THE SKILL SETS REQUIRED FOR MANAGING COMPLEX CONSTRUCTION PROJECTS

Glen Mouchi, Mouchi Project Management Ltd. Auckland
James Olabode Rotimi, Auckland University of Technology, Auckland
Thanuja Ramachandra, Auckland University of Technology, Auckland

ABSTRACT

Very few projects comprise the unique character that construction projects have. The product from construction processes are rarely similar with each having unique set of characteristics and qualities that set them apart from other projects. Hence the management of the production processes demand creative and often times imaginative managers for the achievement of successful outcomes. Undoubtedly complex projects will need to be resourced with the right calibre of managers because they are a higher order management activity. But what is the skill sets required of this calibre of managers? The paper reports on the perspective views of some senior management personnel in construction organizations on what constitutes complexity in construction and what skill sets will be required to achieve successful outcomes on those projects. Their views were obtained through semi-structured interviews. The responses are analysed descriptively with thematic summaries. The paper concludes that there are specific skill sets that are set apart for success on complex projects, and that the skills evolve from knowledge gained from exposure to a wide range of projects.

JEL: L74; M00

KEYWORDS: Project Manager, skill set, complex, construction project

INTRODUCTION

Construction is similar to other production-related industries, in that it follows the wheel of advancement and technology. The increasing demands of the construction industry to make the world a better living place for people has established it as a frontier of an ever advancing world. As a result construction projects are considered with wider perceptions, with project objectives requiring more extensive efforts. Globalization and healthy competition have played a key role in driving the industry to the limits. The industry is trying to pace up with progressively growing demands, varying needs and objectives. Therefore projects of sheer size, novel shapes constructed using innovative materials, methods and technologies have become normal. Projects undertaken in the Middle East during this early century are classic examples of the radical requirements for cutting edge performance by the industry. In probably similar developmental moves, the industries' clientele have become more business-minded and now set project objectives and deliverables that could be considered complex to achieve.

This complex, demanding, and dynamic requirements call for project managers that can manage the construction process from inception to successful completion (Leung, et al., 2009). Financial and reputation issues of construction organizations are now dependent on the project managers assigned to handle these projects. The consequences of a mismatch of skills and project complexity could lead to loss of control and monumental failure of these projects. Failures of projects like the Holyrood parliament building and the Sydney Opera house have raised concerns among industry and substantiated under-performance in the construction industry. Conversely success on projects such as the Burj Al Arab, Dubai Tower, Bahrain Twin Tower, Palm Island and World Island projects etc. highlight victory of skills, knowledge and competencies over prevailing industry issues and concerns.

Conventional and traditional approaches to managing projects may not suit complex projects. Several authors agree that complex projects are like systems and should be addressed systemically and many of them found that the methodologies on controlling systems thinking alone are not suitable for today's projects (Remington and Crawford, 2004; Williams, 2002; Checkland, 1999; Baccarini, 1996). In order to have successful outcomes, project managers should adopt both a system and pluralistic approach with multi ways of thinking. Project managers must draw from a wide range of tools and skills and think in different ways; unconventionally create new methods to suit their projects and the problems they deal with. Managing a complex projects require different approaches and different mentality. Complex projects are a higher-order management activity and should be treated and resourced accordingly (Remington, and Pollack, 2007).

Therefore there has to be awareness on the skills required for different type of construction projects. This paper attempts to identify these skill sets particularly for complex construction projects. These skill sets are viewed from the perspectives of some survey participants, who begin by presenting their understanding of complexity in construction projects. In the next section a brief review of literature on construction project complexity and the functions and skills of construction project managers is undertaken. This is to give contextual background to discussions in the remaining part of this paper.

LITERATURE REVIEW

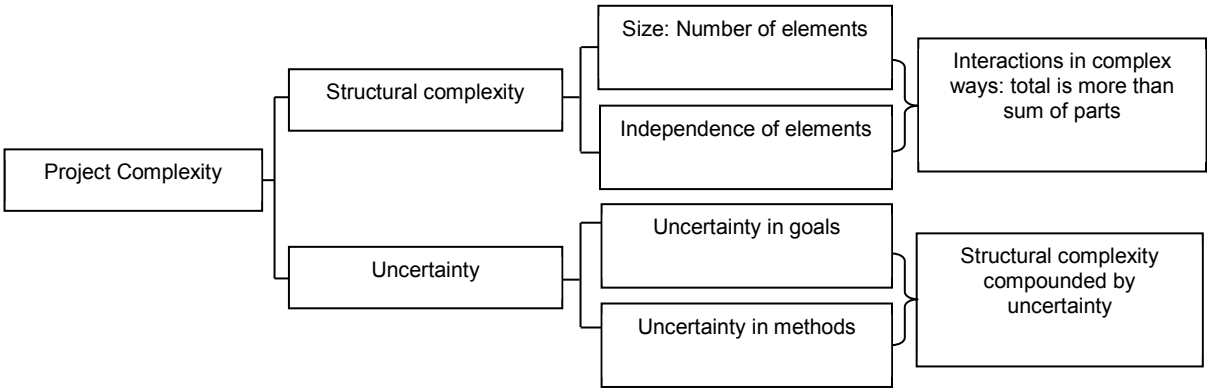
Project complexity is viewed differently by different scholars in the field. However the Centre for Project Management (CPM) in California gives a useful categorization that explains what constitutes complexity in construction projects. Four project types with varying complexities are identified by the centre to include: simple, organizationally complex, technically complex and critical mission projects.

Simple projects are projects which do not require much skills as most of these types of projects are repeated. They do not pose difficult challenges for project managers and most of the times have successful outcomes. The CPM concludes that these type of projects are better suited to new project managers, to start to build their excitement and interests for future projects. Organizationally complex types of projects are structured using a current and known technology, but the complexity is due to the new organizational environment, which could impact on an organization's functions and business decisions. Sometimes the projects could involve a combination of two or more new initiatives and processes. The challenge for the project manager on this project type is to decide the best way and which one to tackle first, whilst also contributing to the business in a proactive way.

Technically complex projects are essential for organizations but are characterized more on their technical complexity than on their organizational value. Technical complexity could appear in different ways. In some cases the technology is new and unknown to the organization or at least there are a small team of professionals that could understand it. Involvement in these types of project is very risky and could lead to disasters. On the hand the projects may involve new technology known to the organization but for which there is no qualified person/ project manager to manage. As this type of project could involve multi changes and complications during its lifecycle, requiring new way of thinking and adopting new ideas alongside the project; the changes could be critical to success. The projects will require special skills and techniques in order to succeed in the mission. Finally critical mission type of projects, require a high quality of performance from project managers for both organizational and technical complexities as these projects are very significant to a business. In some cases organizations struggle to change the scope of the work to suit the changes happening every year, trying to cope with it and stay in line with new technology and be prepared for it. Obviously, this means a lot of work behind the scene and a lot of preparation for good and solid base ready to attack and thrust through the new and complicated projects.

Williams (2002) explains that overall project complexity is characterised by two dimensions: structural complexity and uncertainty. Figure 1 shows that structural complexity further depends on number of elements and independence of elements. Uncertainty in goals and methods is another dimension which makes the project complex. Each of these dimensions has two sub-dimensions as shown in Figure 1. Bertelsen (n.d) states that complexity in construction can no longer be ignored and that the basis for project management paradigms should thus be redefined. This is the real challenge!

Figure 1: Dimensions of Project Complexity (Williams, 2002)



The figure gives the main character of complex projects as those resulting from the project structure or from uncertainties around the project. Each of these two characters is further broken down to size and independence of the project elements; and uncertainty in project goals and methods, respectively.

Different types of projects need different types of project managers. Complex projects need project managers that are equipped with special skills to achieve successful outcomes. Complexity in the system does not require complex management but needs project managers with open minds and thinking outside the box. The projects need some initiatives from project managers to create and produce things that are outside their job description. The most efficient project managers should be able to decompose the apparent complexity of the project situation in order to view it more simply. With great occurrence, projects are becoming cross-functional and progression-related and require personal skills and knowledge, interpersonal, and general management skills. This means that project managers should have knowledge and understanding about the business process. If the project manager is working in an environment that is supportive, it is a fortunate, if not it simply means being more self-reliant. Project success must be the main concern for any project manager and they have to be prepared for the battle.

The primary skill expected from a project manager is to have "good people skills". It is very obvious and true that project managers deal with different types of people, trades and attitudes throughout the project lifecycle. The project manager takes the responsibility of the project and the process. They receive the blame or the praise at the end of the outcomes. They manage all the people but they do not have any authority over them, therefore, they have to have enough skills to influence the team and make them do what they plan to achieve. They have to persuade, negotiate and sometimes even have to beg to get things done. Thus interpersonal skills are required to be at the top of all skill requirements. Henry Ford says,

"Coming together is a beginning. Keeping together is progress. Working together is success."

According to Wysocki and Lewis (2001) project manager's attributes vary from being a barrier to the rest of the organization to having visible leadership. Table 1 provides a listing of attributes expected from project managers. As shown in the table there are only few features which are related to technical and administration aspects of project management, while the rest are inclined towards people management. This shows that people skill is important in most situations because project managers are leaders and

leaders have to effectively get people to follow their instructions and fulfil their goals. Two main types of leaders are in existence: those leaders that are more people oriented and those which lean towards task orientation. How the project manager balances between the two without affecting the project outcomes is the real challenge for a project manager.

Table 1: Attributes of Project Managers

Attributes of Project Managers	
Buffer to rest of organization	Knows strength and weaknesses of team members
Challenges team to do well	Mutual ownership
Clears road blocks	Mutual respect
Delegates	Open minded
Fair	Organized
Follows up	Sense of humour
Gives feedback	Shares experience
Good decision maker	Supportive
Good listener	Team builder
Honest and trustworthy	Understanding
Knows own limitations	Visible leadership

The table gives a list of attributes expected from a project manager. Few of the attributes relate to technical and administration aspects of project management, while the majority relate to people management. The list shows the relative importance of people skills in project goal achievement.

In order to be effective in given tasks a project manager has to achieve project objectives and build a good relationship with his project team, meet client expectations and at the same time maintain the organization's profit motives. Méndez-Morse (1992) concludes that effective leader's behaviours have been categorized along two common dimensions: initiating structures (concern for organizational tasks) and consideration (concern for individuals and interpersonal relations". Having effective interpersonal relation (the ability to create good relationships between oneself and other people) that includes problem solving, decision making, and conflict resolution, are part of a project manager's responsibility. As a team leader the focus is limited to internal and within-team objectives but as a project manager the focus is more external, to see the whole picture and deal with all aspects/factors that could interfere with a project from the outset till completion.

Project success is related to the deliverables, main drivers and objectives of any project. Success is measured by achieving what has been planned. Project success is defined as the satisfaction of stakeholder needs and measured by the success criteria identified and agreed at the start of any project (APM). Alternatively project success could be defined as a "collective assessment by project stakeholders (e.g. client/customer, sponsor, contractors) of the degree to which the project has achieved each of its objectives" (Project Manager Competency Development Framework). It is about blending all facets of success together to make a coherent whole (Abeysekera & Mclean, 2001).

$$\text{Success} = \sum (\text{Achievements of objectives})$$

Project success is dependent on factors such as planning, monitoring and controlling, team selection, technical performance, communication, leadership, strategic direction, team development, risk management (monitoring and controlling), organisational support, stakeholder management, organizational structure, and project definition (Crawford, 2000). Hartman and Ashrafi (2002) provide another useful dimension to project success through a description of 10 factors that could contribute to project success. These factors are given in Table 2. Project managers are expected to be leaders and be able to achieve balance between tasks and people, according to project situations and other factors and constraints. The term leadership is defined as the "art of getting others to do something that you believe should be done" (Packard cited in Lewis, 2002). Several key skills have been identified as attributes of good project management leadership. They include persuasion, people skills, self-confidence, project ownership and planning skills. These skills are briefly described in the following paragraphs.

Persuasive skills are an interactive process which inspires followers to achieve their leader's vision. It is the art of communication and meaningful language. Persuasion is a "generic name for a variety of communication skills and techniques that have as their purpose altering another person or group to the leader's point of view" (Fairholm, 2003 p. 185). Project Managers have to persuade people towards the achievement of successful outcomes. The Harvard Business School explains that credibility which is trust plus expertise, understanding of the audience, solid argument, and effective communication are the four elements that persuasion consists of.

Table 2: Project Success Factors

Success Factors	Description
Project Mission	Clearly defined goals and direction
Top Management Support	Resource , authority and power for implementation
Schedule and Plans	Detailed specification of implementation
Client Consultation	Communication with and consultation of all stakeholders
Personnel	Recruitment, selection and training of competent personnel
Technical Tasks	Ability of the required technology and expertise
Client Acceptance	Selling of the final product to the end users
Monitoring and Feedback	Timely and comprehensive control
Communication	Provision of timely data to key players
Troubleshooting	Ability to handle unexpected problems

The table provides a description of ten factors that could contribute to success on any project. These ten factors show a balance between functional tasks and the management of people, both internal and external to an organisation.

Personality and people skills are more effective sometimes when an informal approach is adopted to get into the heart of people and share their feelings and make them feel part of one big family that are cared for. According to Collins and Lazier (1992) effective leaders master the paradox of both hard and soft management. They hold to incredibly high standards of performance (hard) yet they go to great lengths to build people, make them feel good about themselves and about what they are capable of achieving (soft).

Fisher (2010) outlines six people skills required of effective leaders. The first being the ability to understand other peoples behavioural characteristics. The ability to be genuine, open and honest with others develops an understanding relationship. Secondly, effective leaders should be able to lead others through their good leadership styles. Effective leaders should hold the power of influence, impressing others to support an agenda. Fourthly, effective leaders should have an authentizotic behaviour. They should be able to accept people for what they are and do not try to force them to change. Fifthly, effective leaders should have conflict management skills that would enable them establish the root causes of conflict and deal with the conflicts decisively. Finally effective leaders need to be culturally aware. They should develop and apply an awareness of the cultural differences of their team members.

Self-confidence is one of the fundamental and effectiveness requirements for project managers. Leaders without high self-confidence are unable to take the right decisions and to solve conflicts that could arise amongst their staff (Bass, 1999; Boyatzis, 1982 and Paglis and Green, 2002). Also leaders with high self-confidence are more likely to attempt complex tasks and to set challenging objectives and take more initiative to deal with problems.The feelings of project managers towards their projects play a vital role in project success. It is like a relationship between two partners sharing all the good and bad times together. Similarly on construction projects a project manager should be proud and feel that the project is part of him/her. That feeling is not easy to be achieved and it will not be there if the project manager misunderstands the project and its objectives. Therefore understanding every element of the project, and building a gradual relationship with the project, a manager feels that he cannot go away from the project until achieving the goals. Project managers should live the vision throughout the project life cycle. At the end it means that the project manager is taking care of every step and every activity on site; in other words the manager is taking ownership of the project. Project ownership is another fundamental skill which takes the project manager to the ultimate level of thinking and management. It is essential for new

project managers when they start their career life working with senior project managers to think about this and start to build that feeling. After a while and after involving in few projects, it will become a part of their personality and another source of energy and motivation to drive projects and recharge the battery when it is needed. It is one of the skills that once it is gained, it stays. Complex projects require that project managers have a sense of ownership or feeling. Project managers need to be in a situation that they feel they are part of the project and they will see and forecast the problems before or at least they will be ready for it to find the proper ways to deal before they impact negatively on projects. Taking the ownership of project stays even after project completion. It is common for project managers to refer to their old projects, they lay claim on completed projects as if it is still theirs forever. They will talk about every moment they spent solving issues and other difficulties they faced; and proudly explain how successful the outcomes were. Where the outcomes were negative, they are quick to explain what lessons were learnt from it. The last project manager's skill relates to the abilities to plan and schedule activity performance. Planning is a primary element which is required to ensure a project is following the right path towards set goals. It is not just to schedule time for tasks or activities, but it involves understanding the project elements and its structure, and how the building or the structure is going to be put together.

Project managers need to be able to decompose projects so that they see the whole project specially the complex project into small subtitles or work breakdown structures. This will allow them to allocate the right resources to each activity and the duration required. Team members would be aware of what is required from them at each stage of the project lifecycle, mainly at the execution part of it. Clearly this shows how the project manager is keeping control of the process and he will be able to modify or overlap these activities as needed. The foregoing has outlined the project management function and its skill requirements. The following section covers the data collection aspects of the study by first describing the study methodology, then presenting the study findings within the context of this papers objective.

DATA AND METHODOLOGY

The objective of this study is to determine the skill sets needed by project managers for managing complex construction projects. The approach therefore used for the study was semi-structured interviews as the primary tool in identifying the project complexity factors and the skills required of project managers. Interviews were conducted with five senior management level personnel in five construction organizations in New Zealand. For reasons of anonymity the five interviewees are referred to as interviewees A to E (IA, IB, to IE respectively).There were 10 key questions asked which captured the perspective views of the Interviewees on their understanding of complexity in construction projects and of the skills required to manage this category of projects. The constituent questions in the semi-structured interview are given in Table 3.

Table 3: List of Interview Questions

No	Interview Questions
1	How would you describe complex projects from your organization's point view?
2	How many types of complex projects has your organization been involved in?
3	What sort of preparation would you put in place for this type of projects in your organization?
4	What skills would you expect your Project Managers to have, in order to manage these type of projects?
5	What sorts of training or tools are available to Project Managers in your organization to equip them for complex projects?
6	Can you give examples of these projects and what were the lessons learnt from their management of it?
7	Do you believe and expect that every Project Manager should be capable of managing a complex project?
8	What criteria were used for selecting the Project Managers engaged for your complex projects?
9	Do you believe that traditional management approaches are applicable in complex projects?
10	Could you identify (in three words) what you will consider as the most important skills that a Project Manager will need for successful outcomes on a complex project?

The table gives a list of the ten questions that was asked of the five senior management personnel in the five construction organisations used for the study. The objective of the interview was to determine the skill sets needed by project managers for managing complex construction projects.

RESULTS

From the range of questions asked from the Interviewees about their understanding of complexity in construction projects, it was possible to generate thematic summary of their responses. The responses are summarised in Table 4.

Table 4: Descriptors of Construction Complexity

Interviewees	Complexity Descriptors
IA	Undefined and unclear project scope
	Type of people being dealt with (project participants)
	Technicality of the project (especially where not properly defined) that could create unique management challenges.
IB	Complexity of clients' requirements/brief
	Complex requirements and obligations that cannot be realistically implemented through to completion
	Requirements for project staging and hand-over
IC	Difficult construction sequencing
	Staged handovers or staged access or milestones
	Uncommon features and building elements
	Unavailability of clearly defined documentation
	Political issues around clients and project participants
	Projects with large fluctuations in the management team requirements to deliver them.
	Unusual structure, space and geometry (Construction is irregular)
	Incomplete designs (too many unknowns before execution)
ID	Technical requirement (requiring know how)
	Cultural differences and perceptions
	Project duration and project timing (sequencing)
	Architecturally challenging
	Project location and resource availability
	Lack of construction details
IE	Large number of stakeholders (and probably varied)
	High levels of risks (technical, program, quality, client etc.)

The table gives a list of the descriptors of complexity as provided by the five senior management personnel in the five construction organisations that were interviewed for this study.

The responses show that complexity of construction projects depend on a number of diverse issues which could develop throughout the project life cycle from conception to its commission and beyond. A recurring theme from the responses is the technicality of construction requirements stemming from complex clients briefs for projects with very unusual structure, space, and unusual geometry. Another salient issue connected with project scope is the uncertainty resulting from incomplete designs as at the time physical execution has commenced on the project site. It is not unusual for design development to progress into the construction phases of projects but complexity comes from changes that may be brought about by scope changes that could affect completed sections of the works.

One of the Interviewees explained that on a particular project they had the design running parallel with the construction. Staging was therefore complicated. Consultants were required to issue a package of full instructions and documents for the next stage of building, every two or three months during construction. The consultants were late with their information and the clients still wanted their building on time. The delay by the consultants made the physical progress squeezed up all the way through. Similarly the content of the contractual agreements may allow for loosely defined scopes which are continuously or persistently modified to the detriment of the constructors. This is exacerbated further by difficulties that are associated with the processing of variations. Complexity could also result from the dynamics of the construction supply chain (the project team). Proper project team integration expectedly should ensure smoother flow of operations but this is rarely the case and projects become difficult to manage. Team integration is more difficult with larger teams, each with varied interests and performance motives. One of the Interviewees alludes to the complexity of the managing relationship that existed between his construction company, the client and the project management company on one of their projects. In his

words, '*they were never quite sure who was in charge*'. In another situation a public sector project became complex to manage because there were too many stakeholders and it became highly politicised.

From an organization's point of view, complex projects are projects that have large fluctuations in the management team requirements. The project might start with a few persons and then step up to requiring a larger team because there are a lot of activities taking place simultaneously and then it drops away again. These changes in work sequence impacts resource levels which in turn makes operations difficult to manage.From these responses, it could be suggested that complex projects do not necessarily need to be large projects. For example replacing the roof from an inhabited building could become complex.

Complex projects require additional efforts and thinking beyond the normal green field sites. On international projects it could be the cultural differences, knowledge of local people and work conditions that could make them complex. From the responses, the factors contributing to project complexity were further regrouped into seven main factors and presented according to their thematic frequency. Table 5 gives the percentage contribution of each of the seven factors. The Table shows that technical, buildability and architectural challenges is a chief reason (25%) for complexity in construction projects. This is followed by the size and staging of projects (20%). Factors such as poor documentation and insufficient details and drawings; uncertainty; and involvement of many clients and stakeholders are other significant factors that account for construction complexity.

Table 5: Distribution of Factors Influencing Complexity in Construction Projects

Complexity Factors	Contribution (%)
Uncertainty	15
Poor documents and insufficient details and drawings	15
Technical and buildability and architectural challenges	25
Size and staging of the project	20
Client and stakeholders	15
Cultural	5
Organizational	5

The table gives the percentage contribution of a list of complexity factors presented to the Interviewees. The results show that Technical and buildability and architectural challenges is the chief factor; while factors such as cultural and organizational complexity are the least factors that account for construction complexity.

The second set of questions in the semi-structured interviews was focussed on determining the skill sets that were necessary for successful outcomes on complex projects. The interviewees had described what they understood complex projects to mean, they were then required in this section to explain what type of project managers they felt could handle these complex projects. Similarly, thematic analyses of the interviewees' responses were undertaken, and a summary of their responses is tabulated in Table 6. The skill sets identified by the interviewees in the Table 6 have been condensed into four key skill sets which a capable project manager should have for successful outcomes on complex projects. These four skill sets are presented in the Table 7.

The table shows that communication, people skills and leadership abilities; good visions and focus on the end results; planning and risk management skills; and finally technical skills and experience are all important skills for a project manager. Each of the skills is adjudges 25%. By implication, no one skill is dominant in its requirement for successful outcomes because they all have equal status. The planning skill covers a whole range of planning requirements such as planning for project risks, time management, planning for quality achievement, health and safety planning etc. According to one of the Interviewees, 'it is not just about programme of works, but it is about putting a plan in place for all the different things involved in the project execution'. These skill requirements are explained further in the discussion section to put them in perspective.

DISCUSSION

From the result of the study findings, one can reach a conclusion that construction project managers need to be focused, be good leaders and communicators and that they need the capacity to understand the complexities of the project under their control. Explicitly also is the need for the project managers to be forward-thinkers so that they are able to leave through a project in advance, anticipating all operational bottlenecks before they occur.

Table 6: Skills Required by Managers of Complex Projects

Interviewees	Project Manager's Skills for Complex Projects
	Communication and people skills
IA	Project management knowledge and experience
	Be visionary and plan for its achievement
	Good focus on the end results.
	Clear vision.
IB	Good leadership skills
	Good communicator with all stakeholders and operational staff
	Good technical knowhow on how to put all the project puzzles together
	Good focus
	Good leadership skills,
	Good communicator
IC	Knowledgeable and with the required capacity to understand the complexities of the project.
	Excellent negotiation skills
	Excellent people management and motivation skills.
	Able to delegate and relate to people
	Highly developed technical skills and able to understand project deliverables
	Good understanding and ability to see how the completed project should look.
	Able to forecast project buildability and the process needed to achieve this
	Need to have clarity and people skills
	Able to manage performance
ID	Empathetic team leader, who provides practical support to his team
	Ability to maintain flexibility
	Leadership and good people skills
	Strong desire for getting things done and motivate the team
	Ability to plan projects logically
	People management skills (as the captain of the team)
	Good communication skills
IE	Forward-thinker and be able to look well ahead for risks/problems in advance
	Strategic visioner
	Ability to make others accountable for their performance

The table gives individual responses of the five Interviewees to the skills required of project managers on complex construction projects.

A complex project requires strong and committed leadership that will get the operational team to perform to project expectations. Although the bigger the project the lesser is the project manager's involvement with the nuts and bolts of what is going on. Nonetheless the project manager will be expected to delegate and motivate the right calibre of support personnel that will deal with the nuts and bolts of the project. One of the interviewee puts the leadership and people skill set more succinctly, when he asserts that every person who comes through the project manager's door needs to be managed and possibly treated accordingly. This could be the client, the project consultants, subcontractors, and sometimes the project manager's own personnel. All these needs must be met using different approaches from subtle to more rigid and non-compromising stance. This particular skill sets derives from experience which often times cannot be taught in schools. Another interviewee explains that the objective of their organisation is to gradually introduce the young project manager to different job demands. This exposes the project manager to different types of skill sets requirements that will mature over time.

Table 7: Skills Required of Project Managers

Project Manager's Skills	% Significance
Planning and risk management	25
Communication and people skills and leadership	25
Technical skills and experience	25
Vision and focus on the end results	25

The table gives the percentage contribution of four project manager's skills that were condensed from the long list provided by the Interviewees in Table 6. The resultant four project managers skills all have equal status in complex construction projects.

The moment a project commences, a capable project manager should already be thinking about its completion, so that all planning efforts will be directed towards planning for its completion. Hence the need for strategic visions of the future and the ability to anticipate all work requirements. Especially those requirements that could impact on the achievement of project objectives.

CONCLUDING COMMENTS

There is no doubt that construction projects are becoming increasingly complex undertakings. This may be attributable to clients' demands and other technological developments. Project participants therefore need to possess special skills to manage these complex projects successfully. This paper has as its objective the determination of the skill sets required of project managers to manage complex construction projects. First there was a need to determine what constituted a complex construction project, then to determine what skills the project managers should have to successful manage this type of projects. The study interviewed five senior management personnel of five construction companies that are based in New Zealand to get their perspective views on the subject matter.

The study concludes that complexity in construction projects is dependent on seven key factors viz: uncertainty in project scope and requirements, poor documentation and insufficiency of design details technical and buildability issues, size and staging of project activities, the size and nature of relationships between the project participants, cultural issues related to location and resource availability, and organizational requirements for project execution. The study also concludes that four key project manager skills were necessary to cope with complex construction projects. The skill sets include those of planning and risk management, communication and people skills, technical skills and experience, and a good vision and focus on end results.

Whatever the level of complexity of construction projects, success is achievable so long as the right project manager with the right skills is engaged to tackle it. Although this may appear simple, unfortunately it is not the case always. The good news is that more and more organizations have embarked upon and succeeded on complex projects. There is an understanding of the requirement for special skills for competent project managers and a willingness to provide support when needed. This will result in a win-win for the project manager and these organisations. The roles of project managers are like a two-edged sword, which could result in either success or failure. The right vision for success comes from lateral thinking skills. Regardless of the level of complexity of construction projects, skills requirements will include those of: technical skill and experiential knowledge, communication and people skills, leadership, planning and risk management, and finally is the vision and focus on end results.

REFERENCES

Abeysekera, V., and McLean, C. (2001), Project Success and Relationships from a Stakeholder Perspective. Proceedings of the 17th Annual Conference, eds., Salford, UK, 5-7 September, 485-495.

Baccarini, D. (1996), The concept of project complexity a review, *International Journal of Project Management* 14(4), 201-204.

Bass, B.M. (1999), 'Two decades of research and development in transformational leadership'. *European Journal of Work and Organizational Psychology*, 8, 9-32.

Bertelsen, S., (n.d.). Construction as a Complex System. Retrieved from http://www.bertelsen.org/strategisk_r%E5dgivning_aps/pdf/Construction%20as%20a%20Complex%20System.pdf

Boyatzis, R. (1982), The competent manager: A model for effective performance. New York: John Wiley and Sons.

Checkland, P. (1999), Systems thinking, systems practice. Chichester, New York: John Wiley.

Collins, J. C. & Lazier, W. C. (1992). *Beyond entrepreneurship: turning your business into an enduring great company*. New Jersey. Prentice Hall.

Crawford, I. (2000), Profiling the competent project manager. Proceedings of PMI research conference. Newtown Square, PA: Project Management Institute.

Fairholm, G. W. (2003), *The Techniques of Inner Leadership*. London: Praeger Publishers.

Fisher, E. (2010). What practitioners consider to be the skills and behaviours of an effective people project manager, *International Journal of Project Management.* (In Press).

Hartman, F., and Ashrafi, R. A. (2002), Project management in the information systems and information technology industries. *Project Management Journal,* 33(3), 5-15.

Leung, M.-Y., Chan, Y.-S., & Yu, J. (2009), Integrated model for the stressors and stresses of construction project managers in Hong Kong. *Journal of Construction Engineering and Management*, 135(2), 126-131.

Lewis, J. P. (2002), Fundamentals of project management: developing core competencies to help outperform the competition. New York. AMACOM.

Méndez-Morse, S. (1992), Leadership Characteristics That Facilitate School Change. Retrieved from http://eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED370215&ERICExtSearch_SearchType_0=no&accno=ED370215

Paglis, L. & Green, S.G. (2002), Leadership self-efficacy and managers' motivation for leading change. *Journal of Organizational Behavior*, 23, 215-235.

Remington, K. & Pollack, J. (2007), *Tools for complex projects*. England: Gower Publishing Limited.

Remington, K. and Crawford, L. (2004), 'Illusions of Control: Philosophical Foundations for Project Management', IRNOP VI Conference, Turku, Finland. 25–27 August.

Williams, T. (2002). *Modelling Complex Project*. UK. John Wiley & Sons, Ltd.

Wysocki, R. K. & Lewis, J.P. (2001), *The World Class Project Manager: A professional development guide*. New York: Perseus Publishing.

AUTHORS BIOGRAPHY

Glen Mouchi manages Mouchi Project Management Limited, a company based in Auckland. He consults on a wide range of project management services. He is also a Senior Project Manager with New Zealand Bluescope Steel, Auckland. Glen was awarded the 'James Hardie Award for Excellence in the Building Profession' in 2003 while working as a Project Manager with Mainzeal Property & Construction Limited also based in Auckland. He can be contacted at glenmouchi@clear.net.nz

James Olabode Rotimi is a Senior Lecturer in the Construction Management programme, Auckland University of Technology, New Zealand. James has had various construction management experiences including an associate role in a quantity surveying consultancy. He is a professional member of the Institutes of Building in Nigeria, New Zealand and the United Kingdom. He can be contacted at james.rotimi@aut.ac.nz

Thanuja Ramachandra is a doctoral research student at School of Engineering, Auckland University of Technology, New Zealand. Her background is quantity surveying. She used to lecture in the areas of construction economics and general economics while serving as lecturer at the Department of Building Economics, University of Moratuwa, Sri Lanka.