit the company. This will result in a company specific competency list to execute a lump sum contract. This will also aid in understanding the opinion of the company's personnel on the approach towards different contract types (choose the ones that the company uses the most). In this case

The survey resulted in a conclusion that 60% believe that approach towards cost reimbursable and lump sum contract should be the same, indicating that the competencies are also similar. This was confirmed during the interview process, which resulted in five of the nine i.e. 55.5 % believing that the approach should be the same. This school of thought of majority should change in order to see possible changes in project results in terms of success and failure.

The questionnaire forms an integral part of the research; the questions were validated by conducting a mock interview. During this interview it was observed that the question related to competencies and project success was very open ended, therefore a more directed question was formulated.

Given the time frame of seven months at FLUOR B.V., the best of efforts was put to collect data from as many project managers as possible.

I did attempt to answer all the sub questions and the main research question to the maximum extent possible. Given a chance to do it again, I would make the following major corrections:

- I would reduce the scope. Instead of three topics of competencies, lump sum contracts, and phases of project, I would choose competencies and one of the other topics.
- Due to lack of time I could not include the effect of complexities, so I would probably incorporate that.
- I chose mixed methodology of survey and interviews. Given the time frame, probably I would have done more justice, had I picked just one methodology.
- If I had more time, I would study the past projects of each of the interviewees in a little more depth. I do have some knowledge about their past projects and their types, but I wished to have delved a little deeper.

The research can be validated by implementing the framework in explained in chapter 6. Initially FLUOR B.V, can apply it to smaller scale projects.

First step is for project managers to undertake a competency test (HFM consultancy, can aid in this). After that the scores can be used in the scoring card of competencies and lumpsum contract. This will help identify the phases at which the project manager is best at.

Second step is to make changes to the project teams based on these results. Traditionally a project team is fixed and is static. This will make it more dynamic. This will also help have new insights and view of the project. Often projects last for years, this change might not seem as quick as one imagines. Each phase has substantial amount of time to make changes to the project teams. Interfaces must be manged carefully to avoid more damage than good.

Then the results of the project can be monitored through out the project duration and check the validity of the devised framework and scorecard.

8. Conclusion and Recommendation

8.1 Conclusion

The research was conducted to understand the effect of competencies on lump sum project and its success. The discussion chapter outlined the research question and sub questions. The conclusion chapter will present the answer to those questions and results in a concise way.

Muller and Turner performed a categorical study on competencies and different sectors like IT, Construction etc. This research focussed on three of such aspects namely competencies, construction projects and lump sum contract. This was a ranking study.

- **Identify the competencies of a project manager described in literature and phases of a project?**
  A set of 15 competencies were identified for the purpose of study namely, Critical analysis and judgment, vision and imagination, strategic perspective, engaging communication, managing resources, empowering, developing, achieving, self-awareness, emotional resilience, motivation, sensitivity, influence, intuitiveness, conscientiousness. Five stages of project were chosen for the research namely, proposal/final contract negotiation phase, project kick-off phase, project set-up phase, execution phase, and a close out phase.

- **What are the competencies needed in different phases of a lumpsum project?**
  In every phase of a project the functions are very different, hence the roles and responsibilities also vary. In the proposal phase, intellectual competencies are of utmost importance, followed by managerial competencies, and then emotional competencies. Specifically, critical and strategic perspective are crucial. In the project kick-off phase, emotional competencies rank first, followed by managerial competencies, and intellectual competencies. In the project set up phase and project close out the order is the same, i.e. managerial competencies, intellectual competencies, and emotional competencies. Specifically, in project set up phase, managing resources and engaging communication are most needed while in project closeout it is achieving and managing resources. In the execution phase, managerial competencies are decisive followed by emotional competencies and then intellectual competencies.

- **What are the competencies specific to lump sum contract?**
  In case of a lump sum project, the most essential competencies are critical analysis, engaging communication, and achieving. Critical analysis and engaging communication are also crucial for cost reimbursable. Therefore, the real game changer is zeal for achieving. Strategic perspective, motivation, and influence also play a vital role in executing lump sum contracts.

- **What key performance indicators are affected by the competencies?**
  Two viewpoints of project performance indicators are considered, macro view point and micro viewpoint. The effects of crucial competencies of lump sum contract are as follows:
  1. A project manager with good critical analysis and judgement effects cost and quality at macro level, and time at micro and macro level.
  2. Engaging communication is key to project performance, safety, and cost at the macro level.
  3. The competency achieving influences time at micro and macro level and performance and cost at micro level.

The main research question is, ***"What are the critical competencies of a project manager needed at different phases of a lumpsum project to ensure project success?"***

It can be concluded that, in proposal phase (phase 1), Critical analysis and judgement, Strategic perspective, vision and imagination are of the highest priority. In project kick-off phase (phase 2), Motivation, influence, and conscientiousness are very crucial. In project set up phase (phase 3) managing resources, engaging communication, and empowering, are the key competencies. In project execution phase (phase 4) and close out phase (phase 5) the utmost important competencies are achieving, managing resources, and engaging communication. So, making changes in project teams in terms of competencies will affect the project success.
The following deduction can be made based on results from survey and the interviews. In a lumpsum contract the key competencies are achieving, critical analysis and judgement, and engaging communication. Thereby, the most important phases of a lumpsum project are project execution and close out (phase 4 &5), they are the only phases with achieving as an important competency. It is followed by project set up (Phase 3) and then proposal phase (phase 1). The coinciding competencies with lump sum contract competencies are engaging communication and critical analysis and judgement respectively.

An anomaly found in this research is the competency "critical analysis and thinking", according to the survey (based on competencies and phases of a project) in phase 2 (project kick-off phase) and phase 4 (Execution) it was among the bottom three competencies, but in phase 1 (proposal phase) it is one of the most important competencies and in phase 3 (project set up) and phase 5 (project close out) it is the sixth most important competency. The results of the interview studying the competencies and contract type show that critical analysis, Achieving, and engaging communication are the key competencies needed to execute a lumpsum project.

8.2 Recommendation to FLUOR

Achieving is found to be one of the most relevant competencies to lump sum contract. Hence, it is necessary for FLUOR to make the project managers competent to achieve their goals. Often motivation is a precursor for achieving. Hence, the higher management must keep reminding the goals and expected results at intervals of a project for self-evaluation.

Acknowledging success by a project manager will often help others to prove their mettle. This will eventually lift the performance of the whole team.

The competency framework described in chapter 6, can be used to suitably allocate project managers to the relevant projects. It can also be used in hiring of new personnel. The competencies identified in chapter 5, i.e. the ones relevant to lump sum contract can be imbibed through training.

8.3 Recommendation for further research

This research was an initial step towards competency studies targeted at specific requirements of a sector. In this case it was lump sum contract and project phases. Further research can be done as follows:

- The effect of complexities on competencies needed to execute a lump sum project.
  Often projects are also classified based on the complexity levels, so further investigation with respect to project complexities and competencies can be made. The TOE framework could be adopted.
- An in-depth analysis of one of the phases, instead of an overview of all the phases.

Instead of focussing on all the phases, just one phase could be studied in detail. Each phase has many sub divisions, for example project kick off has contractual phase, project scope finalizing phase etc. These sub divisions can be studied with respect to competencies.

- The next step is to see how the identified competencies can be imbibed by a project manager (through education, training, peer reviews, workshops, etc.).
  A continuation of the thesis is to further study the identified competencies. Their characteristics, behavioural patterns of project manager's with and without these competencies. Methods to improve upon the existing levels of competencies are get trained from the beginning, etc. All such methods can be researched upon.

References

Abend, G. (2008). The Meaning of Theory. *Sociological Theory 26*, 173–199.

Ahadzie, D., Proverbs, D., & Sarkodie-Poku, I. (2014). Competencies required of project managers at the design phase of mass house building projects. *International Journal of Project Management 32*, 958-969.

Atkins, S., & Gilbert, G. (2003). The role of induction and training in team effectiveness. *Project Management Journal,34*, 44-52.

Basili, R., Caldiera, V., Dieter, G., & Dieter, R. (1994). *The goal question metric approach, Encyclopedia of Software Engineering 1.*

Bedelian, H. (1996). Successful major projects in a changing industry. *Proceedings of the Institution of Civil Engineers - Civil Engineering*, 117 - 23.

Bedelian, H. (1996). Successful major projects in a changing industry. *Proceedings of the Institution of Civil Engineers: Civil Engineering*, 117 - 123.

Brophy, M., & Kiely, T. (2002). Competencies: a new sector. *Journal of European Industrial Training*, 165-176.

Brophy, M., & Kiely, T. (2002). Competencies: a new sector. *Journal of European Industrial Training, 26*, 165-176.

Brouwer, M. (1999). Q is accounting for tastes. *Journal of Advertising Research*, 35-39.

Brown, S. (1993). A primer on Q methodology. *Operant Subjectivity*, 91-138.

Chan, A., & Chan, A. (2004). Key performance indicators for measuring construction success. *Benchmarking: An International Journal*, 203-221.

Chan, A., Scott, D., & Chan, A. (2004). Factors Affecting the Success of a Construction Project. *Journal of construction engineering and management*, 153-155.

Cheng, M.-I., & Dainty, A. (2005). What makes a good project manager? *Human Resource Management Journal*, 25-37.

Cooper, H. (2010). *Research synthesis and meta-analysis: A step-by-step approach.* California: Sage publication.

Cottrell, S. (2017). *Critical Thinking Skills: Effective Analysis, Argument and Reflection.* London: Macmillan.

Creswell, J. W. (1997). *Research design : qualitative, quantitative, and mixed methods approaches.* California: SAGE Publications.

Dulewicz,V., & Higgs, M. J. (2000). Emotional intelligence: A review and evaluation study. *Journal of Managerial Psychology, 15*, 341-368.

Edum-Fotwe, F., & McCaffer, R. (2000). Developing project management competency: perspectives from the construction industry. *International Journal of Project Management 18*, 111 - 124.

Eisenhardt, K., & Brown, S. (1998). Competing on the edge: Strategy as structured chaos. *Long Range Planning: International Journal of Strategic Management*, 786-789.

Emmitt, S., & Gorse. (2003). *Construction communication.* California: Blackwell Publishing, Oxford.

Exel, J. (2005). *Q methodology: A sneak preview.* Rotterdam.

Fraser, C., & Zarkada. (2003). Investigating the effectiveness of managers through an analysis of stakeholder perceptions. *Journal of Management Development, 22,* 762-783.

Gareth, D., & Gareth, M. (1994). Imaginization: The Art of Creative Management. *Administrative Science Quarterly 39*, 688.

Ginger, D. (2014). *Key competencies for success in navigating compexity.* Project Management Institute, Inc.

Gretton, I. (1993). Striving to succeed in a changing environment. *Professional Manager,* 15-17.

Hartman, F. (1993). *Construction dispute reduction through an improved contracting process in the Canadian context, PhD thesis.* Loughborough.

Hauptfleisch, A., & Sigle, H. (2004). *Structure of the built environment in South Africa, 3rd ed.* Hatfield: CONQS Publishers.

Hayden, B. (1996). Learning on the jagged edge. *Journal of Management in Engineering, ASCE,* 23-25.

Hinzie, J. (1993). *Construction contracts.* New York: McGraw-Hill,.

Kakabadase, A. (1991). *The wealth creators: Top people, top teams, executive best practice.* London: Kogan Page.

Kallet, R. H. (2004). How to Write the Methods Section of a Research Paper. *Respiratory Care 49*, 1229-1232.

Kangari, R. (1988). Business failure in construction industry. *Journal of Construction Engineering and Management, ASCE,* 172-190.

Kanter, R. (1989). *When Giants Learn to Dance: Mastering the Challenges of Strategy, Management, and Careers in the 1990s.* New York: Simon & Schuster.

Kanter, R. (1992). *The Change Masters: Corporate Entrepreneurs at Work.* New York: Routledge.

Kaplanogu, S., & Arditi, D. (2009). Pre-project peer reviews in GMP/lump sum contracts. *Engineering, Construction and Architectural Management, Vol. 16 Issue: 2*, 175-185.

Koolen, E. (n.d.). *COMPETENCIES, ATTRIBUTES AND TRAITS: WHAT'S THE DIFFERENCE?* Retrieved from Ekoolen consulting: https://emilykoolen.com/2016/10/07/competencies-attributes-and-traits-whats-the-difference/

Kvale, S., & Brinkmann, S. (2008). *InterViews: Learning the Craft of Qualitative Research Interviewing.* California: SAGE publications.

Loosemore, M., Dainty, A., & Lingard, H. (2003). *Managing People in Construction.* London: Spon Press.

Mabelo, P. (2011). When things fall apart. *The Project Manager*, 22 - 28.

Marshall, C., & Rossman, G. (2011). *Designing qualitative research.* California: Sage publication.

Mayumi Takey, S., & Monteiro de Carvalho, M. (2015). Competency mapping in project management: An action research study in an engineering company. *International Journal of Project Management 33*, 784-796.

Miners, T. (1969). *Communications and cost control in the building industry with special reference to the role of the Quantity Surveyor.* Pretoria: University of Pretoria.

Muller, R., & Turner, R. (2010). Leadership competency profiles of successful project managers. *International Journal of Project Management 28*, 437-448.

Newcombe, R. (1996). Empowering the construction project team. *International Journal of Project Management Vol. 14, No. 2*, 75-80.

Organizing Your Social Sciences Research Paper: Theoretical Framework. (2019, April 5). Retrieved from USC Libraries Research Guides: https://libguides.usc.edu/writingguide

Oschadleus, J. (2010). *The power of communication*. Retrieved from http://www.theprojectmanager.co.za/index.php/other/the-power-of-communication.html

Peters, T. (1987). *Thriving on Chaos: Handbook for a Management Revolution.* London: Macmillan.

Pinto, J., & Slevin, D. (1989). Critical Success Factors in R&D Projects. *Research-Technology Management, 32:1*, 31-35.

PMBOK. (2004). *A guide to the project management body of knowledge.* Pennsylvania, USA: Project Management Institute, Inc.

PMI. (2004). *Guide to the Project Management Body of Knowledge, third ed.* Newton Square, USA: Project Management Institute.

Rezvani, A., Chang, A., Wiewiora, A., & Ashkanasy, N. (2016). Manager emotional intelligence and project success: The mediating role of job satisfaction and trust. *International Journal of Project Management 34*, 1112 -1122.

Shenhar, A. (2004). Strategic Project Leaderships Toward a strategic approach to project management. *R&D Management*, 569-578.

Smith, N. (2001). *Current systems in psychology: history, theory, research, and applications.* Wadsworth.

Swanson, R. A. (2013). *Theory Building in Applied Disciplines.* San Francisco: CA: Berrett-Koehler Publishers.

Thomas, J., & Mengel, T. (2008). Preparing project managers to deal with complexity – Advanced project management education. *International Journal of Project Management 26*, 304–315.

Toor, S.-u.-R., & Ogunlana, S. (2010). Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. *International Journal of Project Management 28*, 228–236.

Verschuren, P., & Doorewaard, H. (2010). *Designing a Research Project.* The Hague: Eleven International Publishing.

Warner, B. (1986). Leadership as empowering others. *Executive power : [how executives influence people and organizations]*, 51 - 77.

Zaccaro, S., Kemp, C., & Bader, P. (2004). *Leader traits and attributes.* Thousand Oaks, CA: Sage.

Zulch, B. (2014). Leadership Communication in Project Management. *Procedia - Social and Behavioral Sciences 119*, 172 - 181.

Appendix - A – Interview questionnaire

Interview questionnaire – Appointing manager

Date:
Location:

Personal information of the interviewee:

Name:
Background:
Years of experience (Management | Engineering):

Current project:
Recent projects:

The title of my graduation thesis is **'Competencies of a project manager'**

Q1. How differently do you approach a lump sum contract from a cost reimbursable contract?

Q2. "A project manager needs certain competencies to execute a lump sum contract", agree or disagree?

Q3. On what basis do you select project managers for a project?

Q4. Do you consider the competencies while appointing a project manager to a project?

Q5. What competencies do you think a project manager should possess to ensure project success?

Q6. Competencies: Q-Sort based on relevance to cost reimbursable and lump sum contract.

Q7. Reasoning for Q-Sort?

Appendix - B – Interview questionnaire

Interview questionnaire – Project Manager

Date:
Location:

Personal information of the interviewee:

Name:
Background:
Years of experience (Management | Engineering):

Current project:
Recent projects:

The title of my graduation thesis is **'Competencies of a project manager'**

The title of my graduation thesis is **'Competencies of a project manager'**

Q1. Approaches while executing lumpsum and cost reimbursable contract, should it be the same? Why?

- How is a lumpsum contract different from cost reimbursable contract?
- Advantages and disadvantages of a lumpsum contract.

Q2. Do you think competencies of a project manager effect the project success in executing lumpsum contract? If yes, how? If no, why?

- What according to you are the crucial competencies required to execute a lumpsum contract?
- When according to you is the project successful?

Q3. In the past have you executed projects in which the approach and methods to manage the project were different from the rest?

Q4. Competencies: Q-Sort based on relevance to cost reimbursable and lumpsum.

Q5. How do you think the above competencies affect project success?

Appendix - C – Interview questionnaire

Interview questionnaire – Team Lead

Date:
Location:

Personal information of the interviewee:

Name:
Background:
Years of experience (Management | Engineering):

Current project:
Recent projects:

The title of my graduation thesis is **'Competencies of a project manager'**

Q1. Do you have a specific role in all the projects you work for or the scope of your work varies for different projects?

Q2. How differently do you approach a lump sum contract from a cost reimbursable contract? Any past experiences?

Q3. "A project manager needs certain competencies to execute a lump sum contract", agree or disagree?

Q4. What competencies do you think a project manager should possess to ensure project success?

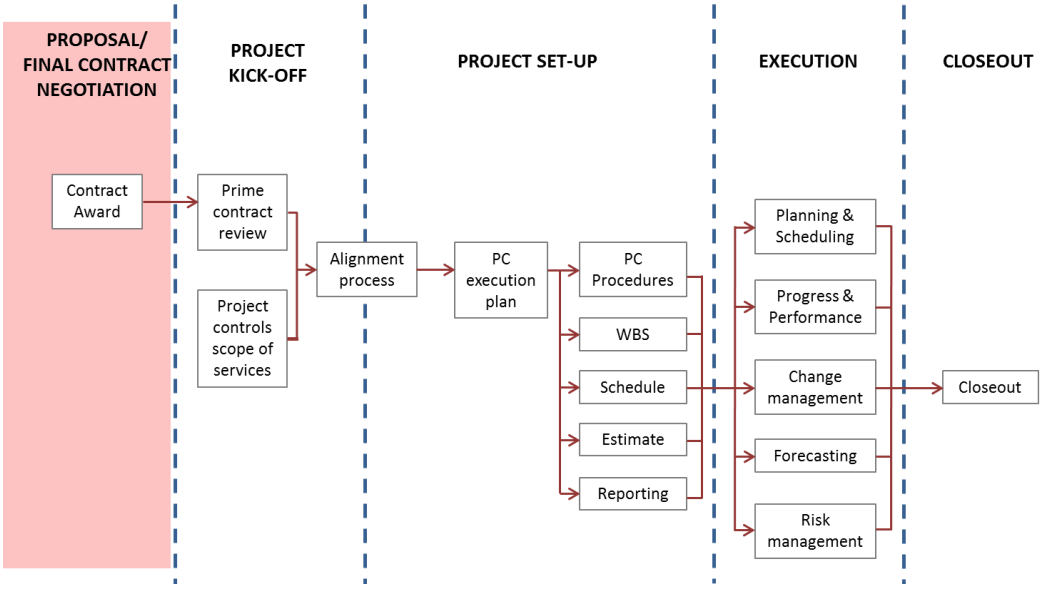
Q5. Competencies: Q-Sort based on relevance to cost reimbursable and lump sum contract.

Q6. Reasoning for Q-Sort?

Appendix - D – Survey questionnaire

Survey Questionnaire:

- **Phase 1 – Proposal/Final contract negotiation:**



1. For a lump sum project Rank the **clusters** of competencies in the order of importance in a **proposal/final contract phase**

CLUSTER	RANK No.
Intellectual Competencies	
Emotional Competencies	
Managerial Competencies	

2. **Intellectual competencies:**
   Rank in the order of importance in **a proposal/final contract phase**

COMPETENCY	RANK No.
Critical analysis and judgement	
Vision and imagination	
Strategic perspective	

3. **Managerial competencies:**
   Rank in the order of importance in a **proposal/final contract phase**

COMPETENCY	RANK No.
Engaging communication	
Managing resources	
Empowering	
Developing	
Achieving	

4. **Emotional competencies:**
   Rank in the order of importance in a **proposal/final contract phase**

COMPETENCY	RANK No.
Self-awareness	
Emotional resilience	
Motivation	
Sensitivity	
Influence	
Intuitiveness	
Conscientiousness	

Note:

- This is repeated for the five phases of a project.
- There are four questions relating to each project phase. The first question is a based on the competency categories giving an overview, i.e. intellectual, emotional, and managerial. The following three questions are ranking questions within each category comprising of a total fifteen competencies, the top eight of which are considered while making a scorecard for competencies and lump sum contract.

Appendix - E – Phase wise data on competencies

Phase 1: Proposal/Final contract negotiation

The order of importance for a lump sum project:

Intellectual competencies:

	1	2	3	TOTAL	SCORE
Vision and imagination	17.50% 7	22.50% 9	60.00% 24	40	1.57
Strategic perspective	40.00% 16	35.00% 14	25.00% 10	40	2.15
Critical analysis and judgement	42.50% 17	42.50% 17	15.00% 6	40	2.27

Managerial competencies:

	1	2	3	4	5	TOTAL	SCORE
Engaging communication	45.00% 18	30.00% 12	17.50% 7	5.00% 2	2.50% 1	40	4.10
Managing resources	5.00% 2	25.00% 10	22.50% 9	20.00% 8	27.50% 11	40	2.60
Empowering	2.50% 1	15.00% 6	30.00% 12	45.00% 18	7.50% 3	40	2.60
Developing	5.00% 2	2.50% 1	12.50% 5	27.50% 11	52.50% 21	40	1.80
Achieving	42.50% 17	27.50% 11	17.50% 7	2.50% 1	10.00% 4	40	3.90

Emotional competencies:

	1	2	3	4	5	6	7	TOTAL	SCORE
Self-awareness	10.00% 4	7.50% 3	7.50% 3	15.00% 6	10.00% 4	20.00% 8	30.00% 12	40	3.13
Emotional resilience	10.00% 4	20.00% 8	15.00% 6	15.00% 6	20.00% 8	10.00% 4	10.00% 4	40	4.15
Motivation	20.00% 8	20.00% 8	15.00% 6	7.50% 3	2.50% 1	32.50% 13	2.50% 1	40	4.40
Sensitivity	5.00% 2	12.50% 5	17.50% 7	12.50% 5	15.00% 6	12.50% 5	25.00% 10	40	3.42
Influence	37.50% 15	12.50% 5	20.00% 8	15.00% 6	10.00% 4	2.50% 1	2.50% 1	40	5.35
Intuitiveness	2.50% 1	20.00% 8	10.00% 4	25.00% 10	22.50% 9	7.50% 3	12.50% 5	40	3.83
Conscientiousness	15.00% 6	7.50% 3	15.00% 6	10.00% 4	20.00% 8	15.00% 6	17.50% 7	40	3.73

Phase 2: Project kick-off

The order of importance for a lump sum project:

Intellectual competencies:

	1	2	3	TOTAL	SCORE
Critical analysis and judgement	26.47% 9	17.65% 6	55.88% 19	34	1.71
Vision and imagination	38.24% 13	32.35% 11	29.41% 10	34	2.09
Strategic perspective	35.29% 12	50.00% 17	14.71% 5	34	2.21

Managerial competencies:

	1	2	3	4	5	TOTAL	SCORE
Engaging communication	58.82% 20	26.47% 9	8.82% 3	2.94% 1	2.94% 1	34	4.35
Managing resources	14.71% 5	35.29% 12	29.41% 10	5.88% 2	14.71% 5	34	3.29
Empowering	5.88% 2	26.47% 9	41.18% 14	26.47% 9	0.00% 0	34	3.12
Developing	2.94% 1	5.88% 2	14.71% 5	20.59% 7	55.88% 19	34	1.79
Achieving	17.65% 6	5.88% 2	5.88% 2	44.12% 15	26.47% 9	34	2.44

Emotional competencies:

	1	2	3	4	5	6	7	TOTAL	SCORE
Self-awareness	14.71% 5	8.82% 3	5.88% 2	8.82% 3	11.76% 4	14.71% 5	35.29% 12	34	3.21
Emotional resilience	2.94% 1	5.88% 2	8.82% 3	20.59% 7	11.76% 4	32.35% 11	17.65% 6	34	3.00
Motivation	44.12% 15	26.47% 9	11.76% 4	8.82% 3	5.88% 2	2.94% 1	0.00% 0	34	5.85
Sensitivity	2.94% 1	14.71% 5	5.88% 2	17.65% 6	26.47% 9	23.53% 8	8.82% 3	34	3.44
Influence	20.59% 7	14.71% 5	38.24% 13	8.82% 3	5.88% 2	2.94% 1	8.82% 3	34	4.91
Intuitiveness	0.00% 0	14.71% 5	8.82% 3	14.71% 5	32.35% 11	14.71% 5	14.71% 5	34	3.32
Conscientiousness	14.71% 5	14.71% 5	20.59% 7	20.59% 7	5.88% 2	8.82% 3	14.71% 5	34	4.26

Phase 3: Project set-up

The order of importance for a lump sum project:

Intellectual competencies:

	1	2	3	TOTAL	SCORE
Critical analysis and judgement	41.18% 14	23.53% 8	35.29% 12	34	2.06
Vision and imagination	29.41% 10	38.24% 13	32.35% 11	34	1.97
Strategic perspective	29.41% 10	38.24% 13	32.35% 11	34	1.97

Managerial competencies:

	1	2	3	4	5	TOTAL	SCORE
Engaging communication	32.35% 11	35.29% 12	14.71% 5	14.71% 5	2.94% 1	34	3.79
Managing resources	44.12% 15	17.65% 6	14.71% 5	23.53% 8	0.00% 0	34	3.82
Empowering	11.76% 4	14.71% 5	47.06% 16	20.59% 7	5.88% 2	34	3.06
Developing	0.00% 0	20.59% 7	11.76% 4	20.59% 7	47.06% 16	34	2.06
Achieving	11.76% 4	11.76% 4	11.76% 4	20.59% 7	44.12% 15	34	2.26

Emotional competencies:

	1	2	3	4	5	6	7	TOTAL	SCORE
Self-awareness	11.76% 4	5.88% 2	8.82% 3	14.71% 5	8.82% 3	17.65% 6	32.35% 11	34	3.15
Emotional resilience	2.94% 1	5.88% 2	8.82% 3	11.76% 4	5.88% 2	44.12% 15	20.59% 7	34	2.74
Motivation	17.65% 6	44.12% 15	20.59% 7	8.82% 3	5.88% 2	0.00% 0	2.94% 1	34	5.47
Sensitivity	5.88% 2	2.94% 1	8.82% 3	11.76% 4	50.00% 17	14.71% 5	5.88% 2	34	3.35
Influence	29.41% 10	26.47% 9	20.59% 7	11.76% 4	8.82% 3	2.94% 1	0.00% 0	34	5.47
Intuitiveness	8.82% 3	8.82% 3	23.53% 8	20.59% 7	5.88% 2	11.76% 4	20.59% 7	34	3.76
Conscientiousness	23.53% 8	5.88% 2	8.82% 3	20.59% 7	14.71% 5	8.82% 3	17.65% 6	34	4.06

Phase 4: Execution

The order of importance for a lump sum project:

Intellectual competencies:

	1	2	3	TOTAL	SCORE
Critical analysis and judgement	70.59% 24	17.65% 6	11.76% 4	34	2.59
Vision and imagination	11.76% 4	38.24% 13	50.00% 17	34	1.62
Strategic perspective	17.65% 6	44.12% 15	38.24% 13	34	1.79

Managerial competencies:

	1	2	3	4	5	TOTAL	SCORE
Engaging communication	17.65% 6	23.53% 8	23.53% 8	26.47% 9	8.82% 3	34	3.15
Managing resources	14.71% 5	35.29% 12	23.53% 8	11.76% 4	14.71% 5	34	3.24
Empowering	17.65% 6	17.65% 6	29.41% 10	26.47% 9	8.82% 3	34	3.09
Developing	2.94% 1	14.71% 5	0.00% 0	23.53% 8	58.82% 20	34	1.79
Achieving	47.06% 16	8.82% 3	23.53% 8	11.76% 4	8.82% 3	34	3.74

Emotional competencies:

	1	2	3	4	5	6	7	TOTAL	SCORE
Self-awareness	5.88% 2	17.65% 6	14.71% 5	5.88% 2	5.88% 2	17.65% 6	32.35% 11	34	3.29
Emotional resilience	2.94% 1	11.76% 4	32.35% 11	17.65% 6	5.88% 2	26.47% 9	2.94% 1	34	3.97
Motivation	47.06% 16	17.65% 6	8.82% 3	11.76% 4	11.76% 4	2.94% 1	0.00% 0	34	5.68
Sensitivity	8.82% 3	0.00% 0	11.76% 4	20.59% 7	23.53% 8	17.65% 6	17.65% 6	34	3.26
Influence	11.76% 4	17.65% 6	8.82% 3	17.65% 6	23.53% 8	11.76% 4	8.82% 3	34	4.06
Intuitiveness	8.82% 3	14.71% 5	5.88% 2	17.65% 6	17.65% 6	14.71% 5	20.59% 7	34	3.53
Conscientiousness	14.71% 5	20.59% 7	17.65% 6	8.82% 3	11.76% 4	8.82% 3	17.65% 6	34	4.21

Phase 5: Close out

The order of importance for a lump sum project:

Intellectual competencies:

	1	2	3	TOTAL	SCORE
Critical analysis and judgement	85.29% 29	8.82% 3	5.88% 2	34	2.79
Vision and imagination	5.88% 2	26.47% 9	67.65% 23	34	1.38
Strategic perspective	8.82% 3	64.71% 22	26.47% 9	34	1.82

Managerial competencies:

	1	2	3	4	TOTAL	SCORE
Engaging communication	23.53% 8	44.12% 15	23.53% 8	8.82% 3	34	2.82
Managing resources	58.82% 20	20.59% 7	11.76% 4	8.82% 3	34	3.29
Empowering	14.71% 5	29.41% 10	47.06% 16	8.82% 3	34	2.50
Developing	2.94% 1	5.88% 2	17.65% 6	73.53% 25	34	1.38

Emotional competencies:

	1	2	3	4	5	6	7	TOTAL	SCORE
Self-awareness	11.76% 4	8.82% 3	5.88% 2	11.76% 4	17.65% 6	14.71% 5	29.41% 10	34	3.24
Emotional resilience	8.82% 3	14.71% 5	14.71% 5	23.53% 8	11.76% 4	20.59% 7	5.88% 2	34	4.00
Motivation	17.65% 6	17.65% 6	26.47% 9	11.76% 4	14.71% 5	11.76% 4	0.00% 0	34	4.76
Sensitivity	11.76% 4	2.94% 1	14.71% 5	14.71% 5	23.53% 8	14.71% 5	17.65% 6	34	3.50
Influence	17.65% 6	17.65% 6	17.65% 6	11.76% 4	11.76% 4	20.59% 7	2.94% 1	34	4.44
Intuitiveness	0.00% 0	11.76% 4	11.76% 4	17.65% 6	17.65% 6	17.65% 6	23.53% 8	34	3.12
Conscientiousness	32.35% 11	26.47% 9	8.82% 3	8.82% 3	2.94% 1	0.00% 0	20.59% 7	34	4.94

Appendix - F – Project director's view on competencies and contract type

Relationship between competencies and Cost reimbursable contract

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment						1	1
Vision and imagination				1			1
Strategic perspective							2
Engaging communication						1	1
Managing resources				1	1		
Empowering					1		1
Developing				1	1		
Achieving						2	
Self-awareness						1	1
Emotional resilience					1		1
Motivation					1	1	
Sensitivity					1		1
Influence						1	1
Intuitiveness					1		1
Conscientiousness						1	1

Relationship between competencies and Lumpsum contract

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment						2	
Vision and imagination				1	1		
Strategic perspective					1		1
Engaging communication						1	1
Managing resources				1	1		
Empowering					2		
Developing				1	1		
Achieving						2	
Self-awareness						1	1
Emotional resilience					2		
Motivation					1	1	
Sensitivity					1		1
Influence					1		1
Intuitiveness							2
Conscientiousness						1	1

Appendix - G– Project Manager's opinion on competencies and contract type

Relationship between competencies and Cost reimbursable contract

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment					1	1	1
Vision and imagination					1	1	1
Strategic perspective						2	1
Engaging communication					1	1	1
Managing resources		1					2
Empowering					2		1
Developing		1		1			1
Achieving			1		1		1
Self-awareness			1	1		1	
Emotional resilience			1	2			
Motivation				1	2		
Sensitivity				2	1		
Influence				1	1	1	
Intuitiveness	1			1		1	
Conscientiousness			2			1	

Relationship between competencies and Lumpsum contract

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment						2	1
Vision and imagination					1	1	1
Strategic perspective						2	1
Engaging communication					2		1
Managing resources			1		1		1
Empowering				1	2		
Developing			1	2			
Achieving					1		2
Self-awareness			1	1		1	
Emotional resilience				1	1		1
Motivation				1	1	1	
Sensitivity		1		2			
Influence				1		2	
Intuitiveness	1					2	
Conscientiousness		1		1		1	

Appendix - H– Team lead's opinion on competencies and contract type

Relationship between competencies and Cost reimbursable contract

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment							3
Vision and imagination					1	1	1
Strategic perspective					1	1	1
Engaging communication						1	2
Managing resources					1	2	
Empowering						1	2
Developing					2	1	
Achieving					1		2
Self-awareness						3	
Emotional resilience					1	2	
Motivation							3
Sensitivity					1	1	1
Influence						1	2
Intuitiveness					1	2	
Conscientiousness						3	

Relationship between competencies and Lumpsum contract

	NOT AFFECTED				AFFECTED		
	STRONGLY	MODERATELY	SLIGHTLY	NEUTRAL	SLIGHTLY	MODERATELY	STRONGLY
Critical analysis & Judgment							3
Vision and imagination					1	1	1
Strategic perspective					1	1	1
Engaging communication						1	2
Managing resources					1	2	
Empowering						1	2
Developing					2	1	
Achieving					1		2
Self-awareness						3	
Emotional resilience					1	2	
Motivation							3
Sensitivity					1	1	1
Influence						1	2
Intuitiveness					1	2	
Conscientiousness						3	

Appendix - I – Competencies and Project success (performance indicators)

	MICRO VIEW POINT					MACRO VIEW POINT			
COMPETENCIES	TIME	COST	QUALITY	PERFORMANCE	SAFETY	TIME	SATISFACTION	UTILITY	OPERATION