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CONFERENCE PAPER

The study of association between organisational portfolios and project portfolio management practices

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Synopsis

Project portfolio management (PPM) strives to provide a holistic approach to organisational investment, strategic growth and the management of benefits realisation. Nevertheless, many organisations struggle to adopt PPM and efficiently manage different sizes of projects and portfolios as they only recognise the project types for associating the PPM practices. This study investigates the relationships of portfolio sizes to PPM practices within the Australian context.

Research design

In this research, quantitative data were collected from 64 portfolio managers in Australia using a survey. The data collected was classified into five categories of portfolios containing 26 variables of identified PPM practices. A nonlinear canonical correlation analysis was conducted to graphically illustrate the relationships between the 26 studied variables and their categories.

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Relevance for practice/education

The adoption of PPM for the holistic management of organisational investment, strategic growth and the management of benefits realisation can be explored for educational purposes.

Main findings

The analysis results indicated that the formation of PPM practices around the portfolio sizes was diverse. The medium-low to medium-high levels of several PPM practices were performed in the portfolios valued from AU$1 million to AU$100 million. On the other hand, the disintegration of PPM practices was evident in the portfolios greater than AU$ 1 billion.

Research implications

This study provides a further understanding of the association between portfolio sizes and practices of PPM in assisting organisations select practices suitable for the size of the portfolio.

Keywords

Project Portfolio Management (PPM), PPM Practices, Organizational Portfolios, Project Management

Introduction

Project portfolio management (PPM), as defined by Project Mangement Institute (PMI 2013b), is the coordinated management of projects and programs to achieve organisational strategies and objectives. According to AXELOS (2011), management of portfolios (MoP) is "a coordinated collection of strategic processes and decisions that together enable the most effective balance of organizational change and business as usual." Despite the PPM knowledge and standards that have been published to provide a greater understanding of effective PPM practices, the implementation of PPM practices remains a challenge to manage diverse sizes and types of their projects and portfolios (Costantino, Di Gravio & Nonino 2015). This is due to the complex nature of PPM, which aims to contribute to the holistic management of organizational investment, strategic growth and the management of benefits realisation (Patanakul 2015). The factors related to PPM implementation are numerous and should be all be taken into consideration in the planning stages. Although project types have been taken into consideration prior to the selection of PPM practices (Blomquist & Müller 2006), the relations of portfolio sizes to PPM practices and selection have not been evidently discussed. Furthermore, it was suggested that practising PPM should be appropriately customised to individual situations, as different practices are required in different contexts (Martinsuo 2013). To have a broader understanding of PPM performance in a specific context, this study was undertaken to highlight the relationships between sets of PPM practices and the portfolio sizes, using the Australian industry sectors as the research target.

This research paper is constructed in five sections. The next section, the literature review, demonstrates an overview of the fundamental concepts and industry practices of PPM. The third section summarises the research methodology. The fourth section presents the analysis of the quantitative data collected from 64 portfolio managers within the Australian context. Within this section, categories under each variable of PPM practices were further examined to determine the correlations between the levels of PPM performance that may associate to different sizes of organisational portfolios. A nonlinear canonical correlation analysis was

conducted to graphically illustrate the relationships between the 26 studied variables and their categories. The last section discusses the implications of this research and concludes the study objectives with some directions for future research.

Project portfolio management concepts and practices

Project portfolio management (PPM) is defined as "a component collection of programs, projects, or operations managed as a group to achieve strategic objectives" (PMI 2013b, p. 3). From the given definition, it can be seen that effective PPM relies on effective management of its components to deliver outputs that align with the organisational objectives. The study of Thomas et al. (2002) confirmed the need to align project delivery capability with corporate strategy. According to Crawford, Hobbs & Turner (2006), the decision-making processes for project portfolio selection, as well as tools and capability to carefully select the projects that achieve the desired benefits, can impact project success. Furthermore, the organisational management must aim to optimise available resources and manage the level of project and portfolio risks, as well as provide strategic alignment in the governance of projects.

Acknowledging the significance of aligning projects with the corporate strategies, *PMI's Pulse of the Profession In-Depth Report: Success Rates Rise* (PMI 2017) highlighted the project failure rates of projects that did not meet the organisational goals and business intent. The report stated that the rates continue, with 17% of projects failing outright. Furthermore, it was estimated that for every US$1 billion spent on a failed project, $97 million is lost forever. The concept of project portfolio management (PPM) is based on theories of portfolio selection and originates from the area of finance and investment in *The Standard Portfolio Management* for portfolio management. The third edition of PMI's portfolio management standard includes portfolio management process groups (defining, aligning and authorizing controlling groups) and five knowledge areas (strategic management, governance management, performance management, communication management and risk management) (PMI 2013b), which aims to cover a wide range of practices for any organizational type and portfolio size. Despite the existence of PPM standards and practices, the PPM delivery remains a challenge. This could result in failing business alignment, monetary losses, unmet productivity and decreased morale of project stakeholders (Patanakul 2015). Martinsuo (2013) pointed out that the lack of awareness of practices and context could be one of the key explanations why organisations still struggle with resource sharing and constant changes in their portfolios. As a result, the success of portfolio management falls behind expectation. According to Voss and Kock (2013), the success of PPM can be evaluated from overall business success, average project success, future preparedness, use of synergies, strategic fit and portfolio balance. It was further suggested that portfolio value should be monetarily and non-monetarily taken into consideration. The larger a portfolio becomes, the more that better alignments with organisational objectives and PPM practices are required. The recent *PMI's Pulse of the Profession* (PMI 2017) reveals that only 62% of strategic initiatives (organisation's projects) met their goals. The report further states the most important factors for strategic initiative failure:

- Lack of clearly defined and/or achievable milestones and objectives to measure progress
- Poor communication
- Lack of communication by senior management
- Employee resistance
- Insufficient funding

It was noticed that the report only demonstrates the worldwide results, not those of individual countries.

Research methodology

Using literature as a foundation, the study was conducted to investigate the relationship between the four sets of PPM practices containing overall 26 related factors. Sixty-four respondents from different Australian sectors participated in the survey conducted in this research. The percentage of research respondents per sector is displayed in Figure 1.

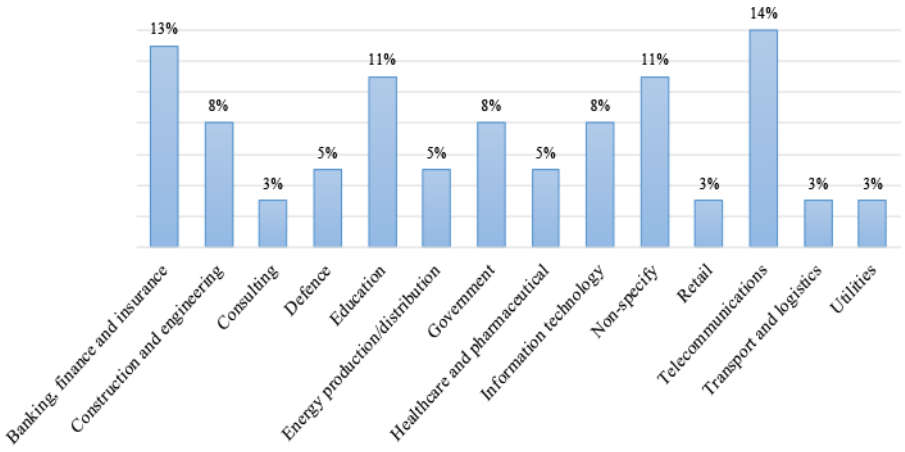

Figure 1 Percentage of respondents per Australian industry sector (in alphabetical order)

The respondents in this research have differing years of experience managing organisational project portfolios, ranging from less than one year to greater than 10 years, as seen in Figure 2.

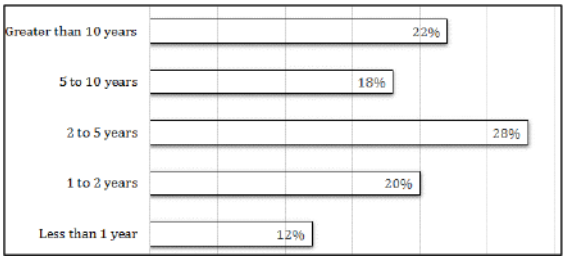

Figure 2 Years of experience in project portfolio management

The collected data were categorical data, which allowed a nonlinear canonical correlation analysis to be performed; this form of analysis is named as OVERALS which represents a short name for more than two sets of variables. The use of OVERALS analysis is suitable for evaluating the associations between two or more sets of categorical variables (nominal or ordinal scaling level) (Meulman & Heiser 2012). The analysis aimed to reveal the complex relationships among the studied organization portfolio sizes that were believed to be contributing to practising PPM. The formulation of OVERALS was conducted using the Statistical Package for Social Sciences (SPSS) toolset.

To perform OVERALS, the data collected were categorised into five sets, with an aim to identify and simplify the practices for the implementation of PPM within an organisation, as presented in Table 1, in which 26 variables were analysed. The five sets of practices identified were as follows:

- Portfolio size
- Project portfolio inventory
- Project portfolio analysis

- Portfolio planning and prioritisation
- Portfolio management and control in an ongoing cycle

The results obtained from OVERALS included the loss index, eigenvalues, fit index and component loading index. The component loadings were demonstrated within a two-dimensional graph for each plotted variable. The plot of centroids was generated to view categories under each variable.

Table 1 Variable coding

Set	Variable	Number of Categories	Variable Type	Category Symbol
1. Organizational Portfolio Size	Portfolio size	7	Nominal	P1
2. Project Portfolio Inventory	List current project status	4	Ordinal	P21
	Organize projects in categories	4	Ordinal	P22
	Document information about available resources, roles, costs and skills required	4	Ordinal	P23
	Calculate expected business value of projects (e.g. NPV, IRR)	4	Ordinal	P24
	Calculate project risk levels	4	Ordinal	P25
	Identify inter-project dependencies and conflicts	4	Ordinal	P26
	Establish a central repository to capture all project information	4	Ordinal	P27
3. Project Portfolio Analysis	Map projects to business strategy	4	Ordinal	P31
	Model alternative project portfolios	4	Ordinal	P32
	Establish a process for optimising the project portfolio	4	Ordinal	P33
	Analyse and present projects that are above criteria for approval before commencing the projects	4	Ordinal	P34
	Establish a quality process to verify information presented in business cases	4	Ordinal	P35

Table 1 continued

4. Project Portfolio Planning and Prioritization	Provide enough resources to make project portfolio achievable	4	Ordinal	P41
	Create plans from a portfolio perspective	4	Ordinal	P42
	Validate project estimates with detailed task plans and budgets	4	Ordinal	P43
	Review and validate project and portfolio	4	Ordinal	P44
	Assess dependencies with other projects in the portfolio	4	Ordinal	P45
5. Project portfolio management and control	Monitor project performance	4	Ordinal	P51
	Summarise and present project performance data to senior management in an executive dashboard	4	Ordinal	P52
	Balance resources capacity and demand actively	4	Ordinal	P53
	Undertake portfolio review and replanning	4	Ordinal	P54
	Review project alignment with strategy periodically	4	Ordinal	P55
	Check project portfolio against shifting business, technology and market conditions	4	Ordinal	P56
	Optimise project portfolio to lead changes	4	Ordinal	P57
	Use a tool that easily accessible to assess the quality of portfolio status in real time	4	Ordinal	P58

Research analysis

The results of the survey analysis produced by OVERALS are demonstrated in Table 2. The fit and loss values show how well this form of analysis fits the optimally quantified data with respect to the association between sets (Meulman & Heiser 2012). Loss values indicated the percentage of variation in object scores that were not explained by the current model (Garson 2012). Whereas the average loss values of the two dimensions are 0.178 and 0.201, respectively, the average loss over sets is 0.379. This indicated the average loss or the difference between the perfect and the modelled relationship.

Table 2 The compliance values of the analysis

		Dimension		Sum
		1	2	
Loss	Set 1	0.178	0.452	0.630
	Set 2	0.047	0.064	0.111
	Set 3	0.531	0.274	0.804
	Set 4	0.067	0.116	0.183
	Set 5	0.066	0.100	0.166
	Mean	0.178	0.201	0.379
Eigenvalue		0.822	0.799	
Fit				1.621

The eigenvalue in each dimension represents the value of 1 minus the average loss of the dimension, as shown in Table 2. The percentage of actual fit of the dimension can be determined by the value of eigenvalue over the fit value in the "Sum" column, that is, the actual fit among the sets of variables in the first dimension is 0.822/1.621 = 50.7%. The maximum potential relationship over sets associated with the current model can be calculated by dividing the fit value by the total dimensions. The analysis shows that the maximum potential relationship of the current model is 1.621/2 = 81.05%. Canonical correlations of the first and second dimensions were calculated as 0.78 and 0.75, respectively. The correlation values suggest strong relationships between the portfolio size and PPM practices. These correlations (ρ) of more than two data sets per dimension were obtained from the given formula below:

$$\rho d = [(K \times E_d) - 1/(K-1)]$$

where d is the dimension number, E is the eigenvalue, and K is the number of sets.

The loading of all variables is displayed in Table 3.

Table 3 OVERALS component loadings

Set		Dimension	
		1	2
1	P1: Portfolio size	0.246	**0.514**
2	P21: List current project status	0.159	0.058
	P22: Organize projects in categories	0.208	0.448
	P23: Document information about available resources, roles, costs and skills required	0.558	**0.664**
	P24: Calculate expected business value of projects (e.g. NPV, IRR)	–0.011	0.290
	P25: Calculate project risk levels	**0.961**	0.111
	P26: Identify inter-project dependencies and conflicts	0.902	–0.355
	P27: Establish a central repository to capture all project information	0.334	0.292

Table 3 continued

3	P31: Map projects to business strategy	0.398	**0.734**
	P32: Model alternative project portfolios	0.565	0.517
	P33: Establish a process for optimising the project portfolio	**0.667**	–0.065
	P34: Analyse and present projects that are above criteria for approval before commencing the projects	.232	.493
	P35: Establish a quality process to verify information presented in business cases	0.551	0.643
4	P41: Provide enough resources to make project portfolio achievable	0.196	0.038
	P42: Create plans from a portfolio perspective	0.207	0.032
	P43: Validate project estimates with detailed task plans and budgets	0.244	0.363
	P44: Review and validate project and portfolio	0.567	**0.759**
	P45: Assess dependencies with other projects in the portfolio	**1.092**	–0.551
5	P51: Monitor project performance	0.275	0.384
	P52: Summarize and present project performance data to senior management in an executive dashboard	0.090	0.196
	P53: Balance resources capacity and demand actively	0.286	0.578
	P54: Undertake portfolio review and replanning	0.348	0.505
	P55: Review project alignment with strategy periodically	**0.384**	0.335
	P56: Check project portfolio against shifting business, technology and market conditions	0.246	0.448
	P57: Optimize project portfolio to lead changes	0.375	**0.693**
	P58: Use a tool that is easily accessible to assess the quality of portfolio status in real time	0.328	0.290

As seen in Table 3, the values listed in each dimension indicate correlations between object scores and optimal scaled variables. The two-dimensional component loadings are plotted in Figure 3. The ratio of distances from the origin to each variable in the component loadings is the ratio of importance of the variables (Garson 2012). When there is no lost data, the component loadings perform closely to Pearson correlations. As seen in Figure 3, the component loadings indicated that *Calculate project risk levels (P25)*, *Identify inter-project dependencies and conflicts (P26)*, *Map projects to business strategy (P31)*, *Review and validate project and portfolio (P44)*, and *Assess dependencies with other projects in the portfolio (P45)* were the most effective variables in relationship among variable sets as they were plotted in the distance from the origin. On the other hand, *List current project status (P21)*, *Calculate expected business value of projects (P24)*, *Provide enough resources to make project portfolio achievable (P41)*, *Create plans from a portfolio perspective (P42)* and *Summarize and Present project performance data to senior management in an executive dashboard (P52)*, which clustered around the origin, were the least effective variables.

The examination of the relationships between the organisational portfolio sizes and PPM practices found that Analyse and present projects that are above criteria for approval before commencing the projects (P34) and Balance resources capacity and demand actively (P53) were positioned in proximity to Portfolio size (P1). The Portfolio size (P1) was also surrounded by

Organize projects in categories (P22), Undertake portfolio review and replanning (P54), and Use a tool that is easily accessible to assess the quality of portfolio status in real time (P56).

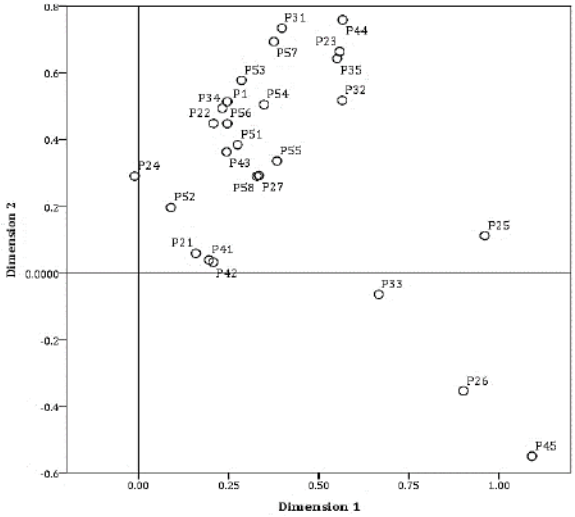

Figure 3 Two-dimensional component loadings

A plot of centroids was labelled according to the categories of the variables. The plot allows a close examination of the relationships between variables through clusters of categories, as shown in Figure 4.

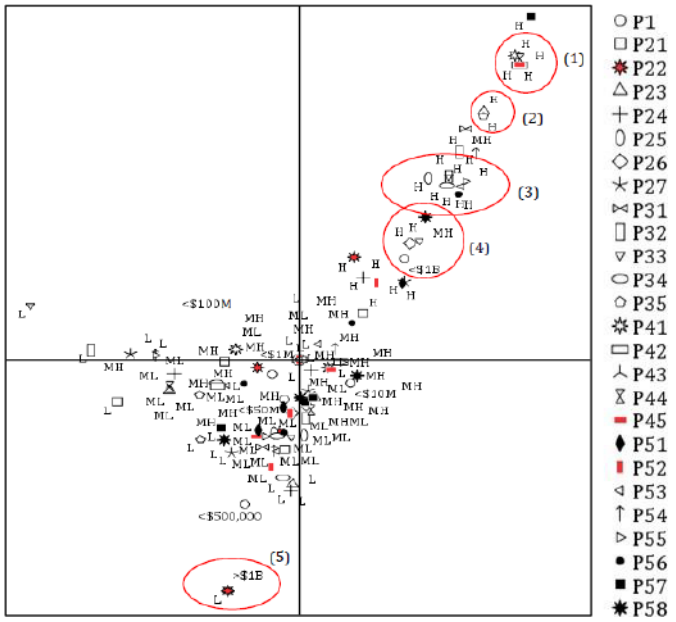

Figure 4 Centroids plot

It is evident in Figure 4 that the first group of association (1) presents an effective formation of relationships at the high level of PPM practices between *Establish a process for optimizing the project portfolio (P33)*, *Provide enough resources to make project portfolio achievable (P41)*, *Create plans from a portfolio perspective (P42)* and *Assess dependencies with other projects in the portfolio (P45)*. These relationships are also intimately connected to the high level of *Optimize project portfolio to lead changes (P57)*. The second effective formation (2) of PPM practices was between the high level of *Document information about available resources, roles,*

costs and skills required (P23) and *Establish a quality process to verify information presented in business cases (P35)*. The third group (3) contained high PPM practices of *Calculate project risk levels (P25)*, *Model alternative project portfolios (P32)*, *Establish a process for optimizing the project portfolio (P33)*, *Analyse and present projects that are above criteria for approval before commencing the projects (P34)*, *Balance resources capacity and demand actively (P53)*, *Review project alignment with strategy periodically (P55)* and *Check project portfolio against shifting business, technology and market conditions (P56)*. They were firmly positioned next to the high level of *Undertake portfolio review and replanning (P54)*. The last effective group (4) within the top right corner was formed between high practices of *Identify inter-project dependencies and conflicts (P26)* and *Establish a process for optimising the project portfolio (P33)*, which closely positioned to the organisation portfolio with AU$100 million to AU$1 billion.

The study also found that the centroids plot demonstrates the relationship between low performance in *Organize projects in categories (P22)* commonly occurred to the portfolio size greater than AU$ 1 billion. The portfolio sizes less than AU$500,000, positioned in the lower left quadrant, and less than AU$100 million had no close relationship to any specific categories of PPM practice variables. On the other hand, the portfolio sizes greater than AU$10 million and AU$50 million strongly formed relationships with several medium-low to medium-high performance in PPM practices.

Conclusion

This research provides significant findings for the implementation of portfolio management to assist organisations with the adoption of PPM for the holistic management of organisational investment, strategic growth and the management of benefits realisation. It provides a further understanding of the association between portfolio sizes and practices of PPM to assisting organisations select practices suitable for the size of the portfolio. The research findings were carefully analysed and briefly explained, with supporting graphs presented. This paper applied the nonlinear canonical analysis or OVERALS to visualise and examine the relationships between the PPM practice variables and the formation of the variable categories using graphical presentations. Twenty-six variables of identified industry practices were grouped into five phases of PPM implementation. Each dataset was treated for any missing data and coded into the SPSS OVERALS tool. The results showed an association between different sizes of portfolio and levels of PPM practices. However, the formation of PPM practices around the portfolio sizes was found to be diverse. The medium-low to medium-high levels of several PPM practices were performed in the portfolios valued from AU$1 million to AU$100 million. On the other hand, the disintegration of PPM practices was evident in the portfolios from AU$ 1 billion and greater. These results may align with the findings published in the *PMI's Pulse of the Profession* 2017 that PPM implementation is still facing a challenge of bridging the gap between strategy formulation and day-to-day implementation. A recommendation for future research is to investigate the causes and effects of disintegration between portfolio sizes and PPM practices from holistic and industry-specific perspectives.

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CONFERENCE PAPER

Investigating coal-mining expenditure projects to increase investment value

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Synopsis

Anecdotal evidence from stakeholders in the Australian coal-mining industry suggests that there are shortcomings in the outcomes of expenditure projects involving the inability of current practices and processes to deliver the intended investment value and benefit to the business. This problem appears to extend across a wide range of capital and operational expenditure portfolios, from small operational projects to major capital investments, with investment value and benefits being diminished by poor management and definition of project requirements.

Research design

The research is based on the exploratory sequential mixed method.

DECLARATION OF CONFLICTING INTEREST The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. **FUNDING** The author(s) received no financial support for the research, authorship, and/or publication of this article.

Relevance for practice and education

This paper explores the background to this problem and outlines a proposed methodology for a research project to provide an appropriate framework for a methodology to improve project outcomes in the Australian coal-mining industry.

Main findings

The research paper identifies existing research in the relevant domains and highlights the lack of direct research that links these concepts together and specifically relates them to requirements management in the Australian coal-mining industry.

Research implications

Management of the project value to deliver the project potential value or benefit to operations in the project delivery phases are possible implications of this research..

Keywords

Benefits management, Requirements Management, Value Management, Project Management, Coal Mining

Background of the research problem

The Australian coal-mining capital expenditure investment has been significantly reduced since 2012 and is expected to decline further (RBA 2016). This reduction in capital investment highlights the importance of maximizing the value of project outcomes and eliminating project shortcomings and failures in an environment where reduced funding is available to achieve the strategic objectives of the client coal-mining organization. In terms of project failures, Ernst & Young (EY 2015, p. 3) identified that "every overrun impacts total shareholder return, ROCE [return on capital employed], capital productivity, corporate performance and strategic outcomes." Maximizing project value is essential in order to achieve capital productivity, which is defined as "a measure of the effectiveness and efficiency of capital investments in generating operational outputs" (EY 2015, p. 5). In short, capital productivity assesses "value for money" on a multibillion-dollar scale (EY 2015, p. 5), with the intent to achieve more with less through a minimal payback period and a high Net Present Value (NPV).

Observations from the author over an extended period from stakeholders in the Australian coal-mining industry provide anecdotal evidence that there are shortcomings in the outcomes of expenditure projects that are eroding the potential project and investment value and that many of the issues can be traced back to the respective stages of requirements management. This problem appears to extend across a wide range of capital and operational expenditure portfolios in the coal-mining industry, from small operational projects to major capital investments.

Analytical framework

To research this perceived problem, a preliminary analytical framework was developed and is shown in figure 1. The framework consists of three core elements:

1. Determination of project requirements from the business strategy and objectives
2. Management of the project requirements in the portfolio management and project delivery phases of the project life cycle
3. Management of the project value to deliver the project potential value/benefit to operations in the project delivery phases of the project life cycle

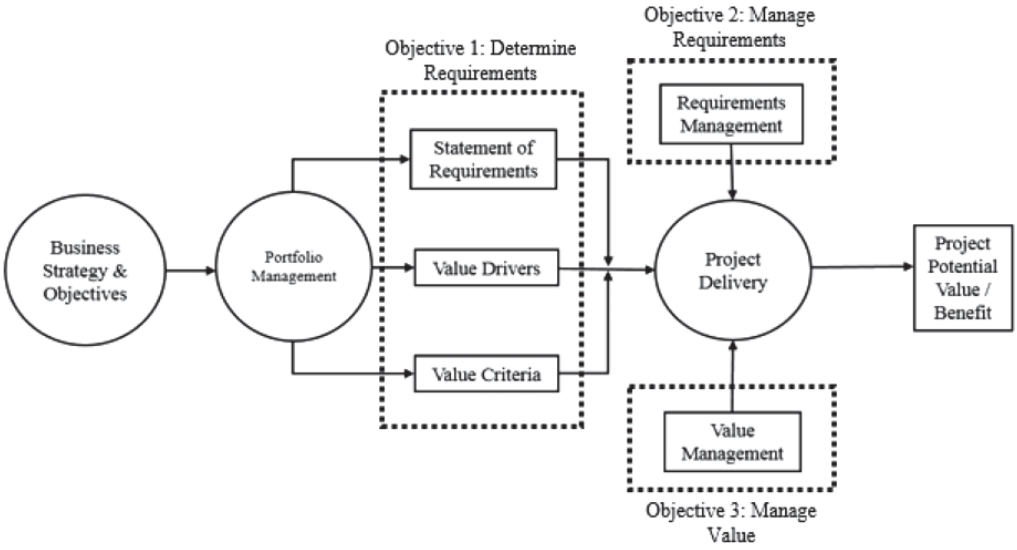

Figure 1 Analytical framework. Source: developed by the author for this paper

Based on the framework, four domains have been identified for carrying out the literature review:

1. Project management practices and methodologies – the first domain deals with project management practices and methodologies used for project delivery in the coal-mining industry. Project management practices and methodologies are concerned with the systems, procedures, controls and processes used across the project life cycle, and are potentially related to the project success or failure. They also determine the approach to defining sponsor requirements in the initial stages of the project.
2. Requirements management – the second domain is requirements management, which is related to the identification, recording and management of project requirements from key stakeholders for capital projects in the coal-mining industry, as well as their possible effect on project outcomes.
3. Value management – the third domain is value management and is concerned with managing the value requirements, benefits and outcomes of the project throughout the life cycle.
4. Coal-mining project overruns – the fourth domain covers capital and operational investment in the coal-mining industry and the occurrence of project overruns.

Literature review

PROJECT MANAGEMENT PRACTICES AND METHODOLOGIES

Project management practices and methodologies in the mining industry appear to be well established with mature procedures, manuals and guidelines (Wittig 2014). A study by Steffen, Couchman & Gillespie (2008, p. 3) indicated that "several of Australia's coal-mining companies have robust capital project management processes in place, and some of these organizations have moved further to the forefront of world's best practice over the past few years as they look to manage larger project portfolios in a time of volatile market conditions."

In spite of these views, other research indicates that project management factors do contribute to project cost and schedule overruns in the mining industry (EY 2015), with anecdotal reports suggesting that inappropriate project management practices and methodologies may be occurring in coal-mining capital projects with many large mining projects experiencing cost and schedule overruns. Findings from the literature review indicate that there has been significant research into project management methodologies in the construction and engineering sectors (Chan, Scott & Chan 2004; Hundertmark, Olinto do Valle Silva & Shulman 2008; Ling 2004; Mahmoud-Jouini, Midler & Garel 2004; Öztaş & Ökmen 2004), but few, if any, related to Australian coal-mining capital projects.

VALUE MANAGEMENT

Value management is the strategic process implemented to harness the value opportunity and should examine all options of the project, which include the social, political, economic and environmental impacts, and develop benchmarks for future decision-making (Hayles, Graham & Fong 2010), with the benefits of the project associated with the performance of an organization (Chih & Zwikael 2015). In a market review, Deloitte (2013, p. 22) stated that "mining companies fail to capture the full value potential that a mining project can offer, either due to the fact that they don't know what that full potential is (lack of knowledge/ expertise) or because they refuse to undertake activities, no matter how value-accretive they are, that deviate from their expertise (ego and pride)" and that "success is more than simply delivering a project on time and on budget." The use of value management in the early stages of the briefing process can assist in optimizing the project outcomes (Yu et al. 2005) and is an essential factor in achieving quality engineering planning (Park & Kwon 2011). However, Bowen, Edwards et al. (2010) established that consulting engineers in South Africa, although aware of value management, do not undertake value management to any significant extent and that there are insufficient training material and programs in the value management education field (Fong 2004). Research by Martinsuo & Killen (2014, p. 66) into value management in project portfolios revealed that "project portfolios may have strategic value beyond financial benefits, but such value is not sufficiently accounted for in project portfolio evaluation frameworks and decision makers' collective sense-making." There is evidence of some research in value management in the construction and engineering industries (Bowen, Cattell et al. 2010; Bowen, Edwards et al. 2010; Cha & O'Connor 2005; Fan, Shen & Luo 2010; Maniak et al. 2014; Park & Kwon 2011; Shen & Liu 2004; Yannou & Bigand 2004; Yu et al. 2005); however, there appears to be minimal research in the general mining area, nor is there any specifically in the Australian coal-mining industry.

REQUIREMENTS MANAGEMENT

A study by KPMG (2013) revealed that 79% of respondents feel that change in project scope/design leads to project schedule overruns in the execution phase in Indian infrastructure projects. (Yang, Chen & Wang 2015) state that "requirements management is crucial to the successful delivery of construction projects," with a major cause of project failure being inadequate requirements management, and that enhanced project outcomes are achievable with better documentation of project requirements. Furthermore, poor systematic processes for the stakeholder identification and requirements management are linked to schedule and cost overruns (Aapaoja & Haapasalo 2014). It has also been established that there is an issue with the management of client requirement information throughout the project life cycle in the construction industry (Karim Jallow et al. 2014). Lopes and Forster (2013, p. 142) acknowledged problems "such as imprecise plans, loss of information and information recorded in ambiguous or incomplete form" are related to requirements management and can lead to cost overruns.

Delays in the South African coal industry include delays caused by too many owner changes (Lee 2012). Similarly, in the building and infrastructure construction industry, multiple changes in owners' requirements or definitions have been determined as a root cause of cost overruns (Rosenfeld 2014). A study by Smith (2014, p. 5) determined that "47% of unsuccessful projects fail to meet goals due to poor requirements management," and this highlights the potential value opportunity for improved requirements management in the Australian coal-mining industry.

There are strong overlaps between coal-mining projects and the construction industry with similar procurement and contractual processes used to execute capital projects in the coal-mining sector. Lee (2012) provides a good illustration of the overlap between the construction industry and the South African coal industry, where there are multiple similar causes of project delays. In Australia, major construction contractors in the coal-mining sector include Bechtel who are a global construction company and which delivered the new Daunia and Caval Ridge coal mines in Queensland (Bechtel 2016). The TMM Group has delivered projects in the coal-mining sector, including the Baralaba North Coal Mine levee and associated site infrastructure in 2013–2014 for Cockatoo Coal (TMM 2016). The links between the mining and construction sectors confirm the growing perception that requirements management is not being successfully implemented in coal-mining projects, leading to shortcomings in project value and benefits. A lack of literature relating to requirements management in coal-mining industry capital projects confirms the need for further research in this area.

COAL-MINING PROJECT OVERRUNS

Research by Singh (2010) provides evidence of overruns in the coal industry in India, with over 60% of projects having a schedule overrun and over 20% having a cost overrun. The 2013 Major Projects Report Queensland Engineering Construction Outlook (Hart et al. 2013) highlights that many projects have experienced large cost overruns in the resources sector. The EY (2015, p. 3) study "revealed that overruns to the sanctioned budget and schedule commitments are the norm with our global mega-project sample group showing an average budget overrun of a staggering 62%" in the global mining sector. There is anecdotal evidence that the mining industry globally has cost and schedule overruns, and this is supported by research by Lee (2012) into project delays in the South African coal sector. However, there is

no recent or relevant literature on the actual extent of schedule and cost overruns occurring in Australian coal-mining capital projects.

Further research

This research investigation is currently being undertaken as part of doctoral studies with an Australian university. The research problem has been identified based on personal experience and observations of the principal author, and the research questions have been derived in order find a solution to the problem. Undertaking this research project is intended to provide an improved conceptual framework for the management of coal-mining projects in Australia, which in turn will lead to improved project outcomes across a range of quantitative and qualitative dimensions. It is anticipated that many of the dimensions of this problem relate to poor requirements management throughout the project, and this will be confirmed or disconfirmed as a result of this research project. Given the small number of large coal-mining projects currently under construction, the project will primarily involve investigation of case studies to gain the relevant insights into the problem, as well as possible solutions.

Research method

This research project will use exploratory sequential design with three phases. The first phase of the study collected qualitative data to gain information and insights into what stakeholders perceive as "value"; its importance; the metrics used to determine, measure and assess it; and how project management practices and methodologies align to achieve this intended "value." The study will use semi-structured interviews involving a minimum of six and a maximum of ten experienced stakeholders from mining companies and construction contractors operating in Queensland and New South Wales. Recent anecdotal feedback received from industry indicates that issues leading to project value erosion include design changes (due to omissions, inadequate, incorrect project solutions), specification changes, poorly defined scope and specification, stakeholder changes and constructability issues. These issues will be included in the topics to be explored during stage 1 interviews.

The results of the first phase will inform the second phase by providing a better picture of the requirements and value management variables. They will be explored through a broader-based survey instrument that will be sent to approximately 200 stakeholders in the sector, targeting a wide cross-section of the industry of key stakeholders in the Australian coal-mining industry. The third phase of the study will develop a draft framework to address the research problem, and this will be evaluated through a series of focus groups with key stakeholders. The population for this research is coal-mining companies, consultants and construction contractors operating in Queensland and New South Wales.

Scope of project and challenges and limitations

The scope of this research is limited to expenditure projects undertaken by coal-mining companies and delivered by construction contractors working in the Queensland and New South Wales coal sector. This research is concerned with the perceived failure of expenditure projects to deliver the potential value of the project to the sponsor.

Challenges anticipated include the availability of company documentation due to disclosure and privacy concerns. It is recognized that detailed project information, including costs, schedules and project data, are unlikely to be available due to sensitivity issues;

however, the research methodology for this study has taken into account the absence of such project information, and this will not detract from the intended research outcomes. Typical documentation that will provide benefit to the study includes project standards, guidelines and procedures. There may also be challenges in gaining access to coal-mining company personnel due to availability and willingness to reveal information. Another issue that might occur is achieving adequate responses from the survey as, historically, surveys achieve low response rates within the industry.

Validity

Qualitative validity will be completed by applying a member checking approach in stage 3, where the findings will be summarized and presented to the stage 1 focus group to confirm the accuracy of the results. The quantitative validity will be achieved by using a construct validity process where the results are reviewed against the research problem to verify that the intended aims have been measured.

Aim of the research

This research will provide five key contributions:

1. Determining whether the intended project value and benefits are being achieved in Australian coal-mining projects
2. Ascertaining the predominant reasons for any failure to achieve the intended project value and benefits
3. Determining whether, and to what extent, the investment value and benefits are being lost due to poor management of project requirements in expenditure projects
4. Providing a framework that leads to better management of project requirements in the coal-mining industry, to achieve the intended value and benefits
5. Enabling the above-mentioned framework to be transposed to other areas of the coal-mining industry, including mine planning process and operational planning, where requirements are the basis to achieve value and benefit to the mine site in order to deliver revenue to the business. The framework may also provide benefit to other sectors outside coal mining, for example the public infrastructure, engineering and construction industries, as the broad principles may be applicable.

Conclusion

This paper has outlined the literature review, proposed methodology and the contribution to research for the perceived problem of shortcomings in the outcomes of expenditure projects that are eroding the potential project and investment value of those investments. The findings from the literature review have identified that existing research in the relevant domains has highlighted the lack of direct research that links these concepts together and specifically relates to requirements management in the Australian coal-mining industry.

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CONFERENCE PAPER

A social network framework for stakeholder engagement analysis

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Synopsis

In this paper, we develop a social network–based framework for the analysis of stakeholder engagement relationships. We demonstrate that senior stakeholders identified by traditional models such as the Salience Model are not necessarily "commanders," as shown by the social network model, as far as engagement (operationalized as "problem solving") is concerned. We discuss several implications of our model at the theoretical level for contribution to project management science and at the practical level for the application of the model.

Research design

Demographic, social network and attitudinal data were collected from employees of an Australian telecommunications company. Using a sociocentric approach, respondents were asked to rate their degree of influence and interest in the project as a stakeholder and nominate team members whom they had interacted with for problem-solving purposes. As well as the self-reported rating of influence and interest described above, a measure of a stakeholder's influence and interest from the perspective of others is collected.

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Relevance for practice and education

This case demonstrates the value of social network theory and analytics for identifying key stakeholders and understanding how to engage them through the perspective of the stakeholder networks they are embedded in.

Main findings

Comparing the traditional project management (PM) model and the social network (SN) model for stakeholder analysis, the former is useful in the initiation and planning phases of project whereas the latter is useful mainly in the project execution phase, where significant problem solving occurs, and team members have to settle in and work on significant phases of the project.

The PM model is useful as a way to navigate the organizational hierarchy. The SN model, however, helps to identify those who hold high organizational authority, salience, currency and influence in the project.

Research Implications

Combining both models together with social network metrics that allow for statistical testing and association with project team and project outcomes appears to be promising, giving a richer, more complete picture of stakeholder identification, engagement and analysis in both the formal and informal networks.

Keywords

Social Network Analysis, Stakeholder Engagement, Stakeholder Management, Stakeholder Analysis, Salience Model

Introduction

At the launch of the *Pulse of the Profession®* report in Sydney in February 2017, the Project Management Institute President and CEO, Mark Langley, stated "Commitment from top executives and clear communication between project team members (horizontally) and between executive management (vertically) is absolutely crucial and *the* most important success factor for successful projects" (Langley 2017). Stakeholder management – the process of identifying stakeholders, aligning them with project objectives and organizational strategy, prioritizing them and constantly engaging with them – is an important, albeit latterly recognized, knowledge area in the PM Body of Knowledge (PMBOK) Guide of 2013 (PMI 2013).

In a previous paper, Chung and Crawford (2015, 2016) discuss limitations with current project management models for analysing stakeholder engagement. In particular, they critique the salience model (Mitchell, Agle & Wood 1997) on a number of grounds. First, the model is useful for identification and mapping of stakeholders, but not for the *analysis* of stakeholder engagement. Second, it is fairly static in that it labels stakeholders based on attributes such as power, legitimacy, influence, interest and salience. Third, while it provides a mapping and identification mechanism of stakeholders in the beginning phases of a project, it does not delineate engagement in terms of relationships in the form of influence, behaviour,

information flow, advice seeking and how work actually gets done. In other words, it does not capture "organic" relationships embedded within social networks – the very essence and platform of stakeholder engagement.

Given these limitations, Chung and Crawford (2016) propose the need for the social network model (SNM) in order to realistically analyse stakeholder engagement in a number of forms – be they collaboration, advice seeking, information providing, socializing and so on. In that paper, they also discuss at length the social network theories upon which the constructs for the model had been developed. In this paper, we demonstrate using empirical data based on a small telecommunications company in Tasmania, Australia, and how the model may be applied as one particular form of stakeholder engagement – problem-solving. In the following section, we provide a brief overview of the SNM for analysing and understanding stakeholder engagement.

Social network model for analysis of stakeholder engagement: conceptual foundations

In the management and organizational studies literature, the first and perhaps only study that suggested the use of a network approach as an alternative analytic stakeholder management approach is by Timothy Rowley (1997). Rowley suggests the need for moving beyond the dyadic ties analysis that was recurrent in most of the contemporary stakeholder management approaches. In essence, he mapped multiple and interdependent interactions that simultaneously exist in stakeholder environments, thus holistically capturing the complex nature of stakeholder interactions for both the focal organization and its stakeholders and its stakeholders' stakeholders. Rowley also theorized that how stakeholders affect the focal organization and how the focal organization responds to these influences depends on the network of stakeholders surrounding the relationship.

In order to do this, Rowley used the notion of density and (betweenness) centrality as key factors for stakeholder analysis. Although stakeholder network density indicates the nature of coalitions or shared behaviour, thus increasing the power of stakeholders to pressure or govern expectations of the focal organization, the centrality of the focal organization confers power in its ability to resist stakeholder pressures. In effect, Rowley (1997) proposes a four-way structural classification of stakeholder influences accounting for organizational responses to stakeholder pressures, shown in Table 1:

Table 1 Structural classification of stakeholder influence

Density of the Stakeholder Network (DSM)	Centrality of the Focal Organization (CFO)	
	High	Low
High	Compromiser	Subordinate
Low	Commander	Solitarian

Source: Rowley 1997, pp. 901

- **Compromiser:** When the density of the stakeholder network (DSN) and the centrality of the focal organization (CFO) are high, it means that the high DSN facilitates stakeholder problem-solving and coordination to form an influential collective force. However, because the CFO is also high, it can influence the formation of expectations.

Therefore, the strategy here would be to pacify and balance expectations with a view to creating win–win situations.

- **Commander:** When DSN is low, it means that stakeholders are rather sparse or isolated, leaving them in a position where they do not communicate or collaborate with each other so as to form a coalition. Coupled with the high CFO, it means the focal organization is now in a commanding position to stipulate expectations and exercise high levels of discretion.
- **Subordinate:** The reverse of the "commander" scenario applies here, as the CFO is low and the DSM is high. This means stakeholders enjoy a power advantage and have higher access to information flows, leaving the focal organization no choice but to accede stakeholder expectations and pressure.
- **Solitarian:** In this scenario, there is low CFO and low DSN. Neither the focal organization nor its stakeholders are well connected, and therefore the power difference remains trivial. Information flow is impeded in such a scenario.

Although Rowley's network theory on stakeholder management is indeed valuable, there are several issues both at the operational and pragmatic level that need to be considered. For instance, how would one operationalize the constructs of high–low density and high–low centrality? Is it possible to conduct similar analyses at the micro-levels of the organization and stakeholder networks? Organizations comprise departments, groups and individuals, and this is similar to stakeholders (e.g. communities, local councils, suppliers, etc.) as well. Furthermore, when considering projects and project organizations, it becomes even more complicated at the micro-level. One particular project may be deemed as the focal organization in such analysis, but in reality, it is actually relationships between people within those projects that constitute the unit of analysis. Determining the centrality of these relationships and capturing the stakeholders themselves as individuals or groups, for instance, is overlooked in Rowley's classification, as it is much more fine-grained. Furthermore, how does one build on Rowley's stakeholder framework in the context of project management where stakeholders are at times ad hoc in nature and are only relevant for the duration of the project?

To address some of these issues, we now illustrate the operationalization of the SSM with empirical data collected from a small- to medium-sized enterprise (SME) engaged in information communications technology (ICT) project work.

Methodology

The context of our study is a small ICT company (referred to as "ACME Telco" thereafter) based in Tasmania, Australia, that was established in 2008 when the founders saw a gap in the market for quality Internet services provision, particularly a need for service-focused providers who were more pragmatic and willing to partner and grow with businesses, and play the role of a trusted business advisor. Since then, ACME Telco grew significantly in operations and now works with over 100 SMEs in Australia across all industries. Employing 31 employees at the time of writing this paper, ACME Telco's primary objective is to maintain the utmost levels of service for their customers and strive to place the local Telco company at the forefront of internet and cloud services within the ICT industry. This company was selected for the research study as they were in the process of announcing company structure changes that would impact all teams. The deployment of the structural changes provided an opportunity for the research study to review the pre-and post-deployment impacts to change and stakeholder management in projects.

Demographic and social network data collection

Ethics application was successfully obtained for this study. For the purpose of demonstrating our social network framework for analysing stakeholder engagement, we restricted our analysis to only internal stakeholders (i.e. the employees), although in reality external agencies can and should be included as well. All 31 employees, including team members, team leaders and business unit managers in ACME Telco, were invited to participate in an online survey in September 2016 which closed a month after. With support from top management, a total of 27 employees responded, achieving a response rate of 87%.

Demographic items in the survey included gender, birth year, highest level of education, role in ACME Telco, years worked and department. Respondents were also asked to consider the most recent project they were involved in and to rate themselves on a scale of 1 (low) to 5 (high) on their degree of (i) influence and (ii) interest in the project as a stakeholder.

The second section of the survey pertained to social network data. As the entire list of the employee names was available, a sociocentric approach (Chung, Hossain & Davis 2005) was utilized, where each respondent was asked if he or she had communicated with the other employees in the list. Using the following name generator, a problem-solving network of each respondent was elicited:

"Looking over the past three months, please tell us who you have you interacted with for problem-solving matters in your project work."

Respondents could then choose the name of the person they had interacted with, followed by another set of questions which elicited the strength and nature of the relationship. This included frequency of the interaction (daily to quarterly) and emotional closeness (ranging from "not close at all" to "very close"). Respondents were then asked to rate the degree to which each person they nominated had influence and interest in the project as a stakeholder. Unlike the self-reported rating of influence and interest described above, this provides a measure of the person's stakeholder influence and interest from the perspective of others.

As each respondent completed his or her survey, we could obtain a whole problem-solving network (sociogram) of the organization. Even though there were five respondents who did not participate in the survey, others have nominated them during the name generator component of the problem-solving network question. Therefore, all 31 employees appear in the sociogram. Rather than names, unique IDs were used for all employees to preserve their anonymity, privacy and confidentiality.

Measures

SOCIAL NETWORK MEASURES: BETWEENNESS CENTRALITY AND EGO-DENSITY

To operationalize the model proposed above, we used betweenness centrality and ego-density. In graph theoretical terms, betweenness centrality measures the extent to which a node (person) lies in between the shortest path of all other nodes (persons) in the network. Mathematically, it is expressed as the ratio of the number of shortest paths between two nodes passing through a particular node over the total number of shortest paths from one node to the other. Therefore, it is a number between zero and one. High betweenness centrality means more information will flow through that node. Hence, it will have more control over the network and is more likely to be the information broker or bottleneck of the network. The mathematical expression for betweenness centrality is:

$$b(i) = \sum_{j,k} \frac{g_{jik}}{g_{jk}}$$

where g_{jik} is the number of shortest paths from node j to node k ($j, k \neq i$), and $gjik$ is the shortest paths from node j to node k passing through node i.

Density or ego-density, in this case, is calculated as the ratio of the actual number of ties over the maximum possible number of ties in the network. The higher the density, the more members in the network connecting with one another. From an egocentric perspective, ego density represents how densely other nodes that one specific ego communicates with are connected. An ego density of 1 means all members that the ego communicates with are connected with one another, which forms a clique. The mathematical expression for ego density is:

In order to produce the cut points and then form the grids in Table 1, we utilized the median scores of betweenness and density, as both variables were not normally distributed.

INTEREST AND INFLUENCE MEASURES

To operationalize *interest* and *influence*, we considered the average of all ratings from others, rather than the self-reported ratings, to keep the measures of interest and influence objective. The ranges of the x- and y-axes were then determined by the minimums and maximums of the variables – interest and power. Because both samples are normally distributed, means of interest and power rated by others were chosen to be the cut points for the x- and y-axes, respectively, in order to produce the grids in the graph that depicts the PM model. The process of data analysis is captured in the following flowchart (Figure 1).

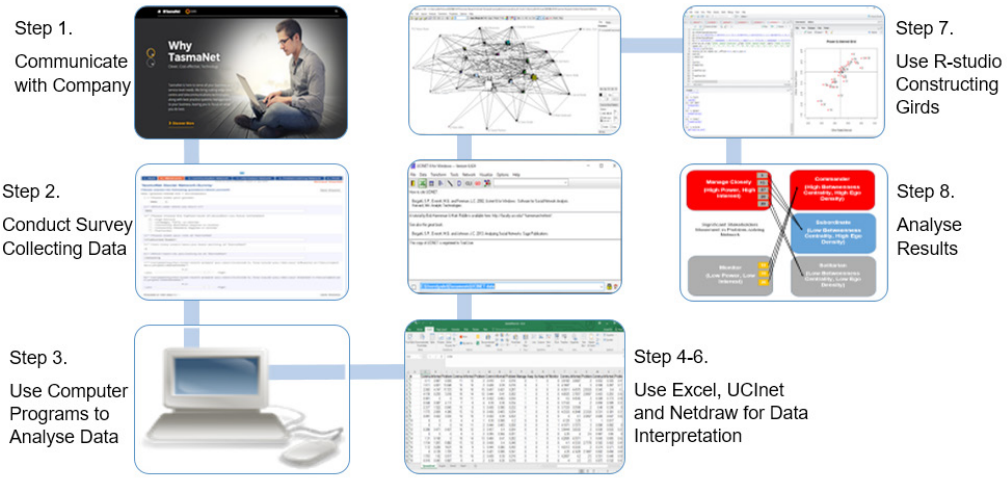

Figure 1 Process of data collection, extraction and analysis

Results

PM MODEL VERSUS THE NETWORKS MODEL FOR STAKEHOLDER IDENTIFICATION AND ENGAGEMENT ANALYSIS

For the power (influence) and interest grid (see Figure 2), the mean scores for interest and power are 3.72 and 3.34, respectively (scale of 1–5). Results are summarized as follows:

- 12 out of 31 members are suggested to be "managed closely" (IDs 3, 4, 5, 6, 8, 9, 13, 15, 24, 27, 28, 29), indicating both high power and interest as stakeholders of the project;
- Five are rated to be "kept satisfied" (IDs 1, 7, 14, 19, 20), which means they are rated to have high power but less interest as stakeholders in the project;
- Three are classified to be kept informed (IDs 2, 17, 23); and,
- 11 of all members should be just monitored (IDs 10, 11, 12, 16, 18, 21, 22, 25, 26, 30, 31) according to the grid.

In addition, there is a very significant and high positive correlation between interest and power according to the data ($r = 0.888$, $p < 0.01$), which means in the opinions of majority employees in the company, a person rated with high interest will most likely also be rated to have high power/influence in the project.

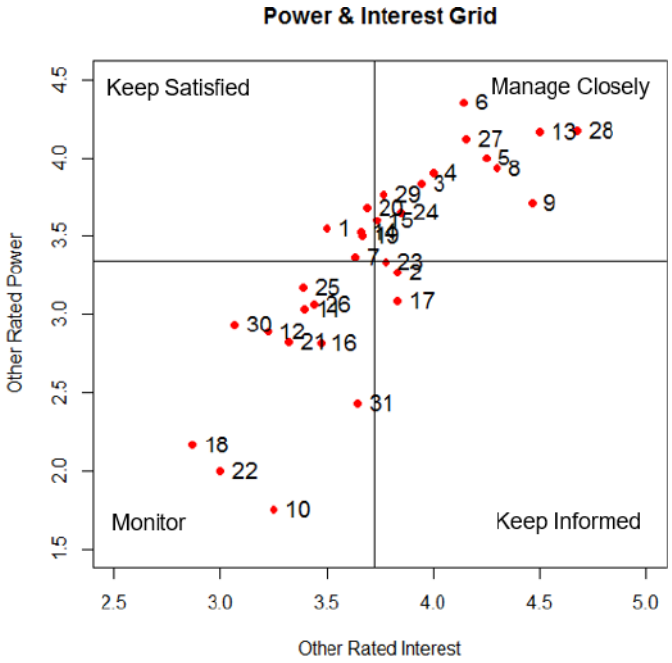

Figure 2 Power (influence) and interest grid (PM model)

On the other hand, according to the betweenness centrality and ego density grid (see Figure 3), the medians for centrality and ego density are 0.1 and 0.42, respectively (out of 1).

- Of the 31 employees, 10 are commanders in the problem-solving network structure (IDs 2, 3, 4, 6, 8, 9, 12, 16, 23, 26), indicating their ability to execute or broker information (Chung & Crawford 2015).
- There were nine subordinates (IDs 5, 7, 11, 13, 18, 20, 25, 27, 30), indicating their dense ego network structure but low centrality in the entire problem-solving network;
- There were five solitarians (IDs 1, 14, 21, 28, 29), indicating that these five employees either do not provide advice or are not asked for advice at all and have low influence in the entire problem-solving network.
- The remaining four are classified as compromisers (IDs 15, 17, 19, 24) – and these are people with moderate density in their advice network while they are also fairly helpful in providing advice for problem-solving.

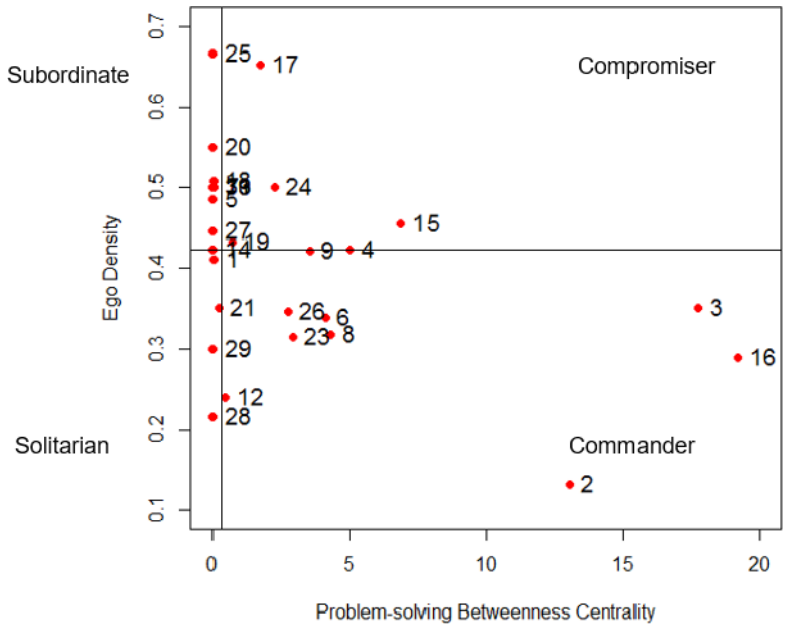

Figure 3 Betweenness centrality and ego-density grid (SN model)

Discussion

Among the four groups in the power and interest grid (project management, or PM, model), members who need to be "managed closely" are more likely to have a significant impact on the project, in contrast with members who are being "monitored", who have both low interest and power. Similarly, in the centrality and ego density grid (social network, or SN, model), information is more likely to flow through members with high betweenness centrality; hence those who have higher centrality in the network are probably more influential.

After comparison, it is obvious that there are differences between the two grids. For instance, employees 5, 13, 27, 28 and 29 have been rated as having both high power and interest and are suggested to be "managed closely" according to the power and interest grid. Of these, 5, 13 and 27 are actually subordinates in the SSM. Numbers 28 and 29 are, in fact, solitarians when it comes to problem-solving. On the other hand, another significant difference is that employees 12, 16 and 26, who have been classified to be in "Monitored" (i.e. low influence/power and low interest), are actually commanders in the problem-solving network, as demonstrated by the SN model.

To visualize the changes of positions between two grids, some of the members with significant shifts who have been mentioned above are depicted in the chart (see Figure 4), showing key movements between the two different classifications of the PM model and the SN model. In fact, only a few of all 31 members are shown to have consistent importance or shown to be less in impact on the project in both grids. Hence, it is reasonable to deduce that managing stakeholders by using only classification models such as the PM models or social network models cannot summarize the complex diversity of stakeholders in the context of a real organization; rather, a more accurate and comprehensive model needs to be proposed to manage stakeholders appropriately.

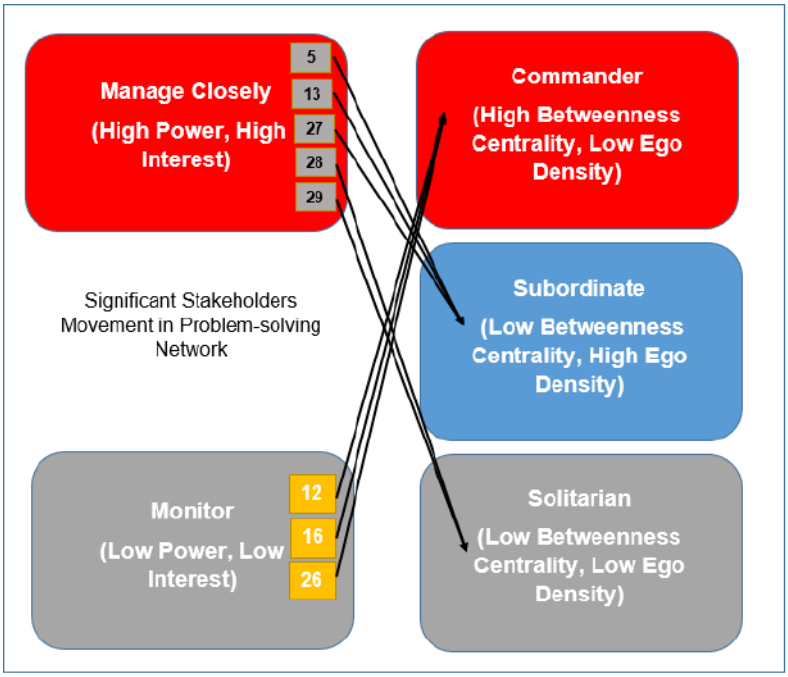

Figure 4 Key movements highlighted between classifications in the PM model and the SN model

To improve the previous two models, Chung and Crawford's model (2016) combines a power and interest grid (PMI 2013) with the SSN. This approach enables the visualization of stakeholder management strategies suggested by a power and interest grid, and attributes data-like roles as well as the relationships between stakeholders. The model utilizes different colours of nodes indicating management strategies, sizes of nodes indicating betweenness centrality and shapes indicating organizations to which stakeholders belong. In addition, tie strength between stakeholders is represented by the thickness of the lines. Combining with social network, relationships between stakeholders can be understood better and are easier to propose proper management approaches.

We do not contend that one model is superior to the other. As stated above, it is useful to form an amalgamation of both models, as there are clear advantages in doing so.

First, the PM model is useful at the outset of the project life cycle – particularly in planning phases. The SN model would not be useful – particularly in the instance of problem-solving networks, where much problem solving of the project has not occurred as yet. The SN model would be useful in the project execution phase, where significant problem solving occurs, and team members have to settle in and work on significant phases of the project.

Second, the PM model is useful as a way to navigate the organizational hierarchy. It does help to identify those who hold high organizational authority, salience, currency and influence in the project. These could be stakeholders who literally hold the highest stakes – ones who could stop or continue to fund the project. The PM model, however, is less useful when one needs to identify how influence occurs, or work really gets done, or who the real commanders and leading groups are within the organization in an informal context. This is where the SN model can address each of these areas.

Combining both models together with the social network metrics that allow for statistical testing and association with the project team and project outcomes appears to be extremely promising. By doing so, one gets a richer and more complete picture of stakeholder identification, engagement and analysis in both the formal and informal networks.

Conclusion

Understanding how to engage with stakeholders and sustaining this engagement remains at the heart of stakeholder management. Contemporary models for stakeholder identification and engagement include the process of mapping stakeholders in terms of their interest or influence and power – which is generally encapsulated by Mitchell et al.'s Salience Model (Mitchell, Agle & Wood 1997). In this paper, we provided a brief overview of stakeholder management literature and models for identifying and analysing stakeholder engagement, discussed the limitations of such models and proposed a social network–inspired model for understanding stakeholder identification and engagement using social network analytics.

We highlight the fact that current PM models do not accurately reflect the significance of stakeholders in terms of influence and power, particularly where crucial information is needed for project work to get done. Our models also show that current PM models are not able to accurately capture those stakeholders who truly need to be "monitored closely." At the same time, we also note that we do not propose that one model is better than the other. We suggest that, although the PM model is better suited to the earlier stages of a project's life cycle and is more suitable for teasing out important stakeholders who are usually in line with organizational and project organization hierarchy, the SN model is more useful in determining *commanders* and *compromisers* of the stakeholder network and in teasing out the informal network structures at play, which is highly valuable for understanding influence, resistance, change championing and opinion-leading behaviour during the life cycle of projects.

In terms of limitations of the study, one of the most serious limitations is the sample size of data. Because the sample size was only 31 respondents from a small Telco, it is difficult to judge the significance of the findings in a generalizable context, as larger sample sizes are generally required for statistical testing. In addition, the scope of the study is limited to an ICT company, and whether the findings can be generalized to other industries requires further research.

This research originated as conceptual and exploratory in nature. Further empirical research is needed to substantiate and evaluate the applicability of the framework in a number of different project contexts and industries. Furthermore, the application of this framework via a case study might be conducted on how a particular organization managed its stakeholders during the different phases of the project; such a study would indeed be valuable. A focus group study or a semi-structured interview with project/program managers might also be conducted to delineate the usefulness of the tool. Operational issues will include the availability of network data, the stakeholders to be included within the scope of the project, a definition of what constitutes a tie and whether the multiplex nature of the tie (i.e. contractual relationships, collaborations, etc.) needs to be considered.

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CONFERENCE PAPER

How does a project-based organization (PBO) scale its business?

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Synopsis

This paper explores how an organization works to balance growth and economies of scale with delivery risk through a longitudinal case study of a project-based organization (PBO) in the construction industry. It concludes that the case organization appears to maximize the project economies of scale while capping project size to ensure manageable delivery risk. The capped limit of project size increases gradually as the organization develops its project delivery capabilities over the years.

Research design

This study is based on a longitudinal case study of a state-owned project development company in China, covering the years 2001 to 2012. The findings draw from archival research and observation. Data triangulation was achieved through multiple data sources, and sequence analysis was then used to organize the longitudinal data.

DECLARATION OF CONFLICTING INTEREST The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. **FUNDING** The author(s) received no financial support for the research, authorship, and/or publication of this article.

Relevance for practice/education

The findings contributed to developing a better understanding of how a PBO might scale its businesses via an empirical case study. This study is meant to be thought provoking and to explore new angles of theorizing.

Main findings

The results suggest that the project's size is limited by project risks and organizational delivery capabilities. However, a PBO can cope with scale changes by chunking jobs into multiple projects and limiting the organization's average project size to a level that the organization is comfortable to deliver. Further, we observed that short-term fluctuations in resources could be dealt with by outsourcing arrangements, while in the longer term, project delivery competencies could be improved through organizational restructuring, process improvements, crystallization of responsibilities and roles, and the implementation of information systems.

Keywords

Project-based Organization, Economies of Scale, Project Delivery Capability, Project Sizing

Introduction

In product manufacturing businesses, the fixed production cost for a product is shared among the total number of the product produced. The higher the demand for the product, the lower the fixed unit production cost of the product – the so-called economies of scale effect (Chandler, Hiking & Chandler 2009).

In the construction industry, work is typically organized and delivered as projects. Unlike the manufacturing businesses, PBOs have limited potential to benefit from economies of scale across projects because of the unique nature of projects and the fact that project size is associated with project delivery risks (Creedy, Skitmore & Wong 2010; Akinci & Fischer 1998). However, PBOs with projects that are similar to each other or using similar technologies could benefit from economies of scale in procurement and production by increasing project sizes subject to a ceiling of project delivery risk. Further, the PBOs could also benefit from economies of scope by sharing project management costs (e.g. EPMO running costs, process development costs and training and development costs for project manager) across the projects (Chandler et al. 2009; Nightingale et al. 2003; Söderlund & Tell 2009; Levin 2007). On the other hand, the scale or size of a project is constrained by the delivery risk of projects. Increasing the scale or size of a project also increases the risk of project delivery (Creedy et al. 2010; Akinci & Fischer 1998), meaning that project chunking decisions need to balance economies of scale and economies of scope considerations with the risk level. The chunking decisions are typically made by senior managers, such as business development managers and CEOs of PBOs.

Much research on the economies of scale and scope is in manufacturing business, where the operation is continuous. In batch production, increases in production volume are not necessarily associated with increases in total fixed production costs, thus resulting in lower unit production fixed costs as total costs are spread across the total production volume – economies of scale (Hobday 2000). Although in PBOs, projects are basic units of work (Hobday 2000) and the operation is time-paced (Söderlund & Tell 2009), increases in production

scale by adding new projects are typically associated with increases in production materials, management resources and processing resources because of the unique nature of projects. For example, resources need to be duplicated if another project of similar scale is required. This makes it difficult to achieve economies of scale across projects, although it is possible to do so within a project capped by the risk the expanded scale may bring to the delivery of the project. However, it is possible to achieve reductions in average cost per project by virtue of economies of scope – sharing common resource needs, such as management procedures and PMO costs, among projects of a similar type.

Despite the importance of project chunking decisions, few studies have examined how these decisions are made and how project scale is balanced with project risk considerations. Based on a longitudinal case study of a Chinese state-owned enterprise, this study examines the pattern of project chunking decisions and concludes that the case organization appears to maximize the project economies of scale while subjecting project size to a capped limit to ensure manageable delivery risk. The capped limit of project size increases gradually as the organization develops its project delivery capabilities over the years.

In the following section, literature is reviewed, and the research design is described. In the results section, the evolution of the case organization's structure during 2001–2017 is presented chronologically. Subsequently, project chunking data are analysed in terms of annual production scale and annual average project size. Finally, conclusions are drawn, and implications, limitations of this study and future research directions are discussed.

Literature review

PBO'S AND THE CONSTRUCTION INDUSTRY

Work in the construction industry is typically organized as projects. As a result, most organizations in the construction business of delivering projects, such as contractors and developers, are PBOs. Research on PBOs mainly focuses on the knowledge management and innovation process in complex products and systems (Hobday 2000; Gann & Salter 2000; Bresnen Goussevskaia & Swan 2004; Lindkvist 2004; Bayer & Gann 2007). A PBO, unlike the matrix, functional or other forms, assumes the project as the basic organizing unit for integrating all the main business functions within the firm, and develops capabilities around project development and delivery (Hobday 2000). The structure of PBOs has been described as decentralized, autonomous and loosely coupled (Lindkvist 2004).

Because of the unique and one-off nature of construction projects, characteristics, skills and resources required for these PBOs are quite different from standard mass-produced products in the manufacturing industry (Gann & Salter 2000; Bresnen et al. 2004). Whitley (2006) distinguishes types of project-based firms (PBFs) by separation and stability of work roles, and singularity of goals and outputs. Complex construction projects tend to have singular goals and outputs (and do not vary dramatically from project to project) and are delivered by standardized, separate and stable work roles, which make it possible for the PBF to retain organizational learning and share learning and management systems among projects (Whitley 2006).

ECONOMIES OF SCALE AND SCOPE

The concept of economies of scale and scope started in the capital-intensive industries – including manufacturing, transportation and communication – in order to improve the

production capacity and reduce unit costs in the nineteenth century (Davies 1996; Chandler et al. 2009; Babbage 1832). Economies of scope refers to the sharing of costs common to projects within a PBO, such as the cost of running an enterprise project management office (EPMO), project manager development costs, process development and improvement costs.

Economies of scale springs from the unit cost reduction by increasing volume of production (Chandler et al. 2009). Economies of scope are achieved by utilizing the same materials and equipment to provide various products at a lower unit cost (Davies 1996; Chandler et al. 2009). Hobday (2000) argued that the PBO is inherently weak at achieving economies of scale. In the construction industry, each project is unique and thus requires some degree of tailoring the system and process to the project (Bresnen et al. 2004; Davies 1996; Thuesen 2010). As a result, an increase in the number of projects requires dedicated project teams and resources for each project. The scope for economies of scale in construction companies depends on the similarity between the projects undertaken. For example, in the single dwelling construction industry, the builders are able to achieve a considerable level of economies of scale by offering only a set suite of house models to choose from with a limited selection of finishes, thereby achieving economies of scale in procurement and construction efficiency. This trend is prevalent in high-rise apartment complexes as well, where there are set floor plans for customers to choose from. As a project's size (as measured in construction areas, land areas, budget) increases, the unit cost typically decreases. On the other hand, as the project's size increases, so are the risks associated with project delivery because the size is associated with increases in the complexity of delivering the project (Akinci & Fischer 1998; Creedy et al. 2010).

Project chunking refers to the allocation of batches of work into projects. The two primary factors to balance in chunking decisions are project size and associated project delivery risks. Increases in project size could result in economies of scale but also increases project delivery risks. There is little in the extant literature on how to balance the two factors. It is imaginable that the PBOs set a limit or cap on the maximum size of the project (as a surrogate for the max project delivery risk) it is willing to undertake.

Therefore, the research questions are:

- How do PBOs make project chunking decisions?
- How are project size and project delivery risk considerations balanced?

RESEARCH METHODOLOGY

This study is based on a longitudinal case study of a state-owned project development company (JHHG) in China covering the years 2001 to 2012. Case study method was chosen because it focused on the dynamics within single settings and helped us conduct an in-depth investigation into the evolution of organizational activities (Flyvbjerg 2006; Yin 2013). In this article, we chose a well-developed Chinese state-owned PBO as a single case study to illustrate how a PBO scaled its business (Siggelkow 2001).

Data collection methods for this study include archival research and observation (Yin 2013). Archival data included publicly available information and internal documents. One of the authors was a member of a research team that had been collaborating with the organization from 2001 to 2012. The research team was granted access to internal documents including professional consultants' reports, meeting minutes, strategic documents and organizational structure change records. Further, observations in meetings and discussions with key management personnel provide rich and valuable background information. Multiple

sources of data helped to confirm the validity of the data we used in this case (Tellis 1997; Yin 1981).

Sequence analysis was then used to organize the longitudinal data (Abbott 1990). The average project size and the total work volume (measured as annual total production area) for each of the years during 2001–2017 was compiled and analysed. Then, we attempted to explain the pattern of the project size information from the perspective of balancing project delivery risks and project scale.

The main structural changes happened during the 2013–2017 period is only included for completeness. Information during 2013–2017 relies upon publicly available information.

Case description

During the period 2001–2012, the strategy and organizational structure of Jinan Hi-Tech Holding Group (JHHG) changed significantly to adapt to the market changes. The restructuring happened in three major phases. In the first phase, the focus was on urban development. Then, in the second phase, when the residential property market was booming, JHHG expanded its business into residential property development. Subsequently, in the third phase, the plateaus of the residential property market, JHHG pulled back the residential property market and focused on highly complex urban infrastructure development.

PHASE I: URBAN DEVELOPMENT (2001–2007)

High-tech industrial development zones (high-tech zones) are areas set up with special tax and customs concessions to attract investment in the development of advanced and innovative technology industries. High-tech zones have had experienced dramatic growth since 1991 in China. The precursor of JHHG was an organizational unit under the Jinan Municipal Government's committee for high-tech zone. The unit's focus was on developing infrastructures for urban development, such as office buildings, a convention centre and industrial parks, on behalf of the government. To support the development of high-tech zones and urban development around the high-tech zone, the government decided to set up JHHG in 2005 as a state-owned enterprise responsible for the development of the high-tech zone. As shown in Figure 1, the JHHG is under the supervision of the government, and the five shaded units were the core supporting units for urban projects development.

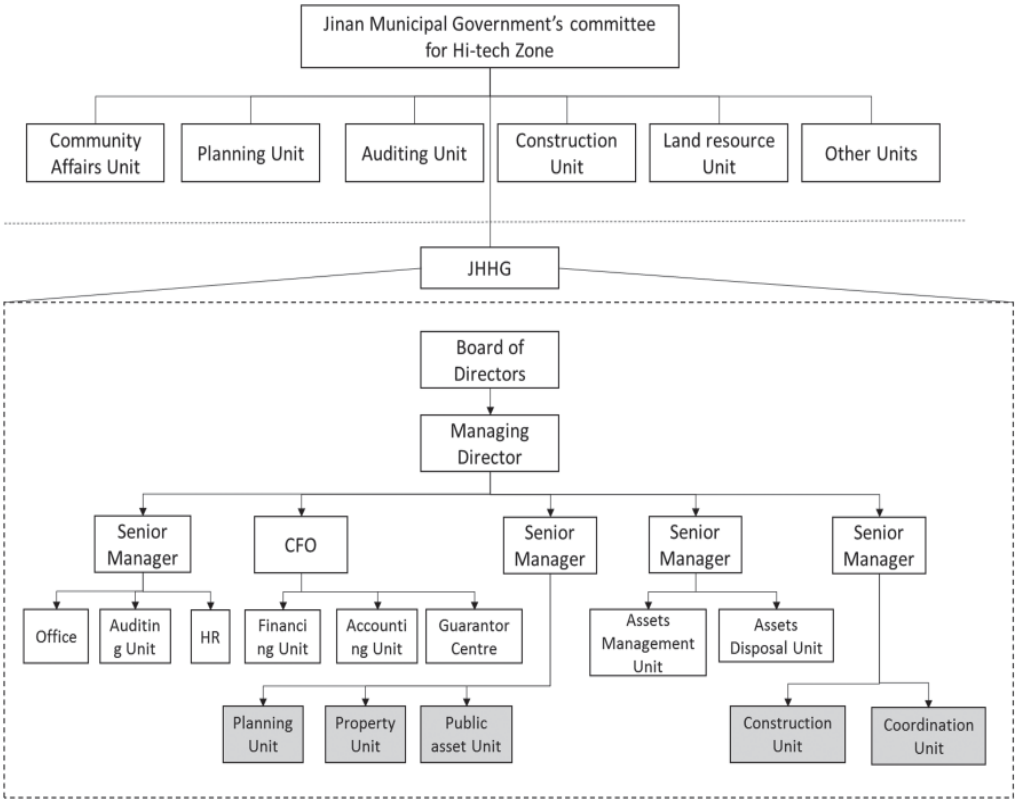

Figure 1 Organizational structure of JHHG (2005–2007)

During Phase 1, the precursor of JHHG (2001–2005) and then JHHG (2005–2007), developed a software park complex from 2001 to 2002, then an international convention centre from 2003 to 2005 and another software industry park from 2005 to 2008; all three programmes have similar scales (estimated total building area around 150,000 m^2).

PHASE II: EXPANSION INTO RESIDENTIAL PROPERTY DEVELOPMENT (2007–2012)

Despite the impact of financial crisis in 2008, the residential property market heated up after a cold spell. For the high-tech zone, the move of the government departments into the zone in 2010 further exacerbated the demand–supply imbalance, giving rise to an evident increase of potential residential demand in this high-tech zone. The market demand was the driving factor for the establishment of the property arm for JHHG in 2007. The arm, a wholly owned subsidiary of JHHG, was responsible for the development of residential projects with autonomy in construction and marketing decisions. The first residential property project was carried out in 2008. After that, another eight residential projects were added to the development process around the same period, from 2009 to 2012, during which 90% of the profit of JHHG was contributed by the property arm, making the residential property development the star performer in JHHG. At that time, half of the residential projects in this high-tech zone were developed by the property arm of JHHG, which made it the biggest real estate developer in the high-tech zone.

The overheated market, however, prompted the government to adopt policies and regulations to slow down demand. The market appeared stagnant. As a consequence, the volume of business in the property arm experienced dramatic fluctuations during 2008–2011.

From the initial project in 2008 to the peak of eight simultaneous projects in 2011, the number of supporting units (such as planning and marketing, sales, construction, communications, design management, etc.) increased from three to eight (shaded units in Figure 2) before all were eventually disbanded in 2012. The property arm's functions were then absorbed into the JHHG.

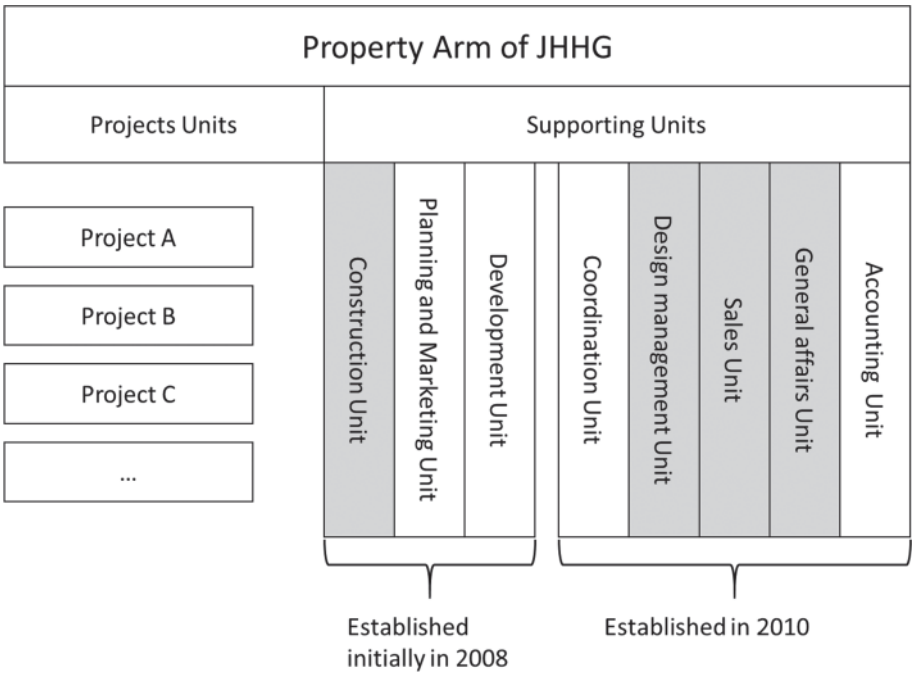

Figure 2 Units of property arm of JHHG

The first office buildings project (337,000 m^2 building area) was developed by JHHG from 2007 to 2010, and the first residential property (160,000 m^2 building area) from 2008 to 2009. Another eight residential properties, covering around 2,380,000 m^2 building area in total, were then developed from 2008 to 2013.

PHASE III: FOCUS ON HIGHLY COMPLEX URBAN DEVELOPMENT (2012–2017)

In the face of an overheated property market with signs of being stagnant and strong government determination to regulate and control the market, JHHG made the decision to pull back from residential property development and refocus on the company's existing strength in urban development (office complex, convention centre, shopping mall, hotel, etc.) with two added caveats. First, banking on years of experience, JHHG's strategic focus had a new priority, that is, projects with a high degree of complexity and high value, and potentially high return to the community. Second, there was an added emphasis on facility management for the high-tech zone.

A large HOPSCA (usually involving hotel, office, park, shopping mall, convention and apartment) project containing a landmark building developed directly by JHHG became the first priority since 2012. With the HOPSCA project progressing into the conceptual design phase and all residential projects nearly in closeout phase, the number of supporting units in the property arm was halved, and resources were relocated to the HOPSCA. This project covered around 4,100,000 m^2 of building area.

After serious consideration and evaluation, the property arm was disbanded and merged into JHHG. Soon after, a steering committee for HOPSCA was set up, composed of senior managers from the key stakeholders in the high-tech zones and heads of functional units of JHHG. To enhance the capability of JHHG to coordinate the stakeholders, an experienced integration management team was appointed. Meanwhile, enterprise resource planning (ERP), building information modelling (BIM), project management information system (PMIS) and project information portal (PIP) had been introduced to support integrated management.

Discussion

As our intention was to extend the understanding of scalability of PBOs, in this section, we first analysed the project chunking data of JHHG based on annual production scale and annual average project size and then how JHHG coped with fluctuations in scale and resources in various contexts. In this paper, project scale and size are measured by building area. Each project was assumed to progress evenly during the year. Accordingly, annual production scale equals the amount of building area constructed during the year; annual average project size equals annual production scale divided by the number of projects undertaken during the year.

ANNUAL PRODUCTION SCALE AND ANNUAL AVERAGE PROJECT SIZE

As presented in the graph below (see Figure 3), annual production scale steadily rose until 2012, when it started to decline, while annual average project size kept relatively stable. From 2001 to 2007, recognized as the urban development stage, both the production scale and average project size stayed around 100,000 m^2/year. Since its formation, JHHG has consistently kept its project sizes to a level that is comfortable to JHHG both in terms of project delivery risks and economies of scale considerations. Bigger project sizes are associated with higher project delivery risks, whereas smaller project sizes could result in inefficient utilization of resources – the opposite of economies of scale (Lyons & Skitmore 2004).

From 2007 to 2010, the annual production scale doubled every year (coinciding with the setting up of the property arm). However, JHHG kept annual average project size almost the same by chunking jobs into multiple projects while limiting an organization's average project size to a level that the organization is comfortable with delivering. In so doing, the PBO was able to maintain its control of project deliveries while capitalizing on economies of scope and scale – sharing costs of project delivery systems on multiple projects and maintaining the maximum project size practical.

We also observed that a project management consulting company was hired to project manage the delivery of residential projects. During this period, residential buildings were the main money-making business of JHHG. JHHG delves heavily into the property market through outsourcing in anticipation of major market corrections.

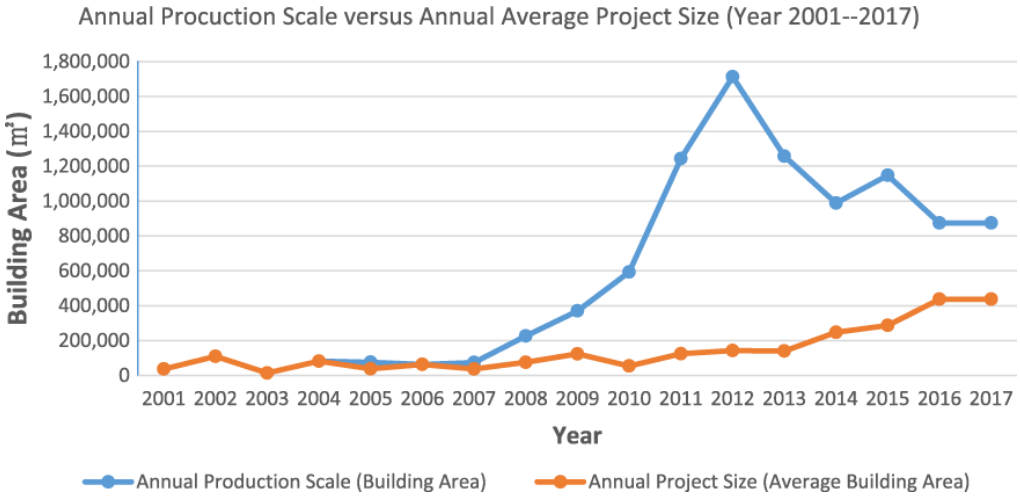

Figure 3 Annual production scale and annual project size of JHHG

Despite the decline in production scale since 2012, mainly due to the closeout of most residential projects, the annual average project size was slowly but steadily increasing, which indicated the gradual improvement of project delivery capability of JHHG.

WAYS TO ACHIEVE BUSINESS SCALABILITY FOR PBO'S

The case shows that JHHG achieves business scalability amid fluctuation in business demands through project chunking. Effective project chunking ensures big construction work is chunked into projects with sufficient size from the economies of scale perspective while the size is below a ceiling marking the organization's comfort zone in dealing with project delivery risks.

JHHG coped with scale fluctuations by chunking jobs into multiple projects with sizes within the range it has successfully delivered. In so doing, JHHG maintained its control of project delivery risks and capitalized on economies of scale by keeping project size within the upper band while sharing costs of project delivery systems on multiple projects (economies of scope).

With its strategic focus on infrastructure development, JHHG delved into the residential property market when the market demand was strong, predictable and steady, through the outsourcing of the project management to specialized consultancies during 2007–2012. JHHG pulled back promptly as the market became stagnant. As shown in Figure 3, with the annual production scale of JHHG increasing from 2007 to 2010, JHHG employed a professional project management (PM) consultancy to look after the design and construction of the residential projects. Meanwhile, JHHG, aware of its need to further improve in-house PM capability, had been taking opportunities to enhance its project delivery capabilities during the period. Workshops were run almost every month to share experiences and lessons learned by both the consultancy and JHHG managers.

It appeared that the development of in-house project delivery capabilities had been a core component of JHHG's organizational capability development on its way to becoming the premier facility management organization in the high-tech zone. Over time, JHHG gradually

enhanced its competencies through organizational structuring, process improvements, crystallization of responsibilities and roles, and the implementation of information systems.

Organizational structure and process were adjusted in accordance with market changes and the corresponding strategic adjustments. Processes, roles and responsibilities were refined gradually based on feedback on the day-to-day running of the projects. The existing capabilities of the JHHG staff were supplemented, in the short run, by outsourcing PM function, during which time JHHG greatly enhanced its project management processes and practical knowledge in project delivery.

The enterprise resource planning (ERP) system initially containing five modules (including procurement management, plan management, contract management, cost management and design management) was developed and implemented as an integrated work platform. The system significantly improved effectiveness and efficiency for information processing, access and distribution, contributing effective project deliveries, including time and costs savings.

As shown in Figure 3, the annual average project size increased gradually over the years from 2013 to 2017, which suggested the capability of JHHG in delivering projects has grown over the years. In other words, the average size of projects JHHG routinely delivers has gone up threefold from 2013 to 2017.

Conclusion

This paper has explored how to balance the economies of scale and delivery risk considerations in project chunking decisions through a longitudinal case study of a project-based organization (PBO) in the construction industry. The findings contribute to developing a better understanding of how PBO scale its businesses. As demonstrated in this case study, it is practical to chunk big jobs into projects while limiting an organization's average project size to a level that the organization is comfortable with delivering. In so doing, the PBO was able to maintain its control of project deliveries while capitalizing on economies of scale and scope – sharing costs of project delivery systems on multiple projects and maximizing project size (within its comfort zone of project delivery risks). Further, we observed that short-term fluctuation in resources could be dealt with by outsourcing arrangements, and in the longer term, project delivery competency could be improved through effective organizational learning practices, process improvements, crystallization of responsibilities and roles, and the implementation of information systems.

As an exploratory study, the findings from this study are based on a single case study and therefore need to be interpreted with caution. This study is meant to be thought provoking and to explore new angles of theorizing. Further studies in various contexts are needed to validate the findings.

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CONFERENCE PAPER

Transferring project management knowledge: lessons learned in open standards projects

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Synopsis

Significant Project Management knowledge is generated by practitioners, usually presented as 'practitioner lessons learned'. However, the role of the academic as *only* project management sense-maker, excluding practitioner knowledge-creator, is questioned. An alternative view is that some academics are also important members of the project management community of practitioners because their project management skills are necessary to do collaborative industry research.

Research design

Participant observation as a team member of an ICT project for development of open standards for construction.

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Relevance for practice / education

This dual role of academics informs reporting the outcomes of ICT projects developing open standards for construction management systems.

Main findings

The 'practitioner lessons learned', success or failure, stories of three USA National Institute of Building Sciences ICT development projects are interpreted through academic sense-making. In addition, identification of the importance of transferring this knowledge within the academic project management community of practice is reported.

Research implications

These lessons should be incorporated into the design of new open standards projects to gain construction industry acceptance, implementation and adoption. In this case, an academic project, CONie (*Construction to Operations for Network information exchange*) is proposed as an open standard for Road Network Asset Management in Australia and New Zealand.

Keywords

Practitioner Lessons Learned, Open Standards, COBie, CONie

Introduction

Morris (2016) designates the role of the academic to making sense of the "lessons to be learnt from the challenges faced by the practitioner community" (p. 367). The concept of 'practitioner lessons learned' (Carrillo 2005) is important within the diversity of project management literature. For example, Kerzner (2013), in the 11th edition of an engineering project management textbook, writes that 'lessons learned' from experience are an important part of project risk management. The 'lessons learned' concept has also been considered from an organizational perspective (Schindler & Eppler 2003), a knowledge transfer perspective (Newell 2004), a learning perspective (Milton 2010), a systems perspective (Duffield & Whitty 2015) and a project perspective (Sense 2007).

In addition, the concept of 'practitioner lessons learned' can be considered from a variety of theoretical viewpoints. Discussions in the literature, from a number of disciplines contributing to project management research, are based on the learning curve (Lu et al. 2013), learning styles (Harfield et al. 2007), practice theory (Reich & Hager 2014) and communities of practice (Garrety, Robertson & Badham 2004).

For this research report, 'practitioner lessons learned' are considered from a project perspective and from the theoretical viewpoint of communities of practice. In this instance, a community of practice assumes common knowledge of project management ideals (Aerts Dooms & Haezendonck 2017). Projects are regarded as temporary and unique (van den Ende & van Marrewijk 2014; Carrillo, Ruikar & Fuller 2013), thus 'practitioner lessons learned' are not institutionalized, but passed-on by individuals through ad hoc vehicles linked to communities of practice (Garrety, Robertson & Badham).

Morris (2016) also writes that projects, of one form or another, are a significant contributor to global economic activity. A considerable part of that activity is due to the construction

industry. For example, all Organization for Economic Co-operation and Development (OECD) countries average five percent of value-add from construction activity. In Canada and Australia, the industry has added a continued growth of value to production activities (from seven percent to over eight percent) between 2007 and 2015 (OECD 2017). This means that topics that concern the construction industry have important global economic, political and social consequences.

The construction industry economic contribution to the global economy means an expectation of continued improvement of industry productivity. For the last 20 years, predictions of improving productivity have been based on the growth of Information and Communication Technology (ICT) for construction project management (Henderson & Ruikar 2010; Hughes & Thorpe 2014). ICT software and systems are closely linked to open standards (Cerri, & Fuggetta 2007) and thus, 'practitioner lessons learned' from ICT projects developing open standards have been reported in the academic literature (East et al. 2011; Laakso & Kiviniemi 2012).

However, Morris's (2016) distinction between the roles of academics and practitioners does not to take into account the fact that many academics must also be considered as project management practitioners, and thus project management knowledge creators. Even though their community of practice is within the academy, not the commercial sector, their collaborative research projects with industry partners (Gürses, Seguran & Zannone 2013) follow the basic structure and processes of project management (Kerzner 2013).

Therefore, the designation of project management practitioner for academics suggests an alternative definition of 'practitioner lessons learned' compared to Morris' (2016) definition that is limited to commercial practitioners. Currently, there is little written on the topic of academic research project management practitioners (Edkins et al. 2014; Walker et al. 2008).

The purpose of this report is two-fold; first, to report on the development of three ICT open standards projects by adding a theoretical framework to make sense of the 'practitioner lessons learned'. Second, to explain how those 'practitioner lessons-learned' have been transferred to an academic/industry research project thus, providing support for the concept of the alternative concept of academic as practitioner within a community of project management practice.

The balance of the paper supplies a description of the research in six sections. Section two outlines the research design. The three sections following provide narratives of three ICT information exchange development projects: SPie, ELie and COBie. These stories of success and failure and "practitioner lessons learned" provide the context for a project management community of practice. Section six illustrates the importance of utilizing 'practitioner lessons learned' to transfer knowledge to communities of practice. This section also identifies an alternative role for project management academics by suggesting they are also members of the project management practitioners community of practice and thus can be creators of 'practitioner lessons learned'. This concept is illustrated using a current ARC Linkage Project: *CONie Open Standard* that is scoped with both pragmatic and abstract "practitioner lessons learned". The final section summarizes the paper and proposes new avenues of research.

Research Design

The concept of 'lessons learned' in the project management literature can be interpreted as an indication of the historical practitioner focus of the project management discipline (Kenley & Harfield 2014). Learnings arise from doing, thus practical research, rather than simulated

research, is an important project management research method (van den Ende & van Marrewijk 2014). In addition, the findings from this type of field research are often presented in research reports to both academia and industry as 'lessons learned' (Deakins & Dillion 2005).

Therefore, this interpretative study (Scales, Sankaran & Cameron-Ros 2015; Denzin 2002) is constructed from specific real-life ICT development project participant observation using inductive logic (Simard & Laberge 2015). The participant observation research method was possible because one of the authors of this paper was involved in the ICT development projects undertaken by the U.S. National Institute of Building Sciences (NIBS 2017).

A narrative, rather than an analytical account of the project is provided. A narrative account is more compact (Czarniawska 2013) for the purposes of these long-term projects. Stories focus on processes and outcomes, rather than on the project details of who, where and when commonly used in reporting short-term project management research (Aerts, Dooms and Haezendonck 2017; Newell 2004). The narratives of the projects in this report were part the US ICT development program of this century as part of the global construction industry move to digital and visual technology for project management (East & Smith, 2016).

These ICT development projects were part of the search for a globally acceptable solution to a 'nebulous' problem of how to move the *ideal* of integrated construction project delivery into a global reality (Rowlinson 2017; Eadie et al. 2013). Because of the collaborative nature of such projects, the concept of 'practitioner lessons learned' is their primary organizing principle. This means that ICT open standards development projects are an example of Morris's (2016) contention that project management knowledge is generated by practitioners.

NIBS (2017) aims to improve the performance of US buildings by reducing waste. To operationalize this mission, the NIBS supports the creation of open standards (Percivall 2011) linked to the global digitalization effort of construction project management (East, Nisbet & Liebich 2013). Thus, providing a mechanism for a significant contribution towards increased construction industry productivity improvement through an integrated construction project delivery process (Kenley & Harfield 2014). In-depth discussions of this process and building information modeling are beyond the scope of this paper because of the limitations of space (Rowlinson 2017). In addition, the concepts and multiple meanings of open standards, open specifications and information exchange, are considered under the common word 'standard' because this is not a technical report (Cerri, & Fuggetta 2007).

In the construction sector, integration is centered on building information modeling (BIM), which provides a BIM-enabled ICT environment (Eadie et al. 2013). A BIM-enabled environment is the application of the culmination of several collaborative ICT development open standards projects (Yan, Xie & Meng 2014). The success of these projects, by paid and volunteer experts, (Barlas et al. 2014; Percivall 2011) provides input into Industry Foundation Classes (IFC) – the building blocks of the BIM-enabled environment. The ultimate aim of IFC development is acceptance of the open standard *ISO 16739 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries*.

The 'lessons learned' from the projects that developed the open standard for IFC should be of interest to project management academics and practitioners. The next sections provide stories of success, failure and 'practitioner lessons learned' from three NIBS ICT development projects. Incorporated into the narratives are theoretical suppositions provided from academic sense-making (Morris 2016).

Lessons learned: be incremental, not aspirational

In many countries and regions, the development of IFC is under the auspices of buildingSmart (East, Nisbet & Liebich 2013). In the US, the NIBS contribution to IFC is the National Building Information Modeling Standard, v3 (NBIMS^{3TM}). The development of the standard (Cerri & Fuggetta 2007) involved a number of ICT information exchange specifications. This paper reports on the 'practitioner lessons learned' for three of these projects: SPie (*Specifiers' Properties for information exchange)*, ELie (*Equipment to Layout information exchange)* and COBie (*Construction to Operations for Buildings information exchange*).

The 'practitioner lessons learned' in this section relates to SPie. The narrative is not a success story. One type of information contained in construction documents is that of manufacturers' product data. The SPie open standard was intended to deliver manufacturer product data to the facility operator by passing manufacturers' information through the construction contract (East et al. 2011). SPie development changed through a number of iterations. However, after six or seven different approaches were tried, no construction contract has used an SPie standard.

Open standards ICT projects have an "open" collaborative project structure, relying on volunteer experts. Experts from the manufacturing sector did not take advantage of the opportunity to participate. In this case, diversity of individual manufacturers and manufacturer peak bodies had the opportunity to provide updated product data in a useable format through the numerous iterations. However, to date this project has:

- failed to achieve United States national **consensus about the properties required** for manufactured or engineered equipment
- failed to identify an **agreed-upon format** for the exchange of such information
- failed to create a **critical mass of industry organizations** that interface with manufacturers and/or suppliers to develop, update, and catalog such information.

At the time of the project, there were approximately 10,000 building product manufacturers with catalogs of products that could have contributed in the SPie information exchange development (East et al. 2011). This large number of possible datasets, suggests that explaining the failure of SPie at the project level is not appropriate.

However, considering the project from an industry level might provide an explanation. We do have proof that the fundamental structure of an industry cannot be transformed rapidly (Carrillo, Ruikar & Fuller 2013). Radical (short-term and major) whole industry change has been advocated in a number of major government reviews of the construction industry, as well as individual researcher studies. Change management models, tools and advice are aimed at this type of radical total-industry change (Lichtenthaler 2007).

The problems associated with the radical-whole industry approach are linked to the nature of the construction industry. The main production unit of the industry is a temporary organization (such as the SPie project) based on sub-contracting labor provision formed to construct a unique structure (Jarkas & Horner 2011). The lack of operational permanence is why radical whole-industry change is advocated, and why attempts at implementation have been an ineffective method of increasing industry productivity (Hughes & Thorpe 2014; Kenley 2003).

An incremental theory of change rather than a radical theory of change is one obvious option. The idea is that 'small but significant' change can in the long-term, be the most effective method of implementing industry-wide change. In addition, focusing on individual

projects, the unit of industry production (Kenley 2014) is also an obvious fit-for-purpose as a way of changing industry practice (Dangerfield, Green & Austin 2010).

> *Lessons Learned* – Focus on aspirational goals of future contexts will not be designed. Simply stated: innovate for today, the future will take care of itself.

The project obviously has 'failed' because the problem of obtaining industry-wide building products datasets is much larger than obtaining an outcome for only one ICT development project. The nature of adding new levels of information organization, such as defining ICT open standards properties or information exchange formats as digital datasets, for an entire industry is not an easy task (Rowlinson 2017).

The lesson to be learned is that to really be successful in industry transformation, research and development projects must have modest goals (Lichtenthaler 2007). The goal of total industry transformation is unlikely without a complete national mobilization backed by long-term political support plus significant capital resources.

Lessons learned: be specific, not abstract

The attempt by NIBS to support the BIM-enabled construction project environment provides examples of a number of basic project issues. A major issue for all research and development is how to narrow the scope of a project. The aim of an ICT project is to make an effective shift from a general problem to an implementable solution. For example, the original conception of the *Equipment to Layout information exchange (*ELie) specification was too general.

The ELie project was envisioned as one way to capture the information contained in schematic system drawings provided alongside traditional construction handover information (East 2014). Given that equipment schematics all held similar graphic artefacts, it was assumed that a single standard project could identify the information-based transformation of those drawings, even though each specification is based on only the relevant geometric information. Could this be an example of the two universal limiting factors; the optimistic human tendency and the need to sell impossible project outcomes (Dangerfield, Green & Austin 2010)?

However, a systematic review of the problem by the ICT project team, with the input of end-users, found that the underlying knowledge represented in the three major building service systems (temperature control, electrical power, and water) were very different. Thus, the expected single project, of necessity, became three discipline-specific specification projects.

These three specifications are now part of the US-NBIMS v3™ (NBIM 2017). Each information exchange specification HVACie, WSie and Sparkie is a specification for a major building service requiring specialist construction knowledge; HVAC system standard (Hitchcock 2012), water system standard (Chipman et al. 2013b) and electrical system standard (Chipman et al. 2013a).

The importance of describing the 'failure' part of the ELie project is to stress the inappropriateness of a top-down solution (Garrety et al. 2004; Vanhoucke 2012) for open standards projects. Open standard definitions that are too general have been rejected by stakeholders, such as associated construction project disciplines, software developers, and ultimately owners, who place required construction project management specifications into project contracts (Larson & Golden 2007; Manderson, Jefferies & Brewer 2015).

The subsequent relative success of the discipline-specific HVACie, Sparkie, and WSie projects are credited to a bottom-up solution based on specific knowledge domains (Barlas

et al. 2014). The end-users of each specification are the professions and trades involved in construction projects. These are many and varied; each has a distinctive language and practice re-enforced by the educational system (Harfield et al. 2007). These specialist knowledge domains are re-enforced in law to ensure the health and safety of the built environment for the end-users.

The basic project management dictum 'define the scope' is not easy, as many experienced project managers will attest (Dangerfield, Green & Austin 2010). In this instance, an ICT project, attempting to identify a generic information exchange specification for an entire building, would never have been successful. Open standards projects developed from a top-down approach (Vanhoucke 2012), without detailed domain and process-specific knowledge, are considered too general or abstract by end-users (Gürses, Seguran & Zannone 2013).

> *Lessons Learned* – Be specific allowing each construction knowledge domain to be led by their own constituents. Generic solutions may be elegant from a data modeling perspective but are likely not to be implemented.

When considering the complexity of most commercial construction projects, the necessity for individual trades and professions to have defined standards seems obvious (Poerschke et al. 2010). However, decision-makers of a program of ITC development projects may only consider the outcome of their program, not how the outcome will be implemented by the end-users. Thus, the continuing search for project success factors from the top-down rather than the bottom-up (Henderson & Ruikar 2010).

Lessons Learned: Be Complete, Support Implementation

Although the project management literature from a variety of disciplines continues to stress the need for 'well scoped' projects, that is not the usual story. Considering that all projects can be negativity affected by two universal limiting factors; the optimistic human tendency, and/or, the need to 'sell' impossible outcomes of a proposed project (Dangerfield, Green & Austin 2010), the miracle seems to be that some are not. For example, the NIBS open standard, *Construction to Operations for Buildings information exchange* (COBie) went from initial discussions to an internationally recognized open standard in under a decade. Truly, a success story from an ICT open standards development perspective.

One of the priorities for BIM, more efficient life-cycle management, should also include reducing the administrative workload (Zhang, Beetz & Weise 2015). However, a significant source of effort wasted in construction projects tends to stem from the arduous task of managing phase documentation and product manuals through all project phases. Traditionally, facility management information specified in building construction contracts was created at the end of the construction process (Larson, & Golden 2007). It was delivered to the facility operator prior to the fiscal completion of the project, as shown in Figure 1.

Figure 1 Building construction handover information

Evidence of the waste inherent in the handover process is that most building owners maintain one or more full-time data clerks. They retype (a small fraction of the) information from the paper documents into automated systems that support maintenance management. Retyping and transcribing are common activities during the capture and use of construction information, despite the fact that virtually the entire set of information can be traced to an electronic source (Dangerfield, Green & Austin 2010).

At the same time, change is gradually taking place. Some facility managers are now specifying and receiving *digital information*, not *paper documents*. More importantly, this transformation is taking place because facility owners are beginning to specify a precise set of information, in an open-standard format. This is the first stage of transforming the construction project handover phase from a document-centric to an information-rich practice (Kenley & Harfield 2014).

This is possible because transferring construction project information to building facility managers is an effective project outcome of an ICT open standard project. Capturing the operations, maintenance, and asset management information from building projects is possible using COBie-*Construction to Operations for Building information exchange* (East 2014).

COBie is the successful result of the development of an open standard ITC development project. It is part of the US-NBIMS V3™ (NIBS 2017). It continues to gain industry acceptance because it smoothly merges building asset information by defining:

- the specific set of managed assets
- the asset's located in a building
- the asset information needed to ensure proper maintenance
- the common classification.

Essential to the specification of COBie is the recognition that facility managers require a different level of detail from the level of detail needed by building designers and builders. They are concerned with the precise location of each piece of equipment. Designers and builders require building tolerance details measured in millimeters, as found in 3D object modeling

and automated design-resolution software (Utiome & Drogemuller 2013) in a BIM-enabled environment.

However, once the building is built, millimeter level of detail is typically not required. The maintenance technician checking the operation of a piece of equipment only requires knowledge of "spatial containment." In fact, the maintenance technician will likely ignore a detailed 3D model, unless the equipment is being completely replaced (Korpela et al. 2015).

A significant part of the success of COBie is linked to the incorporation of the 'practitioner lessons learned' from both the SPie and ELie projects. This transfer of knowledge within a community of practice assisted the ICT open standards development practitioners to accept that some aspects of professional practice **could not** be changed (Lichtenthaler 2007).

As noted above radical industry change takes time. However, a small but sufficient change process can be led by individual changes of the process (Dangerfield, Green & Austin 2010). In this instance, knowledge transfer within a community of practice was a mechanism advantageous to the COBie development project team. The bottom-up ICT development process meant working with building facilities managers to learn about the actual processes that were affected by building information needs (Poerschke et al. 2010).

The 'practitioner lessons learned' from the SPie project was not to focus on the long-term aspiration. Focusing on an outcome of innovating for today, the COBie project rejected the new contractual paradigms of the collaborative BIM-enabled environment. The pragmatic reason was the slow pace of construction industry BIM uptake (Eadie et al. 2013). Thus, development of COBie stuck to the still most common design and construction contract as the basis of the data required for information exchange. This allows COBie to be managed through existing quality control and quality assurance procedures based on external testing (Fallon et al. 2013).

The standard was developed by understanding and implementing the 'practitioner lessons learned' from the Elie and SPie ICT open standards development projects. COBie focuses on incremental industry change and a bottom-up, end-user implementation outcome for practitioners based on innovation rather than aspiration.

> *Lessons Learned* – The concerns and contracts of each party in an information exchange process, and the management of the standard itself must be considered, documented, and tested before the specification for the standard is ready to be adopted.

COBie was approved as part the US National Information Building Modeling Standard in 2011. Implementation of COBie as a global industry requirement will take longer because owners and practitioners are limited by how legal decisions (Larson & Golden 2007) and local quality control/assurance regimes (van Nederveen & Bektas 2013) effect construction contracts. The success of COBie is remarkable within these constraints.

Practitioner lessons learned: linking communities of practice

Morris (2016) designates the role of the academic to making sense of the project management 'practitioner lessons learned'. However, his distinction between the roles of academics and practitioners reduces academics to commentators of project management practice. This paper argues that is not the case.

Some academics actually have a project management community of practice within the academy, if not within the commercial sector. It is important to note that this type of project management community of practice should not be confused with the teaching of project management community of practice (Edkins et al. 2014; Walker et al. 2008).

For example, academics undertake research projects with industry partners. These collaborative efforts follow the basic structure and processes articulated in the project management literature. For example, the Australian Research Council Linkage Projects are funded by both government and industry (ARC 2017). The outcomes of these research projects are expected to sustain economic growth when implemented by industry.

One example, LP160100524-*CONie open standard* research project is intended, by both academic and industry partners, as part of the global ICT open standards development program to support a BIM-enabled construction industry. The design of the project is based on the 'practitioner lessons learned' from the ICT open standards development projects delineated above.

Previous sections were written from the perspective of the role of academic as sense-maker. The balance of this section is written from the alternative perspective of academic as project management practitioner.

This section reports on the transfer of precise 'practitioner lessons learned' as the basis of a collaborative academic/industry ITC research project for road construction and road asset management. In this case, the role of the academic is not as Morris (2016) suggests, to make sense of the 'practitioner lessons learned', but to apply those lessons as a practitioner would to a new project that is informed by experience in making sense of practice.

Clearly, the 'practitioner lessons learned' presented in the preceding sections provide those embarking on an ICT project with assistance in designing and managing a project. Both pragmatic and abstract understanding of a proposed research project can be formulated from these specific lessons (Carillo, Ruikar & Fuller 2013; Duffield & Whitty 2015; Milton 2010; Newall 2004; Reich & Hager 2014).

Table 1 outlines both the pragmatic and the abstract lessons that have been incorporated into the proposal for the ARC LP160100524-*CONie open standard* research project. Both the pragmatic and abstract 'practitioner lessons learned' are compared in table 1 to give some idea of the influence or the two perspectives for the academics who wrote the project proposal. The discussion below indicates this process.

Scoping a project with or without client input is a major skill set for project management practitioners. The process is the same for academic researchers developing a collaborative project with industry. The purpose of the academic, to make sense of these learned lessons, has been presented in this paper. However, an even more effective way of making sense of these lessons would be for academic research to utilize the lessons. Indeed that was the process of defining the scope of ARC Linkage Projects 160100524. Table 1 outlines both the pragmatic and the abstract lessons that have been incorporated into the scope of this project.

For *Construction to Operations for Network information exchange* (CONie), no attempt at radical industry change was considered (Carrillo, Ruikar & Fuller 2013; Utiome & Drogemuller 2013).

Identification of the problem of handover that aims to change from the current construction paper-based information to the required digital-based information was agreed as a narrow scope of work. The project for road asset management in Australia and New Zealand is considered incremental change and current project delivery focused. The larger global BIM-enabled environment is a long-term, future-focused aspiration and well beyond the CONie project scope.

Table 1 Comparison of information communication technology (ICT) project pragmatic and abstract lessons learned

Lesson Learned	Pragmatic	Abstract
Lesson 1 SPie	Focus on aspirational goals of future contexts will not be designed. Simply stated-innovate for today, the future will take care of itself.	Acceptance of open standards through incremental, not radical industry change
Lesson 2 ELie	Be specific allowing each knowledge domain to be led by their own constituents. Generic solutions may be elegant from a data modeling perspective, but are likely not to be implemented.	Open standards implementation because of a bottom-up not a top-down method of data collection and analysis during development
Lesson 3 COBie	The concerns of each party in an information exchange process, and the management of the standard itself must be considered, documented, and tested before the specification for the standard is ready to be adopted.	Open standards adoption based on integrating practical limitations as open standard mechanisms

Lesson 1 outlined in table 1 was thus integrated into the CONie project scope. It proposes a project problem that is focused on a mechanism for ICT open standard development that is currently possible.

As noted in lesson 2 of table 1, a bottom-up approach is considered more effective for ICT open standards project implementation. Obviously, the requirement is for a working standard directly related to the experience of those using that information in daily practice. For the CONie project, each of the industry partners wants to be providers of knowledge on 'how things work' in their current asset management systems. But more importantly, the industry partners see themselves as champions for the CONie development project because it provides for a comprehensive inclusion of knowledge about a wide variety of asset management systems users (Gürses, Seguran & Zannone 2013; Kenley & Harfield 2014).

Lesson 2 is advice for research methods to consider fit-for-purpose (Dangerfield, Seguran & Zannone 2010). Asset Managers, Operations Systems, Maintenance Work Orders, and New Capital Works need to be able to depend on accurate and usable information to enable the best service for all road network stakeholders. The CONie project scope includes methods to ensure the input of these end-users into all phases of the open standard development.

The constraints, as noted in table 1 suggest the structure needed for an ICT open standard. The lesson, that limiting factors should be considered when conceiving the project, is an important issue for all project management practitioners. The difficulty of containing a project is exacerbated by over-reaching at the beginning. CONie scope was written in collaboration with the developer of COBie (East 2014), thus, taking into account constraints at both the project management and the project context. Australia and New Zealand construction project delivery are also based on contract deliverables; thus formation and data limitations are industry or project defined as part of the current local legal systems.

Lesson 3 focuses on accepting limiting factors that are evident at the scoping stage of a project. In the specific case of a research project, this means actively searching for problems

that will not be solvable and eliminating them from the scope of the project (Hughes & Thorpe 2014; Jarkas & Horner 2011).

Applying these 'practitioner lessons learned' from the US NIBS ICT open standard development projects was instrumental in writing the research proposal for the development of the CONie open standard for road networks in Australia and New Zealand. The academics writing the proposal consider themselves as members of a community of practice of project management practitioners, as well as being project management sense-makers. Therefore, it is possible that the knowledge transfer mechanisms from this combination were an important factor in acceptance of the proposal for LP160100524-*CONie Open Standard* by project funders.

Conclusion and Future Research

In his reflection on the field of project management Morris (2016) distinguishes between the roles of academics and practitioners. He designates the role of the academic to making sense of the lessons to be learned by practitioners. He suggests that project management knowledge is generated by practitioners over-coming challenges on the job. This paper provides an alternative role for academics, as members of the community of project management practitioners.

This claim is based on the collaborative work of the authors of this paper; they all have roles as both academics and project management practitioners. All three are authors of academic conference papers and journal articles, and during the last 25 years, they have been collaborating in research projects with a multiplicity of industry partners. One of the authors worked on ICT open standard development projects linked by the US National Institute of Building Sciences (NIBS). This allowed him to be a participant observer associated with three information exchange projects. Thus, the identification of project success or failure described in this paper is based on "practitioner lessons learned" that can be transferred to another knowledge domain within academic information exchange ICT projects.

Academics can apply skill sets as interpreters of 'practitioner lessons learned' in addition to being members of the project management community of practitioners. This combination provides the foundation for a current ARC Linkage Project: *CONie Open Standard* that aims to develop a *Construction to Operations for Networks information exchange*.

The idea that academic researchers are not just project management sense makers, but an important component of the project management community of practice, and thus creators of 'practitioner lessons learned', may not be new. However, the concept is clearly under-reported in the major project management literature. Growing this topic area could provide an interesting stream of publications driven by the current need to identify academic research impact.

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CONFERENCE PAPER

Analysing stakeholder advice networks: an Australian integrated healthcare project

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Synopsis

This paper contributes to stakeholder engagement analysis through social network theory and analytics. An integrated healthcare project was implemented in New South Wales (NSW), Australia, to improve integration and advice sharing between stakeholders of a healthcare system. The aim of this paper is to use social networks theory and methodology to examine how stakeholders (healthcare services) interact and provide professional advice to one another after the implementation of an integrated care project and to identify the correlation between social network variables and integration.

Research design

A whole network design was conducted, where 56 participants were asked to complete a survey questionnaire that aimed to collect information on advice relationships and examine perceived service integration in the health system.

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Relevance for education and practice

This study demonstrates how social network methodology can inform stakeholder analysis by exploring stakeholders' relational attributes and identifying key and marginal stakeholders. The results will assist practitioners in their interventions and strategies towards improving integrated care efforts.

Main Findings

The Pearson correlation results show no correlation between social network properties and perception of integration (integrated care). However, key and marginal stakeholders are identified, and the advice network structure is explored.

Research Implications

This information will help project leaders to engage stakeholders and identify gaps in healthcare integration projects.

Keywords

Social Network, Stakeholder Management, Integrated Care, Stakeholder Analysis, Healthcare Services

Introduction

Many authors acknowledged the importance of managing stakeholders in projects (Missonier & Loufrani-Fedida 2014; Rajablu, Marthandan & Yusoff 2014; Yang, Shen & Ho 2009) because of stakeholders' ability to positively or negatively impact project performance and completion (PMI 2013). It is the human aspect in projects, particularly how stakeholders communicate and interact, more than the technical elements, that determines, to the larger extent, project success or failure (Doloi 2012). In Freeman's (1984) stakeholder theory concept, the foundation for all stakeholder scholars, he defined a stakeholder as "any group or individual who can affect or is affected by the achievement of the organization's objective." An integral part of stakeholder management is stakeholder analysis, which aims to find answers on how stakeholders contribute to an organization or a project, by studying their characteristics such as influence, interest, network, position and relations, and so on (Blair & Fottler 1990; Freeman 1984; Lindenberg et al. 1981).

The first step in stakeholder analysis is to identify the issue or phenomena that need to be investigated in a certain project or environment, which leads to identifying the stakeholders (Bryson 2004; Reed et al. 2009; Varvasovszky & Brugha 2000). Several methods have been used to identify stakeholders, such as semi-structured interviews, focused interviews, snowballing, sampling, and expert opinion and workshops (Bryson 2004; Cova & Salle 2005; El-Gohary, Osman & El-Diraby 2006; Karlsen 2002).

After identifying stakeholders, the next step is to categorize stakeholders based on personal attributes such as interest and influence (Lindenberg et al. 1981); cooperation and competition (Freeman 1984); power, legitimacy and urgency (Mitchell, Agle & Wood 1997); and power-interest matrix (Eden & Ackermann 1998). However, the methods used for stakeholder analysis are limited in what they measure because they only capture stakeholder attributes and

overlook how stakeholders communicate and how the structure of their relationship impacts projects (Prell, Hubacek & Reed 2009). None of these formal stakeholder analysis tools are able to identify key stakeholders according to their relationships and the local social capital that each bears within its immediate personal network.

In 2014, the NSW Ministry of Health released an integrated care strategy (Health 2014) that aimed to improve integration of care between health services. In response to this strategy, one local health district undertook an integrated care initiative that endeavoured to improve integration of care within a defined geographical area in order to improve patient experience and outcomes as well to reduce duplication of services and improve efficiencies.

An integrated health system requires the collaboration of its different healthcare providers in order to provide the best possible care for patients (Strandberg-Larsen & Krasnik 2009). Nelson et al. (2002) describe the health system as a network of clinical providers working together to cure patients' illness. Therefore, Goodwin (2010) proposed using social network analysis to study how health providers communicate where this has been considered to be a detriment for successful care integration. On the other hand, Browne et al. (2004) stated that the success of an integrated care project is determined by how different stakeholder groups, such as healthcare services and providers, perceive integration. Therefore, integrated care requires a multi-stakeholder and project management approach with the application of social networks.

The purpose of this paper is to use social network analysis to capture a snapshot of how stakeholders (healthcare services) interact and provide professional advice to one another after the implementation of an integrated healthcare project. By exploring how healthcare services are connected, we aimed to identify:

- areas of strength to be capitalized on and areas of weakness to be improved in the integrated network; and
- key and marginal stakeholders that need to be engaged in order to increase communication and facilitate the integration of services to provide efficient ongoing care for patients.

Therefore, the following questions were addressed:

1. What is the actual structure of the stakeholder network?
2. Who are the key stakeholders that have a brokerage position and are therefore considered influential?
3. What is the inherent nature of the relationship between social networks and healthcare integration?

Conceptual framework

SOCIAL NETWORKS

A social network is a set of actors (individuals, organizations or countries) that are connected through ties in the form of relationship (Friendship, social support, etc.). Chung and Crowford (2015) demonstrated how social network theory and methodology could be applied to stakeholder analysis and engagement. In the following section, we discuss how the stakeholder advice network can be examined according to the following three network levels:

1. The network level
2. the actor level
3. The tie levels

Network level

Density is the most basic network measure and is a characteristic of the whole network (Rowley 1997). Density refers to the number of actual ties present in a network compared to the total number of ties that can be present if all members are connected to one another (Prell 2012). Scott (2012) mentioned that density explains the social activity present in a network that is represented by the number of ties present. Bavelas (1950) and Leavitt (1951) highlighted an important concept for network analysis called "centrality," also referred to as "centralization" (Freeman 1979; Wasserman & Galaskiewicz 1994). Networks that have high network centralization have central actors who hold the majority of ties in the network.

Actor level (centrality)

Centrality is described from a point's position in a network. The most prominent centrality measures are degree, betweenness and closeness (Freeman 1979). Degree centrality is considered the simplest concept of centrality, where it refers to the number of ties an actor has to others (Wasserman & Faust 1994) and represents communication activity (Freeman 1979). Betweenness centrality measures the extent to which an actor lies on the shortest path between actors (Borgatti 2005). Closeness centrality "is based upon the degree to which a point is close to all other points in the graph" (Freeman 1979). Burt (1992) proposed a theory of structural hole presenting the importance of having "holes" in the network, or what is referred to as the absence of ties between actors that can reshape the performance of a network. Burt used the term *structural hole* to represent the non-redundancy between two contacts. Actors that seek to acquire novel non-redundant information and benefit from competitive advantage must rationally establish ties with groups of people with whom they, or anyone within their groups, are not connected.

Tie level (tie strength)

Granovetter's (1973) theory on "strength of weak ties" argues that information is disseminated faster through weak ties than through strong ties. People who are strongly tied to one another share common characteristics and are more likely to share information within their own cliques rather than transferring it to other people. This leads to redundant information. In contrast, a person can be connected to a wider range of people through "weak ties" and still have access to different sources of information. Granovetter (1973) described a weak tie as "a bridge" that links different people together and facilitates information flow between them. Following the significant work on the theory strength of weak ties, Krackhardt, Nohria and Eckles (1992) highlighted the importance of strong ties in creating trust, dealing with organizational change and shortening project completion times.

CONTEXT OF STUDY

Gillies et al. (1993) described integrated care as the coordination of activities between different functioning units for the purpose of providing efficient health services to patients. From a public health perspective, primary care is the hub of many integrated healthcare systems where it has been considered as the means to achieving integration (Albrecht 1998; Cumming 2011; Robinson & Casalino 1996; Van Lerberghe 2008). Valentijn et al. (2013) considered that primary care, defined in terms of accessibility of services, continuity of care, availability of services and health service coordination, is the establishment of integrated care. On the other hand, integration can occur at different levels of a healthcare system: the micro level (between

physicians), the meso level (between teams) and the macro level (between organization) (Lamontagne 2013). Gillies et al. (1993) and Suter, Hymean and Oelke (2007) identified three types of integration which are clinical (horizontal and vertical integration), physicians-system and functional integration. Valentijn et al. (2013) combined the different dimensions of integrated care mentioned above and presented an integrated care framework, or what is known as the Rainbow Model of Integrated Care (RMIC). Therefore, here we explore the relationship between social network properties and integration as it is described in RMIC.

Case study

Integration of care has been considered a major priority in Australia (Health 2014). The NSW Integrated Care Strategy is a state-wide ministry of health initiative which has been locally interpreted. This case study examines one local health district's focus for integrated care, which is a project that aims to improve integration of care between all health services within a defined end geographical area, in order to improve patient experience and outcomes as well as to reduce duplication of services and improve efficiencies.

Who are the stakeholders?

The first step of stakeholder analysis was to identify the issue to be examined in order to identify who the stakeholders are and which stakeholders should be included in the analysis (Bryson 2004; Varvasovszky & Brugha 2000; Reed et al. 2009). The matter to be investigated was the level of integration among healthcare services, which is not known and for which there has been no evaluation undertaken to date. After identifying the issue, the next step was to identify the stakeholders. According to Freeman (1984), stakeholders are defined as "any group or individual who can affect or is affected by the achievement of the organization's objective." Therefore, the stakeholders that can affect or are "affected by" the integrated care project are the physical and mental healthcare services that operate within the valley. Eight stakeholder groups were identified: hospital-based services, community-based services, services that outreach to the valley, local health district (LHD) Aboriginal health services, LHD mental health and alcohol and drug services, non-LHD health services, general practitioners (some with visiting specialists) and private allied health services.

PROPOSITION

Integration between organizations outside the health field, such as in traditional corporate settings, can take place through the management hierarchy level, where there exists a line of authority (top-down integration), or through market competition characterized by contractual agreements between organizations in the form of partnerships and joint ventures (Axelsson & Axelsson 2006). However, organizations in public health are neither a part of a hierarchy or market competition. Therefore, in this study, we discuss another platform for integration that happens to take place through networks of organizational relationships. In the network mode, integration is mainly achieved when different actors, outside the boundaries of a specific hierarchy, collaborate with one another through intensive communication (Axelsson & Axelsson 2009; Child & Faulkner 1998; Powell 1990). Mur-Veeman et al. (2003) highlighted the importance of building networks across the formal boundaries of private and public care in order to develop and achieve integrated care through the use of social network theory and methodology.

In a study of collaboration and integration among health providers, Provan, Milward and Isett (2002) investigated the referral network of nonprofit providers, to assess service

integration after the implementation of a managed care system that aimed to improve funding and cost control. The results showed an increase in integration between the providers reflected by the increase in density and betweenness centrality scores of the referral network. Similar findings were reported by Fliervoet et al. (2016), where they conducted social network analysis to examine whether integration among stakeholders occurred in managing floodplain along the Wall River in The Netherlands. The results showed that stakeholder collaboration had been achieved, reflected by the high density and high betweenness and degree centrality. In light of the above discussion, we can hypothesize the following:

Proposition 1: Ego-density is positively correlated with perceived integration.

Proposition 2: In-degree centrality is positively correlated with perceived integration.

Proposition 3: Out-degree centrality is positively correlated with perceived integration.

Proposition 4: Betweenness centrality is positively correlated with perceived integration.

Several studies showed that integration is also dependent on central actors who occupy central positions (Nicaise et al. 2013), especially a brokerage position (Freeman 1979) that can span the structural holes and bridge different groups (Berardo & Scholz 2010; Burt 1992, 2004). Scholz, Berardo and Kyle (2008) examined whether density or actor centrality is more comprehensive in explaining the observed patterns of collaboration between stakeholders. The results showed that when central actors are able to bridge across networks, this leads to more collaboration than when actors are embedded in dense networks. Therefore, we hypothesize the following:

Proposition 5: Efficiency of an ego's network position is positively associated with perceived integration.

There is an agreement among many researchers that collaboration in a health system requires trust relationships between its different entities. Trust relationships in social network literature are illustrated by strong ties (Krackhardt 1990). Provan et al. (2002) investigated the integration and collaboration of healthcare services in a health system located in Tucson/Pima country, Arizona, where they found opposing evidence on Granovetter's theory on the importance of weak ties. Rather, they capitalized on the importance of strong ties, where the results of the study showed that healthcare services leaned towards strengthening their relationships with each to achieve integration among services. It was also shown that strong ties in a team of scientists and engineers were essential for solving complex problems (de Montjoye et al. 2014) It has been evident that the absence of trust and strong relations between private and public health in Netherland and England is a barrier to achieve integrated care (Mur-Veeman et al. 2003). In light of these arguments, it is anticipated that:

Proposition 6: Tie strength is positively associated with perceived integration.

METHODOLOGY

Participant recruitment

The research team identified 68 healthcare services to be included in the study. An email that carried information on the integrated care project was sent to all the services identified. Out of the 68 services identified, 53 services consented for their name to be on the list in the social network survey. This list included the most relevant healthcare services that provide mental and physical services.

Study design

This study adapted a whole network design, or a full network study, where the boundaries of the network are well defined and the actors are known (Chung, Hossain & Davis 2005; Robins 2015). A survey questionnaire was undertaken with providers working in the healthcare services, in the form of an interview. The provider supplied information orally on the advice network relationship, and the researchers completed the survey instrument with this information. Each health service was represented by one or two providers (clinicians or professionals) working within the service. The survey questionnaire consisted of three sections. The first section consisted of demographic questions, such as the name of the healthcare service, whether the service provides physical or mental healthcare, number of years/months in current position, and so on. The second part collected information on advice relationships. It involved a complete list of 53 healthcare services. The respondents were asked to select, from the list of 53 services, the services whom they gave advice to in the last six months and then use a 4-point Likert scale (less often, quarterly, monthly compared to weekly) to capture the frequency of interaction that measured tie strength. The name generator question was as following:

Advice to: Please identify those services to whom you have given advice related to your work in the last six months; then identify the frequency of interaction.

After identifying the services that the respondents gave advice to in the last six months and the frequency of interaction, the respondents were asked to give their own perception on the integration of services, using an integrated care instrument that is based on the Rainbow Model of Integrated Care (RMIC) (Valentijn et al. 2013). The integrated care instrument consisted of 29 questions and a 7-point Likert-scale ranging from "Strongly agree" to "Not applicable." The first two sections of the survey were completed by the researcher, based on the information given by the respondent, while the third section on integrated care was filled out directly by the respondent.

Sample size and response rate

All interviews were conducted face-to-face during December 2016 and January 2017, and lasted between 15 minutes and 90 minutes. The interview involved a member of the research team and a healthcare provider who was a representative of the service that he or she worked in. Out of the 53 services that consented for their name to be on the list of services, 49 services participated in the study. The number of providers interviewed was 56.

Data analysis

The data collected were imported into an Excel file in a form of network matrix. Then the Excel file was imported into the social network software program (UCINET) (Borgatti, Everett & Freeman 2002) to visualize the network and calculate the social network properties for each of the nodes. For confidentiality purposes, each healthcare service in the network was assigned a code to make it unidentifiable. The social network data obtained were inputted into the Statistical Package for Social Sciences (SPSS) for proposition testing. The distribution of data was assessed using the Kolmogorov-Smirnov test for normality. The results showed that the data are normally distributed. Therefore, Pearson correlation was used to understand the direction and magnitude of the relationship between each social network property and its perceived integration.

Results

The results from the Kolmogorov-Smirnov test for normality indicated that the independent and dependent variables are normally distributed. Therefore, Pearson's product-moment correlation indices were adopted. The descriptive statistics of the social network properties are presented in Table 1.

Table 1 Descriptive statistics

	Mean	SD	Min	Max
Ego Density	0.31	0.13	0	0.67
In-Degree	7.38	5.27	1	20
Out-Degree	7.38	9.28	0	43
Betweenness	57.5	116.25	0	607.39
Efficiency	0.67	0.12	0.44	1
Tie Strength	2.47	0.53	1	3.74
Integration	108.1	20.57	54	150

Table 2 Pearson correlation between social network measures and integration

	1	2	3	4	5	6	7
Ego-Density (1)	–						
In-Degree (2)	0.006	–					
Out-Degree (3)	–0.333*	0.138	–				
Betweenness (4)	–0.221	0.346**	0.771**	–			
Efficiency (5)	–0.917	–0.06	0.277**	0.2	–		
Tie Strength (6)	0.119	0.114	0.182	0	0.232	–	
Integration (7)	0.2	0.09	0.188	0.6	–0.32*	–0.06	–

** Correlation is significant at 0.01 level (2-tailed).
* Correlation is significant at 0.05 level (2-tailed).

The results of the Pearson's product-moment correlation (see Table 2) show no significant relationship between ego-density and perception of integration ($r = 0.2$, $p = 0.14$). In-degree centrality is not significantly correlated with perception of integration ($r = 0.09$, $p = 0.5$). There is no significant correlation between out-degree and perception of integration ($r = 0.18$, $p = 0.4$).

There is a no significant correlation between betweenness and perception of integration ($r = 0.07$, $p = 0.6$). On the other hand, there is a significant negative correlation between efficiency and perception of integration ($r = –0.32$, $p = 0.017$). Finally, there is no significant correlation between tie strength and perception of integration ($r = –0.06$, $p = 0.662$) (see Table 3).

Locating central actors: out-degree, betweenness and stakeholder category

Two centrality measures can play an important role in identifying the most central stakeholders that are responsible for information flow and giving advice in an integrated care

setting. Out-degree centrality refers to the number of outgoing ties associated with the node. It identifies the stakeholders that are giving the most advice in the network. In Figure 1, the size of the node represents out-degree centrality. The bigger the size, the more advice the stakeholder is providing. On the other hand, betweenness centrality measures the extent to which an actor lies on the shortest path and has a brokerage position between other nodes in the network. These two centrality measures are used to identify the top five stakeholders (Table 4) who are responsible for advice sharing and who are considered to be the most influential.

Table 3 Results of proposition testing

Propositions	Description	Supported/Not Supported
Proposition 1	Ego-density is positively correlated with perceived integration	Not supported
Proposition 2	In-degree centrality is positively correlated with perceived integration	Not supported
Proposition 3	Out-degree centrality is positively correlated with perceived integration	Not supported
Proposition 4	Betweenness centrality is positively correlated with perceived integration	Not supported
Proposition 5	Efficiency of an ego's network position is positively correlated with perceived integration	Not supported. A significant negative correlation
Proposition 6	Tie strength is positively correlated with perceived integration	Not supported.

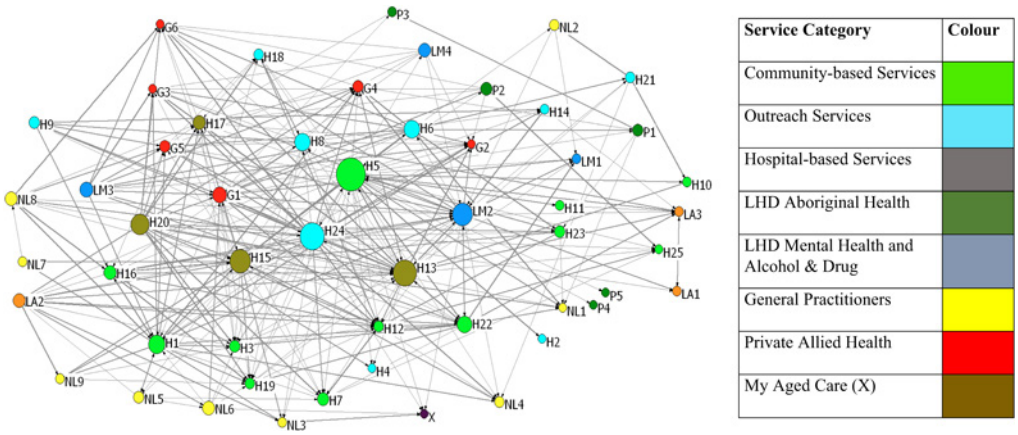

Figure 1 Stakeholder advice network

Table 4 Centrality measures for key atakeholders

Stakeholder ID	Stakeholder Group	Out-Degree Centrality	Betweenness Centrality
H5	Hospital-based services	39	540
H24	Servicers that outreach	29	63
H13	Hospital-based service	28	501
H15	Hospital-based service	23	196
LM2	LHD mental health and drug & alcohol	21	270

Discussion and conclusion

The social network construct (independent variables) that showed a significant relationship with the integration of services (dependent variable) was ego-network efficiency. In contrast, ego network density, in-degree centrality, out-degree centrality and tie strength showed no significant correlation with perceived integration. Although ego-network efficiency is claimed to be positively associated with collaboration and integration (Berardo & Scholz 2010), the results show that the direction of this association is negative. This means that a healthcare service that provides advice to other services to whom it itself is not connected would predict a low level of integration. As an example, in figure 1, if healthcare services such as H6 and H13, who have no advice relationship between each other, seek advice from H5, H5 would perceive integration as being low. Moreover, non-redundant novel information does not seem crucial for stakeholders providing physical and mental services for a patient. In terms of network structure, the network density is 13%, whereas centralization is 0.63. The advice network is highly centralized where very few actors (e.g. H5, H24, H13, H15, LM2) hold the majority of ties, while other services occupy a marginal position.

In this study, we presented how social networks can be used to understand the integration between stakeholders (healthcare services) by identifying which stakeholders or services are currently working together and which ones are not working with others. This information will enable the research team to identify areas and processes for improving integration by reducing the duplication of service and improving efficiencies. Moreover, we identified key and marginal stakeholders based on their position in the network that can be engaged during integrated care interventions. Central actors are considered important for the success of integrated care initiatives because they are able to promote certain ideas and create the required change within a network (Valente, 2010). We identified which properties of social networks are associated with the integration of services. At the domain level, key findings suggest that integration of services is not dependent on non-redundant novel information and the efficiency of a service's network position. Rather, integration can benefit from redundant relationships between healthcare services. Social network analysis can assist practitioners in their interventions and strategies towards improving integrated care efforts by conducting network sessions and seminars that reduce network gaps that exist between key central services and marginal ones. The results demonstrate how social network methodology can inform stakeholder analysis and identify key and marginal stakeholders based on their relationships. This information will help project leaders to engage stakeholders and identify gaps in healthcare integration projects.

A clear limitation of this study is that only mental and physical health services were included in this research and not other stakeholders. In future work, strong and weak ties will be used to thoroughly explore areas of strength and weakness for intervention. Moreover, further statistical tests such as the independent sample t-test and a regression model will be adopted to get more insights into the relationship between social network properties and perceived integration. In addition, we will be exploring the relationships between social network properties and different dimensions of integration listed in the RMIC model. Finally, we will investigate more types of stakeholder relationships such as referrals, socialize and team care arrangements in an integrated care setting.

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CONFERENCE PAPER

Making a case for adoption of project management methodology for capital works projects in Australian local governments

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Synopsis

Literature has been used to support the argument for adopting a project management methodology (PMM) in local government and to describe the potential benefits, including enhanced accountability and transparency, greater consistency in delivery, increased control, better risk management and better staff morale and job satisfaction. However, the question remains: Why have such PMMs not been implemented more widely in local government? Research is needed to investigate the barriers and catalysts of PMM adoption, which might facilitate PMM implementation.

Research design

The proposal is undertaken through a literature review.

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Relevance for practice / education

Despite local government undergoing considerable changes, adoption of a PMM to increase efficiency in the delivery of projects is sporadic. It is not known why the uptake of PMMs is infrequent. The paper argues for further research to explore the challenges of implementing a PMM.

Main findings

Literature indicates that despite the documented benefits of PMMs, their adoption in local governments is intermittent. The paper concludes with asking: Why have such PMMs in local government not been implemented more widely?

Research implications

The paper recommends that further research is needed to explore the reason for intermittent implementation of PMMs in local government. The outcomes of this research also could be used by other researchers to expand the scope into state and federal levels of governments.

Keywords

Project Management, Local Government, Municipal Council, Project Management Methods, Project Management Frameworks

Introduction

Project management failures in the private sector command considerable exposure, attention and publicity. Failure of public sector projects often attracts more attention than the private sector, as public money is being spent. Whilst the local government context provides many opportunities for research, investigation into project failures in the Australian local government context has not been carried out. This paper explores current levels of adoption of project management methodologies (PMMs) in local government bodies in Australia and identifies where further research is required.

Local government is the tier in a larger government sector that is in direct contact with the general public. "It is the level of government closest to the people and gives people a say in matters affecting their local area. Councils are governments that provide a vehicle for the expression of local democracy" (Victoria State Government (VSG) 2016). Local governments play a vital role delivering products and services that benefit and directly impact the population in its municipalities, such as planning and building compliance, local laws, maternal healthcare, animal management, waste and recycling, drainage systems, libraries, local sporting facilities, parks and gardens, local roads and parking, to name a few out of many. It is vital that such services and products meet the expectations of a community and are effectively delivered in order to undertake their role in local government successfully. Conversely, lapses in the delivery of products and services by local government are immediately felt by the general public and are subjected to scrutiny and criticism unlike any other tier in the government.

One of the instruments of delivering service to a community is through capital works projects. Capital works projects in councils need to be delivered efficiently for two reasons: firstly, they are funded through public money; and secondly, capital expenditure projects are relatively expensive, and the risk of losses is high. It would be reasonable for citizens within a local government area to expect value for the money spent on capital works projects. Therefore,

local governments need to demonstrate that capital works projects are being managed effectively and efficiently. De Vries and Nemec (2013) warn, "Spending less and taxing more is very risky, from an economic, political as well as a social point of view. Spending 'better' may help out."

A report by Project Management Institute (2013) suggests that 54% of government organizations globally do not understand the value of program management, and as a result "there is an average of US$148 million at risk for every US$1 billion invested in government agency programs around the globe." Jeff Roorda and Associates (2015, p. 6) estimate the gross replacement value of local government infrastructure for all Australian councils is in excess of AU$438 billion, and the estimated replacement value of infrastructure potentially performing in a poor to very poor state could be in the order of AU$47 billion. Therefore, poor project management could represent a significant risk, with close to AU$7 billion of the AU$47 billion expense of the assets expenditure at risk. This level of risk is ongoing because as assets age with time, they need continual, ongoing refurbishment or replacement.

Considering the substantial value of capital works to be carried out in local government, one might expect local government municipal councils would attempt to employ a PMM to manage capital works projects in order to achieve better outcomes. Indeed, the Australian Federal Government has made several attempts to introduce PMMs at federal, state and local government levels, with what could be described as sporadic success. Perhaps we should not be surprised. "Of the 20 capability reviews conducted by the Australian Public Services Commission and released to date, 11 have noted that departments struggle with project management skills and program management practices" (Shergold 2015). These findings have been confirmed by successive Australian National Audit Office reports, who revealed evidence of poor program and project management capability, especially on more complex initiatives. This is also indicated by the proportion of municipal councils in Australia that had taken up a corporate membership of the Australian Institute of Project Management in 2012: only 7 out of 565 (ABS 2012).

The fact that local government agencies have monopolistic advantages, unique and not subjected to open market competition (i.e. libraries, local sporting facilities, parks and gardens, local road network) means their services are not valued or measured in monetary terms and are not intended to generate profits. As a result, there is less motivation for local councils to adopt process improvement steps such as PMM to improve delivery and outcomes of their project execution. However, they are expected to deliver value for money in enhancing the standard of living of those that they serve, the citizens in their area of governance, the ratepayers. Therefore, the private sector and local governments have their unique offerings; similar in their intentions of creating value, but contrasting in their objectives of doing so.

The unique setting of local government creates challenges and catalysts throughout the life cycle of a PMM, from its inception to its optimal level of maturity. This paper supports the argument for adopting a PMM in local government and describes the potential benefits and the need for further research.

Background of local government in a global context

NEW PUBLIC MANAGEMENT (NPM)

The label "New Public Management" has been brought about because of an emphasis that has emerged recently towards the complete transformation of the public sector (Gomes, Yasin & Lisboa 2008; Hood 1995), originating in the United Kingdom in the 1980s and followed by

European, Commonwealth and Scandinavian countries. De Vries and Nemec (2013) identified two dimensions to NPM, one being the minimization of government, and the second being the attempt to improve the overall internal performance of the public sector. These authors noted that in order to achieve these aims, NPM was attempting to downsize the public service in line with neo-liberalism concepts. This left two alternatives for the reform of the public sector: to outsource work to the private sector or to improve the quality of delivery of public service. Profound changes have occurred in staffing, management and public services delivery because of the introduction of NPM (Lawton 2005).

Public sector organizations now need to operate in a quasi-business manner, within a set of value assumptions and statements which define how a public sector should be designed, organized, managed and function (Diefenbach 2009). Pynnönen and Takala (2014) noted that NPM challenges the traditional bureaucratic framework, going on to say that values such as dynamicity, good service, effectiveness, innovation, flexibility, efficiency and economic achievement are appreciated in NPM. De Vries and Nemec (2013) thought these principles were too demanding and critical and that a demand to adopt such principles suddenly would lead the public sector to perform worse in comparison to the private sector. However, they also suggest that there is evidence that the majority of tools used in NPM, if effectively employed, would improve efficiency.

Although local governments do not aim to gain financial profits, they are to uphold the traditional democratic values which they exercise by means of transparent, multi-stage procurement processes designed to look after and maintain public well-being (Pynnönen & Takala 2014). Thus, there are two different demands on managers in the current public sector environment: firstly, the requirement to take control and have accountability (public and visibility); and secondly, to improve customer responsiveness, efficiency and to have economies of scale (De Vries & Nemec 2013). The first set of demands requires restoration and strengthening elements of bureaucracy. The second set calls for the adoption of better management tools such as lean management, innovation, cooperation and networks in order to achieve better efficiencies and customer responsiveness. Implementing PMM also falls in this realm. De Vries and Nemec (2013) have identified that such demands create challenges in terms of pressures of operating with multiple layers of stakeholders, regulation, self-governing and steering. Adoption of a PMM would be of relevance as a best management process. Lawton and Monfardini (2010) also discuss public accountability gaining relevance in the policies of sovereign countries and in studies by academics in the line of maintaining the ethical behaviour of public servants. A framework such as a PMM embeds and fulfils governance requirements, which in turn assists in framing accountability to the public.

IMPACT ON EMPLOYEE COMPETENCE

The commitment of public sector managers has shifted from being a nominative commitment to a more strategic and utility-based commitment because of the influence of NPM (Pynnönen & Takala 2014). As result of the NPM agenda, outsourcing of functions such as municipal sewerage treatment plants, nation-building efforts and some internal design works to contractors and consultants could be observed. This trend is further elaborated by Kassel (2010) “Governmental employees have gone from being scientists, engineers, technicians, and builders themselves to managers of contracts with scientists, engineers, technicians, and builders”. The resulting loss of such competencies has created a “hollow state” (Kassel 2010) and a shortage of traditionally skilled staff (Crawford & Helm 2009). Nygaard and Bramming

(2008) noted pre-NPM public sector managers needed to have expert knowledge in a limited field and to provide advice on such expertise. They argue that in the NPM era, public servants must now obtain skills and competencies such as PM and stakeholder management.

PMM in local government projects

PUBLIC PERCEPTION OF LOCAL GOVERNMENT

Although it may be unfounded, there is a general perception that the government sector is inefficient and ineffective. The general public expects value for the rates and taxes that they are being charged, and councils are meant to meet these expectations. When such expectations are not met, ratepayers express their frustration through a democratic process of dethroning councillors.

Research by Igbokwe-Ibeto (2012) shows that poor project management is detrimental to the public perception of the council, and incurs significant financial losses. Therefore, it is important that local government councils maintain proper PM procedure, that is, holistic methodology, such as a PMM, to ensure compliance, transparency and governance. As noted by Igbokwe-Ibeto (2012), "Resources, where they are wisely used, promote community and socio-economic development and improve the welfare and wellbeing of people. One of the important roles of local government administration is that it gives government legitimacy in the eyes of the people it governs."

ACCOUNTABILITY IN LOCAL GOVERNMENT

Accountability at the local government level is important in global and local literature. The Project Management Institute (2006) emphasizes that public sector project managers need to be accountable to a broad range of stakeholders, including those within the project team and government as well as those external, such as the public, special interest groups and the media. Adopting an appropriate methodology can increase the likelihood of successful project completion and also facilitate transparency and the accountability mechanism (PMI 2003). The PMI goes on to note that everyone has the right to challenge public sector project managers and a PMM offers an effective management process that provides the assurance to the stakeholders that resources are being effectively managed (PMI 2003)."

FOCUS ON GOVERNANCE

Local government governance maturity has not halted with NPM: in fact, in the early decades of the 21st century, many authors such as Accenture (2006) and Dickson and Sullivan (2014) describe local governments as experiencing a rapid change in processes in response to increasing demands to do more with less. Bryson et al. (2014) describe the next step in the continuing evolution of public administration practice as without a name, but the new phenomena have since become informally known as public value management (PVM). PVM is characterized by a combination of four established features: public value and public values, government role as a guarantor of public values, the importance of public management for the public, and emphasis on citizenship and collaborative governance (Bryson et al. 2014). The gradual decline of NPM does not necessarily mean that all aspects of NPM have failed and need to be discarded. Some aspects of NPM still hold currency in the current context, for example, the call for efficiency, transparency and accountability. Such aspects would also be applicable to the instruments used to deliver the majority of infrastructure services in the public sector – which are mostly projects and programs.

This is further supported by Crawford and Helm (2009), who state, "The vehicles for delivery generally take the form of projects and programs, and effective PM is promoted as improving the ability to achieve outcomes while providing traceability, transparency, and accountability." They further state that, as the trend in government migrates from NPM to PVM and beyond, a change in expectations and realization of value of project management will occur in the government sector. It is presumed that although original values of NPM such as value for money, effectiveness and efficiency still hold, the added focus on public participation, consultation, political awareness/responsiveness and flexibility could be expected in future.

> Interest of the people in activities of their local government especially with regards to projects that they are handling, is to provide or to encourage growth and development of civic consciousness and the desire for improvement in local governance. The second advantage of this interest in government projects at grass-root level is that it helps promote accountability in governments. Political accountability has become necessary in view of so many cases of poor execution of projects, leading to waste of scares resources and abandoned projects that litter different parts of the community. (Igbokwe-Ibeto 2012).

Public sector managers need to be aware that there are ethical issues in the planning and execution of public projects, as such projects are generated because of public interest and benefit. Whilst they need to attend to public demand and interest, they also need to have an equitable balance in handling private sector personal/contractors that they oversee, making sure that distrust is not created with them. The public sector project manager needs to manage the governance of projects within complex rules and regulations while working in a generally politically hostile environment and downsized staffing conditions created by NPM movement (Kassel 2010). Additional challenges arise in the governance of projects when they are initiated as a result of strong political pressures. Maintaining professional standards and processes can be a struggle where stakeholders sometimes push to relax or abandon them altogether (Kassel 2010). Governance, and the systems and processes required to manage projects, can be more rigorously implemented where a PMM is adopted.

EMPLOYEE OPINION ON IMPLEMENTATION OF PMM

Work conducted by Payne and Turner (1999) suggested that in 1993 the majority of senior managers would have gradually risen from technical roles to the position that they are in now. This was not found to have changed in 2010, when Darrell et al. surveyed public administration project managers in Western Australia. They are quite familiar with the existing setup and appreciate things the way they are. They are conservative in terms of change to the existing status quo. They are loyal to their subordinates and wish to maintain the hierarchy and existing working relationships. Therefore, there is a tendency that these senior managers perceive project managers and management as being the introduction of an additional layer wedged between them and their subordinates. Payne further notes that the functional specialist also might feel threatened assuming this additional layer of management, as in doing so, PMs could limit their career progression.

Project management as a career is now more common and accepted, and it is possible that this perception of PMs as an unnecessary level of management is outdated – as demonstrated by Crawford and Helm (2009). A case study carried out by these authors into four government organizations in Australia provides insight into the value of PMs in the government sector.

It was found that overall, the staff valued the opportunity to work on projects and found satisfaction in participation; some were highly supportive of PMM implementation. Senior management considered implementing PMM as essential, and it was worth the effort in having it across the board in the organization. They were willing to face the challenge of an organization that would be resistant to change and continue to invest in PMM development of the people and processes. In all four organizations, there was evidence that PMM implementation was beneficial in terms of staff morale and satisfaction. However, they also noted that in some cases, project managers found the compliance aspect of PMM bureaucratic and time consuming, especially for small-scale projects in light of staff shortages, and found also an increase in workload due to adoption of PMM.

ABOUT PROJECT MANAGEMENT METHODOLOGIES

"A methodology is a structured approach for delivering a project, and consists of a set of processes, with each process having clearly defined resources and activities" (Turner & Simister 2000). A PMM will set out what an organization regards as best practice, improve inter-organizational communication, and minimize duplication of effort by having common resources, documentation and training (Clarke 1999). The Project Management Body of Knowledge (PMBoK) is generally regarded as a best practice PMM for infrastructure and construction projects, and is often adopted or adapted by organizations (Zielinski, 2005). However, in contrast Kerzner (2003) implies that the PMBoK is too rigid, and proposes that organizations adopt a PMM that is sufficiently flexible to support all projects. This may seem labour intensive, but Kerzner points out that the time invested in PMM development would depend on the typical size and nature of projects implemented, market competitons and functional boundaries (Kerzner, 2003). Research done by Payne and Turner (1999) further supports Kerzer's proposition. They go on to say "where people used consistent procedures regardless of project type, size and skill type, they reported less success than where people tailored their procedures" (Payne & Turner, 1999). The world's best organizations are adopting PMM as a "way of working," rather than adopting them as just another methodology or a tool (Eve 2007).

BENEFITS OF IMPLEMENTING A PMM

In the light of demand to demonstrate accountability and transparency to the stakeholders, which is catalysed by political rightness, governance in implementing policy in the form of government PM is a contemporary theme. Crawford and Helm (2009) concluded the following benefits of implementing PMM:

- Enhanced accountability and transparency, consistency in delivery, increased control, better risk management and efficient and effective management of public funds
- Better staff morale and satisfaction in delivering value to the public
- Effective approach to mitigate political risks on adverse media coverage

> "Applying a formalised PM framework, or methodology, to projects can assist in gaining formal agreement to the project objectives, clarifying the scope, identifying the resources required, ensuring accountability for results and performance, and fostering a focus on the final Project outcomes to be achieved." (State Gov Tas 2011).

CHALLENGES IN IMPLEMENTING A PMM, PM MATURITY

Millions of dollars are being spent by large corporates in the hope of developing their PM system (Eve 2007). However, they fail to achieve expected outcomes from such investments because the organization is not fully aligned to adopt and support PM.

> Public sector organizations responsible for infrastructure development in most non-industrialised countries, which include infrastructure departments/ministries, parasternal organizations and other statutory organization's qualify as project-oriented organizations. There are strong indications to suggest that these organizations' PM competencies leave a lot to be desired. At face value, they purport to be fully fledged project-oriented organizations and performing as competent PM organizations, while in reality, they are predominantly dependent on accidental project managers. (Rwelamila 2007)

A common reason for the failure of PMM and of projects in general, as noted by Procca (2008), is a lack of corporate management support and its members' full co-operation. A particular project may not be at the top of management's priorities. Therefore, the project manager needs to make sure that there is a clearly defined sponsor for the project who can ensure his or her dedication and commitment throughout the project. Similarly, the project manager needs to ensure that all resource requirements are communicated clearly and as early as possible. A project stands a better chance of succeeding if senior management broadly communicates its commitment to the project and its sponsorship. This emphatically calls for the rest of the organization to fall in line with the project objectives. From the top to the bottom level, an organization should be sensitive to the needs and priorities of the project throughout its life cycle. If PM competencies are unable to be obtained by the organization and its employees, it would be impossible to create a PM culture – recognizing that establishing a PM culture and a PMM within an organization takes time.

Another cause of failure of the adoption of PMMs in a local government is the people and the culture of the organization (Crawford & Helm 2009; Meier 2008). Expanding on the people aspect, Payne (1993) has identified two most common problems that functionally structured organizations encounter in introducing formal PM methods and practices. The first of such problems is the rift that is created between functionally specialized groups and the project office because of mistrust. Secondly, it is the actual exercise of establishing a project team, selecting the appropriate people who "gel" together and how the team structure would be set up. Lundy and Morin (2013) stress that the ability of the project team to manage change dictates whether or not the adoption of PM is successful. They state that resistance to change causes two-thirds of change projects to fail. Therefore, resistance to change is considered as a critical challenge to the adoption of project management, and in general to the process of change management. It is possible that some of this resistance comes from older staff and those who specialize. Crawford and Helm (2009) further state that such staff are focused on doing the tasks rather than planning. Therefore, they see little importance in tools such as business case and do not see such exercises as real work. However, most employees recognize the importance of PMM; they find it difficult to adopt such to day-to-day practices. So in the event of an out-of-the-norm situation, they abandon PMM practices and just scramble (Crawford & Helm 2009).

It is important that the organization understand where it is in terms of PM maturity in order to understand the level of effort, resources and time commitment required to establish a PMM. Implementing a PMM requires changes to processes, methods and tools which are

currently being used by the organization, in order to achieve desired goals (Martinsuo et al. 2006). Cultural and structural changes may be required in the organization, and management needs to understand the gap between where the organization should be and where it is now. Addressing the identified gaps is a prerequisite for progression to the next maturity phase (Procca 2008). For all of this to happen effectively according to (Eve 2007), the highest levels within an organization need to assume ownership of project maturity growth models. Unless such ownership is shared amongst the executive management team of the organization, such models will not succeed. The responsibility of actual execution of such a PM model could be delegated to the team who are focused on it and who can provide leadership, guidance and direction to the rest of the employees across the organization.

Project management methodology success factors

In his paper, Crawford (2006) identified key factors that influence the establishment of a PM culture, maturity and adoption of a PMM. The first is establishment of a project management office; the role of a project management office is to be the "proverbial glue that holds the PM efforts of the organization together." When attempting to establish a PMM in an organization, the role of the project office is vital. Although it assists project employees with obvious support in the areas of PM tools, training, scheduling and status reporting, a PMM also provides mentoring, consulting assistance, personnel devp office catalyses and facilitates the process of PMM maturity in an organization while acting in the role of being a focal point in maintaining consistency in its approaches and operation of PMM, moving the organization towards a common vision.

The second factor is management oversight: the importance of top management and key leaders' involvement and oversight in establishing a PMM in an organization—not to mention in its maturity. Crawford (2006) stresses that it is important that management demonstrate an active interest in monitoring and measuring project performance and making the project manager responsible for the outcomes and accomplishments. If the PM community in the organization observes lack of interest from the management and realizes that no one is held responsible for project performances, an unwritten signal is sent to them that the organization does not support the establishment of a PMM – or perhaps PM in general. Therefore, top management must use the data which is being disseminated by the PM community, to the improvement of the overall performance of the organization.

Finally, PM is not specific to one specific skill category. It is an odd mix of skills, including technical, leadership and management, which few people naturally exhibit. Therefore, continued learning and development of such skills are necessary. The body of knowledge in these skills continuously evolves, and new skills also crop up from time to time; therefore, project managers need to refine and renew their skill set on a continuing basis. In line with the project manager being held responsible, Payne (1993) also insists that management needs to clearly define the project manager's role and authority in definitively communicating to all concerned within the organization. Thereafter, they must back up the PM help to avoid the interference which would undermine project managers' authority. The project manager's job must be seen by all "to be important and to be considered so by top management" (Payne 1993).

Once the decision to adopt a PMM has been made, selection of the most appropriate PMM requires investigation of several factors (McHugh & Hogan 2011). The first factor would be if there are PM certification providers in order to train, support and certify the

employees. Then, select an appropriate PM method that suits the relevant business. Finally, the PMM needs to be flexible enough to be adopted by the complete range of projects that the organization carries out. Payne and Turner (1999) established through their research that PM practices vary significantly from project to project. Although they found that the adoption of a standard PM practice across all projects increases successful project completion, customizing such processes reflecting the project type further increases the success rate. Affirming this, Kerzner (2003) also states that in order to increase the success rate of a project within an organization, an in-house PM method must be developed that is flexible enough that it could be could be applied to all types of projects within the organization. Zielinski (2005) agrees, recognizing that organizations adopt recognized external PM methods, such as PMBoK, which act as a blueprint to handle projects that have different life cycles and management structures that vary depending on the organization. Delving into the development of such organization-oriented PMM, Kerzner (2003) notes that the time and effort required to tailor a PMM to an organization varies from organization to organization, and it depends on factors such as nature and size of the projects, functional boundaries the projects need to work across and, finally, the competitive pressures.

The adoption of PM culture needs to happen gradually, not radically (Firth & Krut 1991; Wang 2001), which would lead to structural reorganization of the business. They have warned against radical change, stating that it would lead to tremendous anxiety on the part of employees, who would quickly realize that they need different skills and behaviours to what they have and that these would be in high demand and of value in the future of the organization. They identified four key steps for successful adoption of PM by an organization:

- Appraise the current status; identify gaps, development needs and barriers; and define goals to be achieved.
- Establish centralized control of project activities.
- Develop competence in staff and infrastructure. Make working on the project attractive to employees.
- Relax centralized control, as project success is evident.

In line with the above, they have stressed that a formal appraisal method in traditional organizations does not appreciate or evaluate the contribution of the employee towards projects adequately, but captures only operational contribution. Reiterating this, Procca (2008) recommends for the appraisal system to be modified in order to identify and motivate potential project managers. Appropriately, it has been stated by the Project Management Institute (2003) that

> an organization's culture consists of its beliefs, values, and norms. They may explicitly express and often remain hidden to form part of the implicit context or organization life that can exercise a gravitational pull on decision-making . . . The successful implementation of PM depends on an organization's explicit belief that the manner in which projects are managed is just as important as what they achieve. PM becomes the way we do business around here.

In order for a PMM to be successfully deployed, it is important to secure the buy-in and support of the top and middle management of the organization (Firth & Krut (1991). These authors further state that deployment is a delicate balancing act and needs to be rolled out at a pace that is governed by the feedback being received, although, in general, organizations go through a fast phase change in order to keep up with others in the industry. Therefore, the deployment of a PMM might not necessarily attract attention from middle management,

as one would expect. It is important that a PMM be introduced in "small bite" stages in the backdrop of the existing dominant culture; if not, one could expect a backlash. On the contrary, fear of potential antipathy from line managers would slow down the deployment process, which is counterproductive and would not help the movement towards a new PMM culture. During the deployment stage, it is important that specialist PM advice and support be available for projects "in the line." At this stage, it is appropriate, as the PMM competency within the organization grows, that any specialist support be trimmed down.

Conclusion

This paper reviews recent reforms that the public sector worldwide has undergone under "new public management" initiatives. The main focus of NPM was to improve the quality of the public service delivery and to downsize the public service. In order to achieve this, many best practices from the private sector were adopted by local governments. One such main practice was competitive tendering, which led to many public services being contracted and outsourced to the private sector. By doing so, core technical capabilities that local governments possessed were eroded. Governmental employees have gone from being scientists, engineers, technicians, and builders to managers of contracts with scientists, engineers, technicians and builders.

The paper suggests the changes in local government have given rise to a "hollow state" that has changed the focus of the public servants' role from a technical subject matter expert to that of a manager of procurement projects. Literature was used to support the argument for implementing PMMs in local government and to describe their potential benefits. These benefits include enhanced accountability and transparency, greater consistency in delivery, increased control, better risk management and more efficient and effective management of public funds, as well as better staff morale and job satisfaction. For all these benefits, the question remains: Why have such PMMs not been implemented more widely in local government? Future research is needed to investigate the barriers to PMM adoption as well as the catalysts of change in local government that might encourage PMM implementation.

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CONFERENCE PAPER

Social Network Analysis: Towards a network perspective of expertise coordination and project team performance

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Synopsis:

Project teams often under-deliver or fail to deliver altogether. One of the reasons for such failure may be found in the project team member's inability to coordinate expertise within the project team. Research demonstrates that certain communication patterns foster better expertise and knowledge coordination. The purpose of this article is to find supporting research that certain structures of project expertise networks may affect and predict project performance and expertise coordination within the project team.

Relevance for practice/education:

This article demonstrates that a significant gap exists in research that uses a Social Network Theory methodology to measure project expertise networks and to find implications for project team performance. This paper also demonstrates the benefits of using Social Network Theory in the project management domain.

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Research Design:

This research study involves 15-20 project teams, who will complete a survey measuring their project expertise network, project team performance, and expertise coordination. The article presents the relevant literature on the relationship between network structures and expertise coordination, formulates hypotheses and illustrates a research model.

Main findings:

The findings are demonstrated in the form of a literature review.

Keywords

social network analysis, project team networks, project performance, expertise coordination, and knowledge-sharing networks.

Introduction

In this day and age, project teams are responsible for a significant part of organizational work. Without them, it would be difficult to respond to the growing uncertainty and complexity of the modern-day organizational environment. Team interactions, specifically related to expertise coordination, allow project teams to seek out novel solutions to complex problems and, at the same time, meet externally driven deadlines. Yet, to facilitate effective expertise coordination, project team members need to not only have access to resources, but to also navigate within their project expertise network (Cummings and Cross 2003, Chiocchio 2007, Balkundi and Harrison 2006). Social Network Theory offers both a theoretical framework and a methodological approach that can identify and visualize the structure of relations between team members (i.e. the project network) and, thereby foster a better understanding of team interactions within their project expertise network, which shows the flow of knowledge and expertise within the project team, and their effect on expertise coordination as well as project team performance. This paper intends to review the existing literature and to build an operational model for further research.

A brief background on Social Network Theory

Social networks - the structures that consist of patterned relations (known as ties), and individuals (referred to as actors) are an inevitable part of all organizations. Since Social Network Analysis (SNA) analyzes and maps out network structures, researchers can gain significant insight into communication, information or expertise patterns that are transferred through these networks.

In SNA, actors (e.g., Individuals or groups of individuals) have either direct or indirect relations (also known as ties) with each other. Direct relations produce stronger influence than indirect relations and are often marked by greater intensity and access to information. While direct contacts often circulate similar information in their intimate circles, indirect relations occur through agents (i.e., intermediaries) and bring greater exposure to new information and opportunities (Granovetter 1973; Scott 2012).

Social networks are complex systems, and hence, the relations between entities are dynamic. (Vega-Redondo 2007). Thus, social network structures are not static, but are in a state of

continuous change due to the changing relations between actors (i.e., some ties become non-existent between entities, while other ties form in their place). Such changes within the network arise both intentionally and unintentionally and modify the network structure (Manson 2001).

Social networks reveal different properties of connections that, in turn, influence the beliefs, perceptions, and actions of the actors involved (Scott 2012). SNA is therefore able to infer the effect that certain network structures will have on project team performance and expertise coordination within that team.

Prior research has largely been conducted outside of the business and project management domain. Researchers are starting to value the use of SNA in project management, and the effect that network structures have on individual performance (Cross & Cummings 2014), project team performance (Balkundi and Harrison 2006). It is our intention to show that there is value in expanding SNA further to the project management domain, and to demonstrate that the structures of project expertise networks may affect how expertise is coordinated in project teams, and how, in its turn, it also impacts project team performance.

In what follows, we aim to associate different characteristics from the three levels of a project expertise network (whole network, actor, tie level) with project behaviors and characteristics and rely on existing research literature to determine how the project network might relate to project success.

Project network structures and the project team

Although research in project team networks is limited, studies on team and group, in general, can provide pointers towards a plausible hypothesis for project team performance and project network structures.

Teams with many direct and indirect ties create a dense network, which allows team members to respond well to crises, to continuously interact with team members, and to foster a free flow of information (Ahuja and Carley 1998, Krackhardt and Stern 1988; Krackhardt 1999; Cross & Prusak 2002). Disconnected project team networks (with a low density of ties) may hinder their own performance by not sharing critical information. In such networks, the few individuals that are better connected to the rest of the team than the others may involuntarily hoard or distort the information that they share with the rest of their team members and, thereby, negatively affect team performance (Burt 1992). Because the exchange of significant task-relevant information is particularly important to project teams, as project work requires timely coordination of knowledge and expertise for successful project completion (Chiocchio 2012), the structure and connectedness of the project expertise network (as a whole) plays an important role. Therefore the following propositions, based on the network level, are as follows:

H1a: Density of ties in the project expertise network will be positively related to project team performance.

H1b: Degree centralization in the project expertise network will be negatively related to coordination of expertise.

The Project Leader and the Social Network

Research demonstrates that team leaders central to their network are more competent and carry a wealth of knowledge as well as expertise gained through experience, interactions and their own skills (Balkundi and Harrison 2006).

While centralization relates to the whole network (i.e., the degree to which a network), centrality refers to a single actor's position in the network. Despite the project leader's competence and skills in project management, s/he also needs to be able to effectively navigate among the project team, stakeholders, clients and the steering committee and to coordinate, monitor and direct the delivery of the project. In a sense, a part of project manager's job is related to coordinating the expertise among his team members. This requires a conscious ability to navigate within the social network of the organization. It follows that to aid the team in problem solving and to provide relevant information for specific tasks, the project leader needs to be central in the expertise network. Otherwise, the project manager, without knowing who possesses the relevant information and how to align that information with the project tasks, may find himself in an unfortunate position of following only the formal (hierarchical) channels for the delivery of the project, which may hinder project performance and project team performance (Cross and Prusak 2002). To further this point, Cross and Cummings (2003) suggested that an integrative and interconnected network structure is essential for positive performance, as such structure decreases the reliance on a single person within the network and allows for an effective flow of information between the project group. Therefore, the following actor-level propositions align with the research:

> *H2a: Project leader's degree centrality in the project advice network will be positively related to coordination of expertise in project teams.*

> *H2b: Project leader's degree centrality in the project advice network will be positively related to project team performance.*

Although it is assumed that the project leader acts in the best interest of his team, the project leader could contribute to the structural holes in project teams to exercise more power of the information that each group member receives (Cummings and Cross 2003; Burt 1992) and to "enjoy the concurrent informational power benefits from non-redundant ties" (Sparrow et al. 2002 p.318).

Thus, while project leader does not have full control of his team's interactions, s/he can still affect them by avoiding intentional structural holes within the team network and by fostering dynamic interactions between team members.

Project Team Performance and Project Performance

A variety of measures exist to assess project team performance. These comprise outcome-based project measures that include but are not limited to cost, budget, profit, sales, schedule and cost variance (Fleming & Koppelman 2000), self-assessments, feedback mechanism, measures that account for team health, team orientation, team longevity and team viability (Ammeter and Dukerich 2002). All of these measures have their benefits and limitations. While self-report measures of performance are often distorted, and objective measures are not always available or carry the same level of significance among different projects, assessments by expert judgment could result in reliable performance data.

For the purpose of this study, project team performance will be split into project performance and team orientation.

Despite the disagreement between scholars about what constitutes project success, there is a general consensus in literature focusing on project success with Baker, Murphy and Fisher (1998) stating that projects are judged to be successful based on subjective perceptions and a project will often be deemed to be an overall success if the project has met its primary mission, and the key individuals on the project team along with the key stakeholders (clients and users) are satisfied with the project outcome. Although the technical factors of projects delivery – scope, time and cost are important within the overall context of the project, they are not the primary determinants of project success. For the purpose of this study, Pinto and Slevin's (1988) survey will be used to measure project outcomes.

The concept of team orientation perceives a healthy team as a potentially high performing team, where team members support, respect and trust each other; where team goals are placed above personal interests, communication is frequent, information flows freely, and teambuilding occurs in harmony with the team environment (Katzenbach and Smith 1993; Balkundi and Harrison 2006).

Such team players that will not only perform well in their existing team but will also often be a part of productive teams in further projects. To measure the internal state of the project team, a survey from Watson, Johnson & Merritt (1998) was adapted; it provides comprehensive and validated questions that measure team orientation.

Project network and expertise coordination

Because project teams are seen as an important organizing factor for a large amount of work in organizations, team interactions, specifically related to task and coordination, play a significant role in both project team performance and effective project management (Chiocchio 2007).

Coordination in project teams refers to the use of strategies and behavioral patterns aimed at integrating and aligning the actions, knowledge and objectives of interdependent members with the view to attain common goals (Arrow, McGrath & Berdahl 2000; Brannick, Prince et al. 1995). It is through coordination that teams are able to function as a whole. Thus, when coordination is poor, process losses occur that negatively affect project team performance (Rico et al. 2008). Past research has demonstrated that teams rely on explicit team coordination (Espinosa, Lerch & Kraut 2004). Despite the benefits of planning mechanisms (also known as impersonal, or administrative coordination) and communication mechanisms – achieved through feedback processes, personal coordination of formal and informal interaction – recent literature emphasizes the importance of *implicit coordination*, which takes place when team members *anticipate* the needs and action of each other, and are able to *adjust* their own behaviors accordingly. This is especially relevant to project teams that often deal with ambiguity and are required to adapt to stress and uncertainty, which affect the team's cognitive thought processes and flexibility.

Expertise coordination

Faraj and Sproul (2001) created an expertise coordination measure that can be largely attributed to implicit coordination rather than explicit coordination. By using this measure, it is possible to assess implicit coordination.

Literature provides two distinct interpretations of expertise. The first view considers knowledge to be an abstract representation, *while expertise is the possession of such knowledge*

(Faraj & Sproull 2000). Thus, teams are seen as instrumental in collecting expertise from different areas and accumulating individual skills and knowledge. The other perspective assumes that expertise emerges from the structural interactions between individuals and is context dependent.

Faraj and Sproul (2000) suggest that expertise coordination consists of the following elements: knowledge of expertise location, recognizing the need for expertise, bringing expertise to bear. Teams that are conscious of how knowledge is transferred to other members have shown an increase in team performance (Liang et al. 1995, Stasser 1992). Similarly, Cross and Cummings (2004) demonstrated that because one's awareness of other's expertise is associated with collecting information from that person, individuals that are aware of expertise networks are able to use them resourcefully and to respond timely to difficult situations, thereby positively affecting project team performance (Cross et al. 2003). Thus the following hypothesis is proposed:

> *H3: Expertise coordination within the project team will be positively related to project team performance*

A part of effective expertise coordination lies in the team's ability to integrate and communicate the knowledge acquired with the rest of the team. This is where the team network is instrumental in communicating the relevant knowledge, as formal processes of expertise access are not sufficient for complex problems and tasks (Kmetz 1984).

Strength of ties

In 1973, Granovetter suggested that in certain circumstances, weak relations (i.e., ties) carry more value than strong ties. Because strong ties form clusters of similar people, the information in these clusters is often redundant. Weak ties, on the other hand, can create a "local bridge" to different networks of individuals with access to new information.

Later, Burt (1992) drew a distinction between the two concepts of tie strength and the density of ties. He suggested that redundancy of information is characteristic of a dense network rather than merely strong ties. Because strong ties require a lot of time to maintain, shedding some of those ties could allow one to focus on ties that bridge structural holes and retain new information.

Although organizations would benefit from weak ties and access to structural holes, when it comes to expertise and knowledge within an organization, research tends to favor strong ties. Specifically, Hansen (1999) differentiated between giving out and receiving information. He suggested that there is a difference between identifying, locating and transferring knowledge. He concluded that project networks composed predominantly out of weak ties yield explicit knowledge. Although some projects require outside information, the ones that are characterized by complexity and require tacit knowledge, which takes time to explain and learn, would benefit from fostering strong ties (Ghoshal et al. 1994; Hansen 1999; Szulanski 1996; Uzzi 1996, 1997; Levin and Cross 2004). Thus, consistent with these findings the following hypothesis is proposed on the network tie level:

> *Hypothesis 4a: Tie Strength will be positively associated with expertise coordination.*

> *Hypothesis 4b: Tie Strength will be positively associated with project team performance.*

Tie strength has been measured in different ways. In practice, scholars have measured ties as reciprocated nomination (for strong ties) and unreciprocated nominations for weak ties (Friedkin 1980). Granovetter (1973) used frequency of contact as a determinant of tie strength. This research study incorporates Granovetter's measures of tie strength because they provide an objective measure that deals with the purpose of the research questions.

The Operational Model

The operational model in Fig. 1 depicts the measures used to assess the research variables and incorporates the hypotheses construed from past research. It is worth noting that the project expertise network is considered as an independent variable, while the project team performance and expertise coordination are dependent variables. The network measures incorporate different levels of analysis. On the network level, density is one of the most used measures in SNA and refers to the interconnectedness of actors, or the amount of ties between team members in relation to the greatest number of ties possible; degree centralisation refers to the social network structure as a whole and evaluates how centralised the network is (i.e., if relations are not spread out, but tend to point towards a handful of individuals). On the actor or individual level, degree centrality measures the actor's position in relation to others within the network, while on the tie level tie-strength measures the strength of the relations between individuals by determining how often these individuals interact with each other and the nature of their relationship.

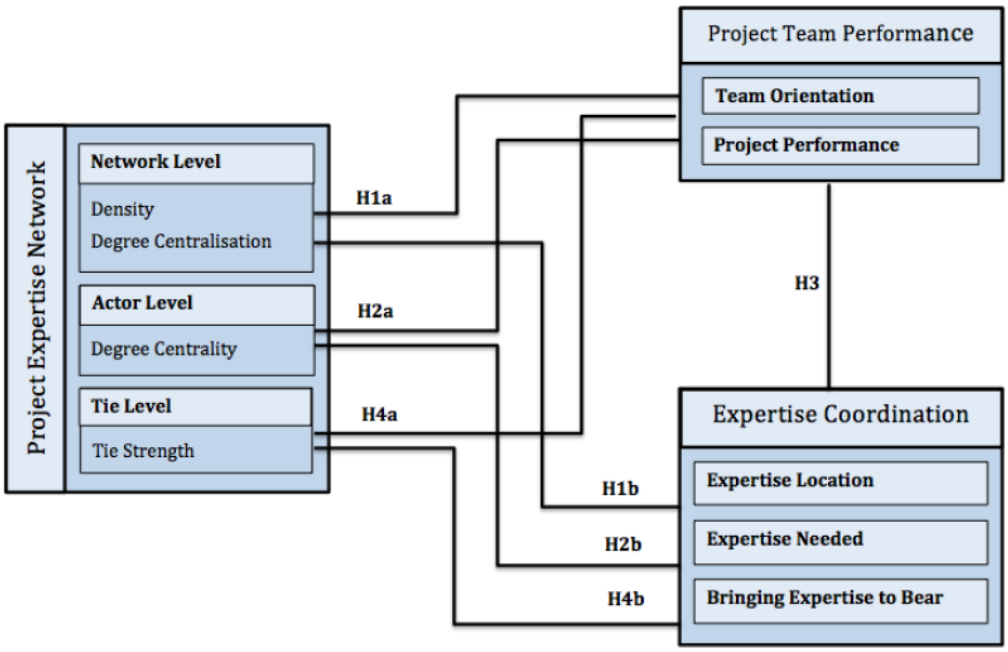

Figure 1 Operational Model

Project team performance is separated into two parts to measure project performance (a survey of Pinto and Slevin 1988) and team orientation (a survey of Watson, Johnson and Merritt 1998).

Expertise coordination measures will be based on Faraj and Sproull's (2000), and include three main categories: locating expertise, knowing where expertise is needed and bringing expertise to bear.

Because the operational model supports the existing research, it offers a comprehensive approach for collecting the required data.

Conclusion and Limitations

With the growing complexity of the current organizational environment, teams will remain as an important organizing factor of organizational work (Chiocchio 2007). Project teams, in particular, will need to be productive and efficient. Through SNA it is possible to improve our understanding of team interactions, and thereby point out the project expertise network structures that may aid these teams in coordinating expertise and improving their performance.

This paper outlined the relevant research and attempted to clarify the relationship between the project expertise network, expertise coordination and project team performance; it also presented an operational model, formed from the hypotheses that were supported by a review of the literature.

The limitations of this study include the highly debated definition of project success, the clarification of what project work entails due to the large diversity that project teams encounter within the organizational domain. It is also problematic that social network analysis uses a snapshot of a current network state and does not measure the actual project dynamics that may change within an organization due to a host of reason (i.e., change management, strategic alliances, people leaving their jobs, shifting to other departments). The amount of members in a project team may also pose a problem for this research as well as the amount of time the individual has been employed for.

All these elements are acknowledged and represent an imminent hurdle for the research study. Yet, despite these limitations, this research has the potential to clarify the effect that project expertise networks have on project team performance and coordination of expertise - a relationship that has not been studied specifically in project teams. Thus, this study stresses the value of extending Social Network Theory to the project management domain to gain a better understanding of project phenomena.

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CONFERENCE PAPER

Exploring the Effects of Centralised Procurement on Projects in South African Matrix Mining Organizations

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Abstract

Synopsis: The increasing use of centralized procurement in South African mining organizations has led to the need to understand the effect that this procurement governance model has on project procurement performance in matrix organizations. The purpose of this study is:

a) to understand the challenges experienced in projects in South African matrix mining organizations using centralized procurement;

b) to explore how the aforementioned challenges impact project performance in terms of time, cost, quality and client satisfaction.

Relevance for practice education: The study has identified knowledge gaps in centralized procurement literature especially in the context of the South African mining industry, which encourages further research in this field.

Research design: This paper presents the findings of a qualitative study, where 13 semi-structured interviews were conducted with project managers, procurement officials and suppliers of 5 different mining organizations in South Africa.

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Main findings: The study found that centralized procurement in a matrix mining organization is not perceived by the research participants to significantly influence procurement or project performance. The perception of the interviewees is that there are mainly positive effects in adopting centralized procurement in matrix mining organizations.

Research implications: The study highlights the relevance of centralized procurement in the mining industry in South Africa and denotes areas of improvement within the industry which could improve project procurement as well capital expenditure.

Keywords

Centralised procurement, Matrix organization, Mining, South Africa

Introduction

Time is a very precious commodity in projects, as it is generally linked to the cost performance of the project (Mahmoud-Jouini, Midler, & Garel, 2004). History and research has shown that most projects suffer from project schedule delays, budget overruns, poor quality and countless contractual claims, which are influenced by the risky and uncertain nature of projects, variation in project deliverables and excessive phase overlaps, amongst others (Dvir, T, & Shenhar, 2003; Yeo & Ning, 2006). Therefore much can still be done in terms of studying project challenges/failures and how these situations can be avoided (Glass, 1999). An area that requires further research is project procurement management. In Padalkar and Gopinath's (2016) most recent paper which summarises thematic trends and future opportunities in six decades of project management research, it is stated that the procurement management knowledge area has only been minimally represented. Furthermore, one of de Araújo, Alencar and de Miranda Mota's (2017) findings (following their structured literature review of project procurement management) is that future procurement research must consider new perspectives, such as client/supplier relations, due to the importance of having partnerships with suppliers that meet organizational needs. For these reasons, this study explores the procurement governance model for projects executed in matrix mining organizations in South Africa. The procurement governance model used in a project to a large extent determines the nature of the client/supplier relationship and imposes certain project procurement advantages and challenges (Blomberg, 2006; McBeath, 2011).

South Africa's mining community makes a significant contribution to the gross domestic product (GDP) of the country and is one of its primary employment sectors (Chamber of Mines of South Africa, 2013; Gunter, 2009; M. I. Walker & Minnitt, 2006). In 2012, the total expenditure of the South African mining industry was ZAR 497.1 billion[1], 33% of this was spent on operating and procurement costs. Furthermore, a sum of ZAR 59 billion was dedicated to capital expenditure in order to ensure growth and sustainable production (Chamber of Mines of South Africa, 2013). The mining industry in South Africa is valued at ZAR 650 billion (Gunter, 2009).

The mining community invests substantial capital into the economy, through procuring projects and this investment needs to be carefully managed. Therefore procurement management is one of the key areas where project costs and delays can be reduced, as less time

1 The rate of exchange for the South African Rand (ZAR) on the 10th of November 2017 is 1 US$ Dollar = R 14.33 (XE currency, 2017)

spent on procurement results in less time-related costs for each procurement process, reduced risks, less uncertainties and improved coordination between construction and project managers (Humphreys, McIvor, & McAleer, 2000; D. H. T. Walker & Rowlinson, 2008).

In this study Sparrius's (2016) definition of procurement is used which states that "procurement is the process of creating, performing and completing a contract which is mutually beneficial to all parties, with the intent to cement a long-term relationship between the parties." Procurement is a very important function for suppliers and clients to build sustainable and mutually beneficial relationships and to ensure that the acquisition of engineering and construction materials and professional services is done in a cost-effective manner (Sparrius, 2016). In the mining industry procurement is facilitated through a procurement governance model. This model determines the framework for client/supplier interaction as it governs the way in which the need for goods or services are determined, the identification of suppliers, bid solicitation and awarding and managing contracts. The procurement governance model sets the basis for cooperation between the client and suppliers and is essential to manage costs, and increase the quality of the deliverables (Sparrius, 2016).

A mining organization can adopt a centralized, decentralized or mixed method procurement governance model. Decentralised procurement is a model which delegates procurement decision making to the different operations of the organization, thus localizing procurement activities. In contrast, centralized procurement concentrates decision making to a central point such as the headquarters of the organization and all procurement activities are handled there. Mixed methods is a combination of centralized and decentralized procurement (Blomberg, 2006; McCue & Pitzer, 2000).

The procurement governance model is undertaken within an overall organizational structure, which for most mining companies is either functional or matrix (D. H. T. Walker & Rowlinson, 2008). The two basic organizational structures are the functional structure and the pure project structure. The matrix structure is a combination of the two basic structures (du Plessis, 2014; Steyn et al., 2016). Matrix organizations try to combine the strengths of functional structures (such as the development of key competencies, continuity at project closure and the availability of resources to all projects) and pure project structures (focus on project objectives and on the project client, flexibility, speed and team spirit). This study will only focus on the matrix organizational structure which is discussed in more detail in the next section.

Successful execution of project procurement in a matrix structure with a centralized procurement governance model is quite a challenge (McBeath, 2011). In many such instances, the organization has a project management office which delivers projects, working alongside other functional departments, this has its own set of advantages and disadvantages. Project managers find the matrix organizational structure immensely bureaucratic especially when the project is complex and there are many uncertainties (Geraldi, 2008). Therefore it is very likely that this is also the case when working in a matrix organization with a centralized procurement governance model.

There is a host of literature on centralized procurement governance models in several industries in both the public and private sector (Aritua, Smith, & Bower, 2011; Murray, Rentell, & Geere, 2008; Pemsel & Wiewiora, 2013; Saharidis, 2011; Singh, 2007). However, research regarding this topic in the mining industry is limited. Moreover, very little research exists regarding the procurement governance model and organisational structure within which a project must be done and its influence on project procurement performance (i.e., time, cost,

quality and client satisfaction) (Financial Review Business Intelligence, 2012; McBeath, 2011; D. H. T. Walker & Rowlinson, 2008). Therefore, this paper aims to investigate procurement processes, considering the following research questions:

1. What are the effects of a centralized procurement governance model on a matrix mining organization in South Africa?
2. How do the identified effects impact on project performance in terms of time, cost, quality and customer satisfaction?

The unit of analysis is mining organizations in South Africa.

This paper summarises the work and results of an inductive, qualitative study, consisting of semi-structured interviews, which were transcribed and analyzed by means of pattern matching, and interpreted. The next section of this paper reviews the research on the centralized procurement governance model and matrix organizational structure; then the research methodology is described. A discussion of the study findings follows, including the practical and theoretical implications thereof. Finally, the study is concluded with recommendations for further research.

Literature Review

CENTRALISED PROCUREMENT GOVERNANCE MODEL

Centralised procurement has been studied in some detail in various countries (e.g., Brazil, the European Union and Uganda) and industries (e.g., ICT, defense and government) (Agaba, E. and Shipman, 2007; Cox, 2002; Sorte, 2013). However, literature regarding centralized procurement in mining organizations is sparse.

Centralised procurement is one of the methods preferred by mining companies such as Anglo American. (McBeath, 2011). Anglo American is a leading global mining company with assets in the South African mining industry. In 2015 the company expended ZAR 12.6 billion[2] on procurement (Govender, 2015). Generally, organizations tend to gravitate towards centralized procurement, as it allows them to leverage their economies of scale, obtain buying power, control decision making, streamline processes and enforce governance (Blomberg, 2006; Vagstad, 2000; M. I. Walker & Minnitt, 2006; Yeo & Ning, 2006).

Centralised procurement is also associated with sacrificing the budget holder's autonomy, the individual in charge of delivering the project has little power to use their budget as they see fit (Murray et al., 2008). There is evidence that suggests that this could negatively impact on projects delivery and could result in greater cost expenditure (Eriksson & Westerberg, 2011). This system is also hierarchic as the approval of contracts is done by the central procuring review body, and the release of purchase orders is done by procuring officials who are centrally located at the headquarters, this can introduce inefficiencies in the procurement process, which could increase project costs (Singh, 2007).

Centralised procurement requires the procurement officials to elicit information from project managers, or delegate decision making as they have little knowledge of the mine and local suppliers' capabilities (Vagstad, 2000). This is because most South African mines are situated in remote locations, while procurement for these mines is in most instances done at the head office. The distance between the procurement officials and the mine can cause project

2 . The rate of exchange for the South African Rand (ZAR) on the 10th of November 2017 is 1 US$ Dollar = R 14.33 (XE currency, 2017)

managers and operational staff to have unrealistic expectations and often delays purchasing activities. This may place the procurement official under pressure to skip certain steps, thus neglecting the procurement policies (Financial Review Business Intelligence, 2012; Wittig, 1999). According to the Financial Review Business Intelligence (2012), procurement officials often lack adequate skills, training, and resources to seek the correct vendor for the tender, to conduct work at the level required by the project manager, and they have difficulty with maintaining long-term supplier relationships (Micheli, Cagno, & Di Giulio, 2009; Pesämaa, Eriksson, & Hair, 2009; Singh, 2007; Tysseland, 2008; Wardani, Messner, & Horman, 2006).

The shortcomings of centralised procurement need to be addressed as improved procurement has many benefits for an organisation, such as purchasing the correct equipment the first time which reduces quality costs, drives standardisation (everyone is buying similar products) and the organisation is able to gather market intelligence, thus obtaining the best technology at the best prices, all of these benefits are of monetary consequence (Blomberg, 2006).

MATRIX MINING ORGANIZATIONS

Organisational structures are said to be vital for organizational performance, specifically procurement, as well as for accomplishing the project mission (Pettijohn & Qaio, 2000; D. H. T. Walker & Rowlinson, 2008). A mine's organizational structure should be designed to promote efficient project procurement and should not be an obstacle to complete the project objectives. Mining industries cannot use a pure projects structure, as their core business is selling ore not projects, nor can they rely on a purely functional structure, because they need projects to improve and sustain the business. They resort to a matrix organization which is far more integrative and agile (Steyn et al., 2016).

When a matrix structure is implemented well, the organisation should be working as a team, focused on the strategy, fully integrated across projects and functions, thus making resource sharing easier, and therefore information transfer will be efficient, and there will be sufficient skills development (du Plessis, 2014; Steyn et al., 2016). The matrix structure is beneficial for mining organizations as it is agile and can adapt to change. However, the matrix structure can present its own challenges. Project managers struggle with slow decision making in matrix organizations as a result of the conflicting objects of the different functional managers. Project delivery may also be slower due to resource over-allocation and multi-tasking caused by resources being assigned to multiple projects or operational tasks (Steyn et al., 2016).

Organisational structures have been discussed in the context of its characteristic composition (Ahmady & Mehrpour, Maryam Nikooravesh, 2016), its influence on communication (Král & Králová, 2016) and strategy implementation (Hyväri, 2016), amongst others. However, literature to substantiate the influence of matrix organizational structures on procurement is very limited. This study will specifically explore the effect of a matrix mining organization on centralized project procurement.

CENTRALISED PROCUREMENT IN A MATRIX MINING ORGANIZATION

The current situation in the South African mining industry is that mineral deposits are limited and are getting harder to access. Increasing pressure is being put on mining companies to mine more responsibly, and with changing economic conditions, mining can become expensive and unsustainable. The strategic objectives of the mining companies are normally aligned with

these changing circumstances, and capital budgets are allocated to operations, which carry out projects to meet these objectives (Govender, 2015). The projects are executed on-site by the project managers while procurement is done by the purchasing department at head office (Humphreys et al., 2000; McBeath, 2011; Saharidis, 2011). Supplier selection and contracts are negotiated centrally, and contractual terms are valid for all business units. Specialist procurement officials negotiate high-value contracts to increase bargaining power which encourages the standardization of products (D. H. T. Walker & Rowlinson, 2008). According to Murray et al. (2008), "centralized procurement operates on the basis of a specialized unit being in place through which procurement strategy is developed and implemented, and all tactical and operational procurement is channeled." Centralized procurement is used by executives to maintain control over important decisions, and is used as a tool to maximize efficiency and maintain company integrity (Gianakis & Wang, 2000).

According to Blomberg (2006), "Anglo-American recently decided to move from a decentralized procurement governance model to a centralized procurement governance model." With the old procurement model, each operation had its own procurement staff compliment. However, they realized, that they had common suppliers in areas such as petroleum, oils and greases, explosives, yellow equipment, tires, temporary labor, and other services. This meant that they could consolidate spending across operations by creating four groups.

This restructuring improved their ability to leverage economies of scale, and they were able to identify cost-saving initiatives by merging their spending in each category which resulted in optimized operations and lower prices through global sourcing. However, the disadvantages of centralized procurement were that project managers did not have any control over the sourcing for their project, long lead times on items, inflexibility and little to no relationship between the project manager and the supplier(s).

The performance of project procurement in a matrix organization can only be measured according to the Key Performance Indicators of the entire project; therefore procurement should be delivered on time, within the correct specifications, within budget and must meet the customers' expectations (Sparrius, 2016). It is proposed that these four performance measures may be influenced by the ten challenges associated with centralized procurement as identified from the literature. Table 1 provides a summary of these challenges and their effect on centralized procurement in matrix organizations.

Conceptual Model and Research Propositions

A conceptual model is proposed in Figure 1 which focuses on matrix organizations in the South African mining sector. Specifically, centralized procurement governance and how this effects project procurement performance, measured in terms of time, cost, quality and client satisfaction.

Effective and efficient project procurement is vital in the mining industry and needs to be done in the smartest manner possible to ensure that the organization is sustainable. The following propositions are put forward in this study based on the literature summarised in Table 1.

P1-1: A HIGH NUMBER OF MISALIGNED KEY PERFORMANCE INDICATORS BETWEEN PROJECT MANAGERS AND PROCUREMENT OFFICIALS WHEN USING CENTRALIZED PROCUREMENT IN MATRIX ORGANIZATIONS CAUSES CONFLICT AND PUTS PRESSURE ON THE PROCUREMENT OFFICIAL.

According to Aritua et al. (2011), the procurement department and project office generally have misaligned key performance indicators. An example is the procurement official's maintenance of the company's bidders list by removing inactive suppliers. However, this exercise could impact the project manager's ability to obtain competitive rates during the tender process as shorter bidders lists could lead to collusion among bidders. The misaligned key performance indicators may also result in the project managers having unrealistic deadlines, which clash with the procurement official's procurement protocol, thus placing undue pressure and creating conflict between the two parties.

P1-2: LOW SUPPLIER INVOLVEMENT IN PROJECT SCOPING LEADS TO POOR SCOPE OF WORKS AND REWORK.

Market intelligence gathering is a crucial activity in project procurement. However, the client (project manager) and supplier often do not interact until the execution phase. This can lead to multiple risks, depending on the project phase at that time (Edler et al., 2003). Normally the policies and systems in centralized procurement do not allow the project manager to go into the market prior to the execution phase, as this can lead to corruption (Blomberg, 2006; Pettijohn & Qaio, 2000; Wardani et al., 2006). Moreover, poor market intelligence, can result in poor scope of works, rework and time wastage.

P1-3: THE FURTHER (DISTANCE) THE PROCUREMENT OFFICIAL IS FROM THE MINE (OPERATIONS), THE LESS HIS UNDERSTANDING OF SITE NEEDS.

Mining operations staff are best informed about their local conditions, and best positioned to choose a local supplier (Wittig, 1999; Yeo & Ning, 2006; Yeqing, 2003). It is recommended that procurement officials be located closer to the operations so that they can be aware of operational needs (Blomberg, 2006; Yeqing, 2003). This means that the distance between where the procurement takes place and where the project takes place leads to a lack of understanding of site needs and delays in procurement and price variations.

P1-4: FEEDBACK BETWEEN THE SUPPLIER AND CLIENT WILL BUILD MUTUAL TRUST AND ENSURE REPEAT BUSINESS FOR THE SUPPLIER.

The procurement official plays an important role in developing the relationship with the supplier. In some cases, the procurement official does not have a relationship with the suppliers, which is disadvantageous for ensuring quality and for relational functions such as negotiating contracts (McBeath, 2011; Sparrius, 2016). Failing to develop this relationship with the supplier can lead to poor delivery from suppliers and poor trust between the parties which affects the supplier's ability to improve and obtain repeat business (Wittig, 1999; Yeo & Ning, 2006).

P1-5: FLEXIBILITY IN PROCUREMENT GOVERNANCE LEADS TO FASTER EMERGENCY RESOLUTION.

Projects are uncertain, and poor risk identification often leads to project managers pushing the procurement officials to expedite procurement (Haseeb, Bibi, & Rabbani, 2011; Love,

Gunasekaran, & Li, 1998). Unfortunately, there's no flexibility with centralized procurement, as there are many rules and regulations in place which inhibit expediting emergency work, as and when required by the project manager (Geraldi, 2008; McCue & Pitzer, 2000).

P1-6: THE GREATER THE NUMBER OF CHANGES IN ROLES AND RESPONSIBILITIES IN THE CENTRALIZED PROCUREMENT OFFICE IN A YEAR, THE SLOWER THE PROCUREMENT PROCESS TURNAROUND TIME.

The procurement officials in a centralized procurement governance organization do not have a standard role or responsibility assigned to them, they get distributed according to the workload, or need, and this has an effect on efficiency because they may not be competent for the job (Financial Review Business Intelligence, 2012). This also impacts on performance because they move from one role to another, which means that they do not get time to learn and become efficient in their work. These role changes can result in multitasking and student syndrome, meaning that they cannot focus on a task; therefore activities get delayed, and as a result, project performance may begin to decline (Nicholas & Steyn, 2012; Steyn et al., 2016).

P1-7: PROCUREMENT OFFICIALS WITH LIMITED KNOWLEDGE AND SKILLS IN THE PROCUREMENT OFFICE LEAD TO SLOWER PROCUREMENT PROCESS TURNAROUND TIME.

Great emphasis is placed on the training of procurement officials to be better equipped to do their jobs (Blomberg, 2006; Humphreys et al., 2000; McBeath, 2011; Yeqing, 2003). Financial Review Business Intelligence (2012) and Wittig (1999), states that the procurement official often lacks adequate training and resources to conduct the work at the level required by the project manager. Sometimes the low skill level affects their ability to seek the correct supplier for the tender.

P1-8: THE MORE PEOPLE THE PROCUREMENT OFFICIAL REPORTS TO THE SLOWER THE PROCUREMENT PROCESS TURNAROUND TIME.

A challenge of matrix organizations is multiple boss syndrome. The project management office co-exists with other functions, and the project manager allocates work to individuals in other departments (Steyn et al., 2016). The official procurement reports to the procurement manager and the procurement manager have conflicting business requirements from the project manager, and this leaves the project managers operating in a space of minimal authority over the procurement officials (Steyn et al., 2016). In most cases, the functional managers' legitimate power, wins the war for resources. In this case, the project manager needs to use interpersonal skills to overcome this challenge and get the procurement official to assist them with adequate urgency (du Plessis, 2014).

P1-9: THE SLOWER THE TURNOVER OF APPROVALS IN MATRIX ORGANIZATIONS, THE SLOWER THE PROCUREMENT PROCESS TURNAROUND TIME.

Functional managers are focused on how to do the job, they are specialists in what they do and normally operate in silo's, which can prevent the sharing of resources (Steyn et al., 2016). The different managers are not aligned with their work execution strategies, and this can result in slower decision making. In some cases, the delivery of projects procurement may be slower due to resource multitasking, as the procurement official is allocated tasks simultaneously, in multiple projects (Steyn et al., 2016).

P1-10: GOOD RELATIONSHIPS BETWEEN PROCUREMENT OFFICIALS AND PROJECT MANAGERS, LEADS TO BETTER PROCUREMENT SERVICE DELIVERY.

The matrix structure is heavily reliant on interpersonal relationships (du Plessis, 2014). The project manager normally has to make commitments regarding the project without any positional power (especially legitimate power) due to the hierarchy in matrix organizations. This situation forces the project manager to rely on personal power to get the job done. If there is no relationship between the project manager and procurement official, the project manager will not be able to influence the procurement official to assist in accomplishing the project goals. This would mean that the procurement process would be late, over budget and sub-standard leading to an unsatisfied client.

Research Methodology

This section describes the research methods. A realism perspective was adopted, using an inductive interview-based qualitative study, which is presented in this paper. The research will seek to describe the cases in their real-world context, attempt to explain why some conditions exist and to propose research questions or procedures to be used in the subsequent research study (Yin, 2014).

The unit of study is the South African mining industry. According to the Chamber of Mines of South Africa (2013), there are eighty-seven mining companies affiliated with them in South Africa. These include open cast and, underground mining operations. The study investigated companies which have mines in South Africa. However, these companies could be foreign owned. As the respondents from the selected mining companies are spread across South Africa, telephonic interviews were done. To have a well-rounded view of the research problem, practitioners responsible for the procurement in a project, the project manager and the project suppliers for each of the study mining organizations, were approached to participate in the study.

Development of data collection instrument

Semi-structured telephonic interviews were chosen as the data collection instrument. The interview questions were derived from literature and tested in a small pilot study. The first set of questions ask the interviewee to describe their designation or role in the organization, responsibilities, how often their role had changed, if they received training and the key performance indicators for their role. The second set of questions revolved around the procurement governance model used in their organization, the reason for the model and some exploratory questions regarding pros and cons of the model. Thirdly, information is requested about how market intelligence is gathered and how procurement emergencies are handled. The next questions are about their company's organizational structure, reporting structures, and the interpersonal relationships which exist between themselves and their suppliers and colleagues. Finally, if the interviewees state that they are project managers they are asked about the procurement performance in their project(s) in terms of schedule, budget, quality and client satisfaction.

Sampling and data collection

Gunter (2009), states that five cases and ten interviews are sufficient, while Baškarada (2014) states that anything less than fifteen is insufficient for qualitative research. A sample of five

mining companies in iron ore, diamond, copper and manganese mining, as well as their suppliers were invited to take part in the study. Purposive sampling was used to identify fifteen participants that were then approached to participate in the study, thirteen responded positively. To collect a variety of data and get integral information, the interviewees consisted of procurement officials, project managers or suppliers from various mining organizations in South Africa. The sample group was also not restricted to people from organizations with a specific procurement governance model or organizational structure. The interviews were conducted in a semi-structured manner with open-ended questions; these questions were adjusted depending on the person's role (Project manager, procurement official or supplier). Transcriptions were made immediately after the interviews and sent back to the interviewees for validation (Flick, 2009). The sample demographics of the interviewees is provided in Table 2.

Data analysis method

Case-study design is appropriate when the context of the research must be clearly understood. Case-study design is considered a pragmatic approach that permits employment of multiple methods and data sources to attain a rich understanding of the phenomenon under investigation. The findings from such multiple methods can be reconciled in case-study analysis, specifically through a pattern-matching technique (Almutairi, Gardner, & McCarthy, 2014).

After the interviews had been transcribed and checked by the interviewee pre-set and open coding was used to study the text. Pattern matching was used as the method of analysis in this study. This method compares the predicted patterns and/or effects with the ones that have been theoretically observed, and the identification of any variances or gaps (Baškarada, 2014; Yin, 2014). This study tested the necessary conditions by assessing whether outcome y is present when condition x exists. A number of conditions or categories were derived from literature. By counting the number of interviewees who mention the outcome y (codes/ expected effects) when condition x (challenge in centralized procurement) is present, or by counting the number of times the outcome is stated, it will be determined whether outcome y is related to condition x.

The proposition is disconfirmed if there is no evidence of predicted effects when a certain challenge is present. Greater differences in rival patterns/effects make the pattern matching easier, and disconfirming conclusions/results are more convincing (Baškarada, 2014). This means that when using pattern matching, confirmations of counterintuitive predictions will be more convincing than confirmations of logical predictions.

Analysis and Results

This section is divided into two parts, the first is an assessment of project procurement duration and the second investigates the ten propositions which are put forward herein. 13 interviews were held out of the 15 who were invited to participate, and this is a response rate of 86.7%. Walker and Selfe in Human and Steyn (2013) states that a minimum response rate of 70% is required for qualitative research. Response rates are graded from 8% as being 'unacceptable' to 100% as being 'excellent'; therefore the response rate for this study was recorded as acceptable (Human & Steyn, 2013). A count summary for the codes associated with each of the ten challenges/propositions in provided in Table 3.

Procurement duration

The interviewees had similar views regarding the duration of the procurement process. The data revealed an average procurement process cycle of 3.8 months with the outliers considered. However, this figure decreased to 1.7 months when the outlier responses were excluded. No duration guidelines could be found for procurement process turnaround times in the mining industry; however, according to USAID Deliver Project (2013), the procurement process should generally take between 1 and two months. The centralized procurement interviewees had an average procurement process duration of 2 months, and the decentralized procurement interviewees had one month. Both are within the recommended time frame. It should be noted that there is a perception from centralized procurement interviewees that they perceive the procurement turnaround time to be much longer.

Discussion of proposition results

P1-1: A HIGH NUMBER OF MISALIGNED KEY PERFORMANCE INDICATORS BETWEEN PROJECT MANAGERS AND PROCUREMENT OFFICIALS WHEN USING CENTRALIZED PROCUREMENT IN MATRIX ORGANIZATIONS CAUSES CONFLICT AND PUTS PRESSURE ON THE PROCUREMENT OFFICIAL.

The codes used to investigate the first proposition were *conflict, pressure on procurement official, less competition and collusion among bidders* which together were mentioned four times. The code 'collusion among bidders' arose during transcription as it is a practice that is quite common in the South African procurement landscape. Time and budget were the key performance indicator's that were mentioned the most in centralized procurement, and this was common for both procurement officials and project managers. There was not enough evidence to support the pattern that a high number of misaligned key performance indicators between project managers and procurement officials when using the centralized governance model in the matrix organization results in conflict and pressure on the procurement official.

P1-2: LOW SUPPLIER INVOLVEMENT IN PROJECT SCOPING LEADS TO POOR SCOPE OF WORKS AND REWORK.

The codes for this proposition were, *poor scope of work, rework and time wastage,* which were mentioned a total of ten times. Although all suppliers had to some extent been involved in the scoping of the project, they mentioned that it was not often done in the mining industry. Four of the suppliers also mentioned that the scope of works received, lacked detail and led to poor tender outcomes such as receiving few, no bids or incorrect bids. A few of the interviewee's pointed out that being involved in the scoping earlier on greatly improves the results of the tenders as the person adjudicating is able to adjudicate on similar work, and the prices are normally similar. In cases where the suppliers were not involved earlier in the project, the suppliers ended up with insufficient designs, poor scope of works, rework, and price variations. Based on the data analyzed it is evident that low supplier involvement in scoping leads to poor scope of works and rework.

P1-3: THE FURTHER (DISTANCE) THE PROCUREMENT OFFICIAL IS FROM THE OPERATIONS, THE LESS HIS UNDERSTANDING OF SITE NEEDS.

Site requirements, delays in procurement, knowledge of local suppliers, incompetent suppliers and price variations were the codes used to identify this procurement challenge/proposition. In

total, the codes were mentioned ten times. Most interviewees mentioned that the procurement department was in the city or at their headquarters and that the procurement official did not understand the mine's requirements and the implications of remote locations in terms of quoting. There was also a need for the procurement official to understand operational requirements, as this affects the tender process. For those with decentralized procurement, they reported a better understanding of site requirements as a benefit of a decentralized model. These interviewees also reported that the reason for adopting a decentralized procurement governance model was because of different site requirements. Therefore the further (distance) the procurement official is from the operations, the lower the understanding of site needs.

P1-4: FEEDBACK BETWEEN THE SUPPLIER AND CLIENT WILL BUILD MUTUAL TRUST AND ENSURE REPEAT BUSINESS FOR THE SUPPLIER.

The challenge/proposition regarding feedback between client and supplier had the following codes, *poor communication with suppliers, issues with payments, affects negotiating, lack of repeat business, and poor delivery from suppliers,* which were mentioned a total of twenty-four times. However, eleven of the thirteen interviewees mentioned either having a progress meeting or closure meeting where feedback was given to the supplier, and two of them mentioned that this was used as criteria for repeat business. One of these interviewees used centralized procurement and the other decentralized procurement. Good communication between the supplier and project manager ensured that the supplier received feedback and obtained an opportunity to improve. Based on the responses feedback between the supplier and client builds mutual trust and ensures repeat business for the supplier.

P1-5: FLEXIBILITY IN PROCUREMENT GOVERNANCE LEADS TO FASTER EMERGENCY RESOLUTION.

This proposition had the following codes: *pressure on procurement official to skip steps, slow resolution, and delays,* which were mentioned fourteen times in total. The results show that emergency resolution in both centralized and decentralized procurement can take 2.5 weeks. According to the USAID Deliver Project (2013), procurement emergencies should be treated within a week. Most interviewees stated that procurement could be expedited in cases of emergencies in their organizations. Therefore, the flexibility or strict policies of the organization's procurement model did not affect emergency resolution.

P1-6: THE GREATER THE NUMBER OF CHANGES IN ROLES AND RESPONSIBILITIES IN THE CENTRALIZED PROCUREMENT OFFICE IN A YEAR, THE SLOWER THE PROCUREMENT PROCESS TURNAROUND TIME.

This category had the following codes, *approval, slow, change of role, dealing with different procurement personnel,* which was mentioned 15 times in total. Four out of the five suppliers felt that they dealt with different individuals during the procurement process or for procurement matters during the project. Fifty percent of the centralized procurement officials had changed roles in the past year. This was reported as having an impact on the procurement turnaround time. It was found that the greater the number of changes in roles and responsibilities in the centralized procurement office in a year, the slower procurement process turnaround time.

P1-7: PROCUREMENT OFFICIALS WITH LIMITED KNOWLEDGE AND SKILLS IN THE PROCUREMENT OFFICE LEAD TO SLOWER PROCUREMENT PROCESS TURNAROUND TIME.

The challenge/proposition of training and skills development had the following codes: *slow procurement process, trained, skilled, underwent training, none technical,* which were mentioned a total of twelve times. All the suppliers reported dealing with procurement officials who were proficient in handling contracts and the tender process, however, some did mention that they struggled with clarification questions as the procurement official was not technically knowledgeable. The procurement officials were well trained therefore their lack of training did not affect procurement process turnaround times. As none of the interviewees had dealt with incompetent procurement officials, there is no evidence to support the proposition that the presence of procurement officials with limited knowledge and skills in the procurement office leads to slower procurement process turnaround time.

P1-8: THE MORE PEOPLE THE PROCUREMENT OFFICIAL REPORTS TO THE SLOWER PROCUREMENT PROCESS TURNAROUND TIME.

The codes for this proposition/challenge was*: slow procurement process, procurement official reporting to project manager and procurement manager, too many approvals*. In total, the codes were mentioned 11 times. There were cases where the procurement official has to report to the procurement and project manager. However in none of these cases was procurement found to be to slower than the standard two months. Therefore reporting to multiple people is not perceived to impact the procurement process turnaround time.

P1-9: THE SLOWER THE TURNOVER OF APPROVALS IN MATRIX ORGANIZATIONS, THE SLOWER THE PROCUREMENT PROCESS TURNAROUND TIME.

This challenge/proposition had the following codes, *too many approvals, slow procurement process, slow decision making* which was mentioned a total of fourteen times. The suppliers mentioned that multiple approvals were required for invoice payments which meant that suppliers received late payments and the creation of purchase orders is delayed which affects project commencement. Therefore the slower the turnover of approvals in matrix organizations, the slower the procurement process turnaround time.

P1-10: GOOD RELATIONSHIPS BETWEEN PROCUREMENT OFFICIALS AND PROJECT MANAGERS, LEADS TO BETTER PROCUREMENT SERVICE DELIVERY.

The codes for this proposition were as follows: *relationships, communication between the project manager and the procurement officials and conflict*, which were mentioned thirty-two times in total. The project managers mentioned that their good working relations, as well as the respectful interactions with suppliers, had resulted in efficient procurement delivery. This relationship often helps them to expedite procurement processes. Some mentioned that there are conflicts which arise however these are healthy conflicts and make the procurement official perform better. Therefore good relationships between procurement officials and project managers lead to better procurement service delivery.

1.1 DISCUSSION OF PROJECT PROCUREMENT PERFORMANCE RESULTS

Three of the suppliers had projects which were late, and four of the five suppliers were involved with projects that were over budget. One of the centralized procurement project managers

had a late project which was over budget, and the other project was just over budget. On the other hand, the rest of the project managers were involved with projects that were performing satisfactory and were adhering to scope. Centralised procurement alone cannot cause delays within the projects. However, as shown earlier the procurement governance structure can influence the project space in many other ways which could result in delays and costlier projects.

Conclusions and Recommendations

In this qualitative study, 13 practitioners representing five different mining organizations in South Africa were interviewed. The purpose of the study was to explore the effects of centralized procurement on projects in South African matrix mining organizations. Data was gathered through telephonic semi-structured interviews. An inductive approach was used to analyze the interview data in order to answer the research questions:

1. What are the effects of a centralized procurement governance model on a matrix mining organization in South Africa?
2. How do the identified effects impact on project performance in terms of time, cost, quality and customer satisfaction?

Contrary to the literature survey conducted, the results from the study showed various positive effects associated with projects in organizations using centralized procurement. Procurement in this environment is still completed within the recommended two months. Procurement staff were found to be well qualified and experienced within the organizations with centralized procurement. The findings show that the project managers and procurement officials are aligned in terms of important performance indicators. The project manager is also able to expedite the centralized procurement process in cases of emergencies. The procurement official and project manager are able to keep records of the suppliers' performance which is used to determine repeat business.

The disadvantages of centralized procurement are that the procurement official is normally based at the organization's headquarters (in the city), while the project is undertaken on the mine, which may be in a remote location. There is perceived to be a lack of market intelligence gathering for scoping purposes on the part of the procurement official, which is crucial for obtaining the right suppliers, avoiding rework and subsequent price variations. This distance between head office and site impacts the procurement official's participation in solicitation and project meetings, and they generally don't understand the scope of works and site requirements. The distance reduces the frequency and quality of communication between the project manager and the procurement official. Moreover, the fact that the two parties are not co-located is also detrimental to their working relationship; therefore, there is often conflict between them. However, this conflict is perceived to be beneficial as it tends to expedite the procurement process.

Some of the specific effects of centralized procurement in a matrix mining organization are:

- Slow decision making in terms of turnover of approvals which slows procurement.
- Low supplier involvement in scoping the projects as the procurement officials are allocated to multiple projects and based at head office.
- The procurement officials have a poor understanding of site requirements/needs as they are allocated to multiple projects and based at head office.
- Little to no relationship between procurement staff and suppliers which reduces trust and supplier performance and the possibility of repeat business.

- Changes to the roles and responsibilities of procurement officials are perceived to increase the procurement process turnaround time.

It was found that centralized procurement in matrix mining organizations does not affect the turnaround time for emergency procurement. The fact that procurement officials in such organizations report to multiple bosses is not perceived to influence project procurement turnaround time significantly. The study found that centralized procurement in a matrix mining organization is not perceived to influence procurement or project performance significantly.

Some of the disadvantages of centralized procurement in matrix mining organizations could be addressed by mines encouraging and supporting frequent interaction between the project manager and procurement official as well as between the procurement official and suppliers. This would facilitate communication, assistance with procurement processes, as well as decision making. They should also investigate the use of engineer, procure, construct and manage (EPCM) contracting strategies, which may improve scoping and reduce rework and price variations.

The theoretical implications of the study are that it provides insight into the effect of centralized procurement on projects in South African matrix mining organizations, which to date has not been explored in the literature.

A limitation of the study was that the data analyzed did not include company records of previous project cost and schedule indexes to substantiate details regarding project procurement duration and time taken to resolve procurement emergencies. All the information gathered was based on the interviewee's perception and some of the procurement performance information could contain bias based on the interviewee's role in the study. It is recommended that a quantitative study be done which includes secondary data such as company records to assess how many projects in a portfolio tend to experience delays during procurement and determine the extent of the delays.

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Tables and Figures

Table 1 A summary of the challenges and effects of centralized procurement in matrix organizations.[3]

Summary of challenges and effects of centralised procurement in matrix organisations		
Challenges	Effects	Reference
P1-1. Misaligned Key performance indicators between procurement official and project manager, which can lead to reduction in vendor lists. Governance being put over quick delivery of procurement services.	Less competition, collusion among bidders, pressure on procurement official, conflict between PO and PM	(Aritua, 2011; Blomberg, 2006) (Walker & Minnitt, 2006; Singh, 200
P1-2. Low interactions between the project manager and the contractor prior to implemetation, due to policies which can result in low market intelligence gathering and poor tender documents.	Poor scope of works, reworks, time wastage	(Blomberg, 2006; Pettijohn & Qaio, 2000; Wardani, 2004).
P1-3. Procurement offices are often far away from the operations which leads to poor coomunication between project managers and procurement officials.	Lack of understanding of site needs, delays in procurement, low knowledge of local suppliers, incompetent contractors, price variations	(Yeqing, 2003; Blomberg, 2006), (McBeath, 2011; Vagstad, 2000). Hanlin & Kaplan (2011)
P1-4. Lack of feedback loop between contractor and client which can affect supplier relationships.	Poor communication with suppliers, issues with payments, affects negotiating, lack of repeat business, poor delivery from suppliers	(McBeath 2011; Sparrius 2013), (Mahmoud-Jouini, et al., 2004), (Ye Ning, 2006; Wittig, 1999)
P1-5. Strict policies don't allow for flexibiltiy in order to treat emergencies.	Pressure on procurement official, slow resolution, delays	(Wittig, 1999)
P1-6. Having multiple roles and responsibilities in short periods, or constantly changing roles.	Multitasking, slower procurement turnaround time	(Steyn, et al.,2013) .
P1-7. Training and skills development obtaining training for your roles, showing knowledge of role.	Slower procurement turnaround time	(Humphreys, et al., 2000; Blomberg 2006; McBeath, 2011; Yeqing, 200
P1-8. Multiple boss syndrome- reporting to the project manager and procurement manager at the same time. Each has their different requirements.	PO reported to PM and Procurement manager, multitasking, slower turnaround time	(Steyn, et al.,2013) .
P1-9. Decision making - Slow to make decisions due to governance framework and meetings which need to be held.	Too many approvals, slow procurement process, slow decision making	(Steyn, et al.,2013) .
P1-10. Interpersonal relationships, Good relationships between the procurement and project personnel assisting with communication.	Poor relationships (related to distance), infrequent communication (struggle to get ahold of the procurement personel),	(du Plessis, 2014)

3 Acronyms: PO refers to the Procurement official and PM refers to the Project Manager

Table 2 Sample demographics

Gender	5 females
	8 males
Role	5 project managers
	3 procurement officials
	5 suppliers
Project management experience	3-5 years
Time period supplier has been working with mine	7-15 years
Centralised procurement in organization	9 interviewees
Decentralised procurement in organization	4 interviewees
Matrix structure in organization	10 interviewees
Functional structure in organization	3 interviewees

Table 3 Summary of challenges and effects of centralized procurement in matrix organizations

Categories	Codes	Times mentioned by interviewees
P1-1. Misaligned key performance indicators between procurement official and project manager, which can lead to a reduction in vendor lists. Governance being prioritized over quick delivery of procurement services.	Conflict, pressure on procurement official, less competition, collusion among bidders	4
P1-2. Low interaction between the project manager and the supplier prior to implementation, due to policies which can result in low market intelligence gathering and poor tender documents.	Poor scope of work, rework, time wastage	10
P1-3. Procurement offices are often far from the operations which lead to poor communication between project managers and procurement officials.	Site requirements, delays in procurement, knowledge of local suppliers, incompetent suppliers, price variations	10
P1-4. Lack of feedback loop between supplier and client which can affect supplier relationships.	Communication with suppliers, issues with payments, negotiating, repeat business, delivery from suppliers, turnkey	24

Table 3 continued

P1-5. Strict policies do not allow for flexibility in order to treat emergencies.	Pressure on procurement official, slow resolution, strict policy, compliance with governance	14
P1-6. Having multiple roles and responsibilities in short periods, or constantly changing roles slows down the procurement process turnaround time.	Approval, slow, change of role, dealing with different procurement personnel	15
P1-7. Training and skills development obtaining training for your roles, showing knowledge of role.	Slow procurement process, trained, skilled, underwent training, none technical	12
P1-8. Multiple boss syndrome- reporting to the project manager and procurement manager at the same time.	Slow procurement process, procurement official reports to project manager and procurement manager, too many approvals	11
P1-9. Decision making - Slow to make decisions due to governance framework and meetings which need to be held.	Slow approvals, slow procurement process, slow decision making	14
P1-10. Interpersonal relationships, Good relationships between the procurement and project personnel assisting with communication.	Relationships, communication, conflict	32

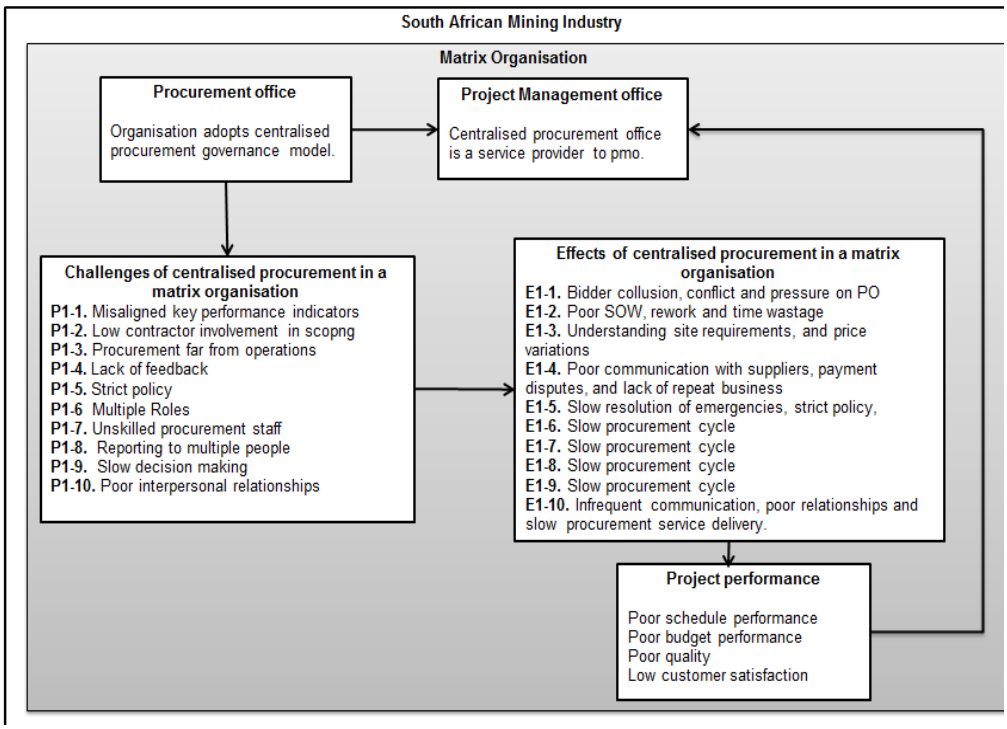

Figure 1 Conceptual framework

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CONFERENCE EDITORIAL

Bridging the practitioner-academic divide

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Project Management (PM) is a dynamic and fast-evolving management discipline that has experienced significant growth and acceptance over the last few decades. As the field transitions from its engineering and construction origins, it has become a more generally applicable management discipline relevant to all manner of business organizations.

At least, that is my personal perspective of the field, and as I have spent my entire career working on projects, it seems self-evident to me—no referencing necessary. Writing as a consultant or industry thought-leader, I could legitimately move on to more insightful, if not well-substantiated, thoughts about the state of PM. However, as an academic, I am uneasy and want to find some references to justify even these introductory statements. So right there, in the first paragraph, we encounter the practitioner-academic divide. But more on that later.

What provides evidence of the growth of the PM discipline is the increasing membership in professional associations, with the Project Management Institute (PMI) now reaching over half a million members globally (PMI 2017a). This is combined with studies predicting a growth in demand for PM professionals that is expected to reach 33% in the next decade (PMI 2017b). This trajectory has resulted in PM becoming an established course in many universities and tertiary institutions as graduates are trained to fill the jobs of the future. And as a result, there is an increasing need for engagement between PM academics and practitioners – especially when combined with the research interests in this burgeoning management field.

Academics effectively play twin roles: they are at once researchers acquiring knowledge, and educators imparting that knowledge to students. Although balancing these roles can result in an uneasy tension about which aspect to prioritize, they are both better served by a rich interaction

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with the practitioner base. Where poor engagement between practitioners and researchers can limit the quality and relevance of research, it becomes more problematic when universities are also responsible for training students – potentially educating them on impractical theories.

Interactions between academics and practitioners should form a virtuous cycle combining research, knowledge sharing and the education of future generations of project professionals. The study and understanding of how projects are managed in the wild can then be distilled into knowledge that is used to educate students better and prepare them with the skills and capabilities required by society. Practitioners deliver the projects that change our world, whereas researchers develop the theoretical foundations that offer insights into PM practices, with students learning about their real-world application and acting as accelerants, bringing new energy and enthusiasm to the profession.

That is good in theory anyway. The reality, as often is the case, can be a little different.

Left to their own devices, PM practitioners and academics tend to separate into insular communities that are content to work independently of each other. With limited interactions between the two camps, an underlying suspicion can emerge that discounts the value of each other's perspective. Such a disconnect between research and practice is not new, nor is it limited to PM. The (academic) management literature has lamented the situation and discussed the challenge of bridging the practitioner-academic divide (Lilien 2011; McNatt, Glassman & Glassman 2010). The sentiment is captured in this quote:

> The big problem with management science models is that managers practically never use them. There have been a few applications, of course, but the practice is a pallid picture of the promise. (Little 1970)

Although PM practitioners may not agree that practice represents the "pallid picture" described by Little, personal observations and discussions with both practitioners and academics confirm that such a divide exists and hinders information exchange between the parties. And though each of us has a unique story to illustrate the different biases at play, the issue deserves more exposure in the PM domain. So, in the interests of greater understanding of the different perspectives of each camp, I recount here my personal experiences (see Personal Perspective on page 5). It was these experiences, after all, which led me, as Chair of the Inaugural Academic Program at the Project Management Institute Australia Conference (PMIAC17), to introduce the Call for Papers as follows:

> As a management discipline based upon execution and delivery, PM professionals are more likely to be influenced by the experiences of their industry peers and press than any formal research findings. It is interesting to ponder:
>
> How many project managers read research papers on the subject?
>
> There can be a disconnect between researchers looking to contribute to improving PM practices, and PM professionals working at the coalface. Similarly, PM educators responsible for developing the next generation of project professionals can benefit from the real-world experience of PM practitioners and closer links to industry.
>
> The PMIAC17 Academic Program aims to provide a forum where academics and practitioners can exchange views and explore opportunities to collaborate on meaningful research. The end result will improve the quality and relevance of PM research while exposing practitioners to the frontiers of PM knowledge.

Achieving the virtuous cycle described earlier requires a catalyst to help these otherwise siloed groups forge the necessary relationships that can help advance the burgeoning PM profession. This is where professional bodies have a significant role to play, connecting their membership of PM professionals with the academics seeking to understand the real-world complexities of the discipline better. PMI has globally championed this cause, and the six Australian PMI chapters initiated the Academic Outreach National Project in 2016 with the goal to improve engagement between practitioners and academia. Engagement best practices were identified, developed and shared, as different chapters had varying degrees of interaction with local PM academics. Our focus and hope were that PMIAC17 could be the meeting point where all stakeholders in the Australian PM community could connect with one another and actively engage in building bridges.

The PMI Academic Group was key to the success of that mission, as it agreed to run its regional workshop for PM educators as a part of PMIAC17's Academic Program. The PMI Global Accreditation Centre's team, responsible for the accreditation of PM degree programs worldwide, invited academics from universities across Australia and subsidized their attendance at the conference. The first day of the Academic Program comprised presentations on Best Practices for PM Degree Programs, and panel discussions on topics including Establishing Industry Involvement in PM Programs and Working with Student Capstone Projects.

The second day of the PMIAC17's Academic Program comprised presentations of research papers. These were selected following a double-blind review process undertaken by academics and supported by PMI volunteers who coordinated and administered the reviews using the ExOrdo submissions management tool. The nine papers published in this Special Issue of the *Project Management Research and Practice* journal represent the PMIAC17 proceedings.

Social network analysis (SNA) proved to be a vibrant area of PM research, with three papers from Kenneth Chung's research team at the University of Sydney. It was pleasing that these papers were co-authored with young PM academics, with the paper by Fares, Chung, Passey, Longman and Valenijn (2017) applying SNA techniques to an integrated healthcare project and examining the stakeholder interactions in order to gain insights that help improve the delivery of health services. This collaboration between researchers and healthcare professionals shows the potential of new SNA techniques, which Anichenko, Chung and Crawford (2017) propose to apply to the PM domain itself. They provide a literature review to underpin a study of project team interactions that may potentially be able to predict project performance. To complete the theme, Chung and Du (2017) study influence and engagement in a project and propose that SNA techniques can complement the traditional static approaches of stakeholder analysis and could offer useful measures of stakeholder engagement during project execution.

Different aspects of project organizations were covered by a further three papers, with Hadjinicolaou, Dumrak and Mostafa (2017) reporting on their quantitative research based on a survey of project portfolio managers and look for correlations between portfolio sizes and the adoption of PPM practices. Ranasinghe, Gharaie and Gilbert (2017) provide a literature review to support their argument for adopting a PM methodology in the Australian local government context characterized by increased outsourcing that reduces technical expertise but increases the reliance on project management. To round out the project organizations theme, Liu and Chen (2017) consider longitudinal data from a construction business to investigate the how a project-based organization scales its business and the relationship this may have to project size and delivery risk.

Efficiencies in mining projects were the focus of two papers, with Skerman and Todhunter (2017) providing the background and literature review to support a study into an appropriate framework that can improve project outcomes in the Australian coal-mining industry. Meanwhile, Milanzi and Bond-Barnard (2017) describe the results of a qualitative study exploring the challenges and implications of centralized procurement on projects in South African mining organizations.

Finally, these proceedings come to a fitting close with Kenley and Harfield (2017) looking at the transfer of PM knowledge in Open Standards projects which see academics actively engaged as "practitioners" and supplying the lessons learned. The blurring of roles evident in this paper is a timely reminder that the practitioner-academic divide is not the dichotomy it first appears. This is especially true of PM knowledge where the ubiquity of projects means that academics may also be required to be practicing project managers for certain initiatives.

The richness of PM lies in the fact that everyone knows something about how projects work, but we also know we can do a much better job delivering them. So it will not be unusual to find ourselves applying both practitioner and academic perspectives concurrently, operating at both ends of the "divide" depending on the task we are performing. And with that realization, there seems little to prevent academics and practitioners from coming together to advance the art, and develop the science of Project Management.

Personal Perspective

I conclude this discussion of the roles, or perceptions, of PM practitioners and academics with a personal perspective of my career - as what might be termed a "pracademic." I had been a project professional with over 15 years of industry experience when I commenced my Ph.D. studies, and the interaction on both sides of the practitioner-academic divide has allowed me to observe what are some apparently common views regarding research.

A major portion of my career has involved in the adoption, evangelizing and – less ennobling – the marketing and sales of services relating to what could loosely be termed PM best practice. This involved positioning the wares of a well-known IT company in the business, as having some critical technologies or knowledge that was not freely available to others and which could only be shared as part of a purchase or consulting engagement. Executing the sale involved setting up certain individuals as gurus on a specific topic, who would then publish whitepapers for the company and do the rounds giving special lectures and workshops. For my sins, I was such a "manufactured guru" who was promoted and wheeled out by the marketing team to instruct major clients and advise sales prospects on the benefits of our solution. Long before my Ph.D. was completed, I always believed that I had some valuable experiences and even knowledge to share – but it was really not necessary and optional in the role.

Yet, the carefully constructed presentations, glossy marketing brochures and, more recently, engaging websites are what represent knowledge in the business world. I realized this clearly when the marketing team began to create their own material devoid of any input from any subject matter experts in the company. I became increasingly uncomfortable when the names of techniques and whole practices could be changed to provide some differentiation from a competitor's offerings or to give the appearance of something new and innovative. The resulting Tower of Babel was not of major concern to businesses, whether vendor or customer, as it merely meant that there could be product comparisons created which gave the illusion of market analysis with detailed comparison charts that guided the cognoscenti to make the best decision for their business.

Knowledge (like alternative facts) can be made up, packaged and distributed as a by-product of a marketing campaign – and then be forgotten and replaced just as quickly. This artificial, "latest thing" knowledge does not have to wait for any real discovery or progress, it only requires an understanding of the customers pain-points and a clever catch-phrase or product name which promises to address it. Add a compelling campaign which attracts prospective customers and a charismatic account manager who targets key dates in the purchasing cycle (around the tax year), and you have a winning sales formula.

That is what any burgeoning market can lead to a frenzy of marketing activity that serves only to confuse and confound the industry. And while there are apparently good people, like my younger self, working and learning in such organizations, the business goals are not driven by knowledge acquisition, so it will be the best sales campaign or team that wins the day (or more appropriately, the customer) rather than the march of knowledge.

What is disconcerting and indeed disturbing, is that the marketing hype works so well.

Armed with the latest, cleverly crafted buzz-words and with the help of marketing budgets that enable generously catered seminars and industry networking events, consultants and technology vendors can get the attention of practitioners, or more importantly, the decision-makers in any organization they target. Sophisticated presentations focus on key roles in the organization to make clear the relevance of the solution proffered – to the CEO, the CTO, the CFO and even the humble practitioner who is necessary to punch in the original information. With clearly stated benefits, customer case studies and return-on-investment calculators for the adoption of the solution, you can sense the power that the marketeer can wield with their weapons of mass-deception. At its worst, this is fake-knowledge creation on an industrial scale, and it presents a clear challenge to academia.

Becoming disenchanted with my role as an industry thought-leader, I attempted to redeem myself and chose to do a mature-age Ph.D. I undertook research on a problem-area I had previously identified working as a Test Manager in a large telecommunications organization. My attempts at penance proved to be somewhat naïve, and my idealistic aim of creating *true knowledge* through academic research soon hit some obstacles.

So as not to risk demoralizing any prospective academics or bore the reader, I will summarize my research challenges as follows:

1. There was simply no literature that discussed the real-world issue, as researchers did not yet thoroughly understand the problem. This necessitated a change in my thesis topic to study a related problem area that academics recognized.
2. Attempts to collect data from practitioners required applying for bureaucratic ethics approvals because questions that could be discussed over a coffee needed to be reviewed for potential risks and legal exposure as they involved invasive medical procedures.
3. A few practitioners were not willing to participate in the research, principally because they were required to sign Informed consent forms, which made individuals nervous about discussing their organization's problems.
4. Finally, when the thesis was finally written up, the findings were of only moderate interest to my practitioner colleagues who considered the rigor of the arguments to be implementable and certainly not as easy a read as competing marketing material.

The above issues are not insurmountable and were indeed overcome in due course, and wiser and more experienced researchers would know there are ways to undertake research expediently. But the challenges nonetheless demonstrate the hurdles facing academic research and knowledge creation that do not exist for marketeers Indeed, at the end of my Ph.D.,

having seen how both academic and industry knowledge creation systems operate, I genuinely wondered if doing academic research was perhaps a detriment to the development of my ideas. This was the opposite of my original idealistic expectation that my rigorous, impartial research would be accepted as an antidote to the clear, bias evident in the marketed solutions apparent in business.

I was wrong – no one cared. All knowledge seemed to be equal in the eyes of the practitioner. But how could that be, when one aspires to be thorough and impartial while the other is focused on selling products and services?

There is appears to be an unconscious equation that practitioners apply when assessing knowledge, irrespective of whether that knowledge comes from consultants, vendors or academics. Simply put, it is that business relevance, practicality and evidence of tangible results trump the academic's theoretical grounding, peer-reviews and comprehensive referencing. The two sides of the equation are not mutually exclusive, but there can be a practitioner bias which assumes they are, and that any result of academic research will necessarily be theoretical and irrelevant.

Academics are not without their own biases and preconceptions, one being that practitioners are merely the raw material from which to extract knowledge which can then be used to train and enlighten a new generation. Yet, without the strictures of a rigorous research method, practitioners often utilize far more advanced practices than are realized by academics. I have personally witnessed practitioners groan as an academic presented some new research finding that was new in the literature but has been common practice for decades. Although these practices may not appear in journal papers or have the theoretical underpinnings academics demand, they are very real, often with well-developed constructs described in industry papers.

Bridging the practitioner-academic divide requires both sides to understand and address their respective biases. Although there are challenges to getting academic research accepted by practitioners and adopted by businesses, doing so represents an opportunity to break out of a perpetual marketing cycle which offers little in the way of knowledge advancement. Yet, while the academic's tools of the trade may be useful in the development of new knowledge, that knowledge is only valuable if it is of relevance and value to practitioners.

Academics appear to me to be in an excellent position to extend their influence if they can borrow some of the marketer's techniques and apply the first rule of marketing: Know Your Customer. Yes, this requires that practitioners be recognized as the customer, or consumer, of academic research – not simply other academics. And it would demand deeper engagement between academics and practitioners so that problems are understood, and the search for solutions is a more collaborative endeavour. Finally, it would mean that any management model or theory is tested on the basis of its practicality, adoption and acceptance by practitioners, just as scientists must test their theories in the natural world.

On the road to this Nirvana, the role of practitioner and academic would blur, and the distinctions dissolve until all that remained was the informed investigator motivated to overcome the challenges facing society.

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