The Assessment of a Risk Management Implementation in Saudi Construction Industry

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Abstract

This study shows how an organizational and external environmental factor contributes to construction project failures within the Kingdom of Saudi Arabia. A 45-Item Questionnaire was distributed to 68 contractors, surveyors, and construction project managers in KSA. A principal component analysis was performed which produced five factors measuring the contribution of organizational and external environmental factors to the failure of construction projects in KSA. Questions related to competitive threats, company health, and productivity and infrastructure inadequate tools represented the highest commonalities scores of .81, .78, and .79. The findings indicate an existing contribution of organizational and external environmental factors in project failures in the KSA construction industry.

Keywords: Organizational Process Assets, External Environmental Factors, Construction Projects, Saudi Arabia

Type of Article: Quantitative Research (Principle Component Analysis).

Introduction

Background

Saudi Arabia, as a member of the G20, has been one of the biggest economies in the Middle East within the last four decades. In fact, Algahtany, Alhammadi,&Kashiwagi, (2016) referenced the construction industry as an indicator of growth by stating, "The public construction sector in Saudi Arabia is considered as the biggest in the Gulf countries with $575 million spent on public construction projects between 2008 and 2013." However contrary to the huge spending on construction projects, in 2015 it was reported that several construction engineering companies had sanctions levied against them for failure to complete government-awarded projects valued at $69 billion SAR in KSA (Arab News, April 28, 2015). The companies refused to answer any inquiries levied by the government. No project management related reasons were stated or reported pertaining to the why these projects failed. A year prior to this news, a report was conducted on the KSA construction industry aimed at classifying and identifying project failures (Ikediashi, Ogunlana, & Alotaibi, 2014). This report was conducted on 67 respondents with many years of experience in civil engineering, architecture, surveyorship and building engineering of infrastructure projects in Saudi Arabia. The findings showed risk management was ranked the highest in critical failure factors for infrastructure projects, while budget overruns and poor communication by management followed closely at second and third, respectively. Both of these reports speak of another underlining cause of project failure in addition to the typical project management related causes of cost, time, scope and quality. This study examines the impact of organizational and external factors on construction projects in the Kingdom of Saudi Arabia.

Regardless of the typical project management's factors that influence risk inside the construction industry in KSA, the organizational factors are just as important. However, unlike the project management factors, the organizational and external factors go unnoticed and almost never addressed in prior research on root causes of project management failures. This study looks at the organizational and external factors that impact construction projects in KSA based on the survey responses by professionals in the industry. This study examines the external factors of industry and market mismatch, development process gaps, process non adherence, productivity and infrastructure inadequate tools, inadequate training, project resources, insufficient funds, competitive threats, team physical proximity, company health, and unrealistic stakeholders' expectations and layout a framework for a risk assessment tool for predicting future project failures with a significant degree of accuracy in the Kingdom of Saudi Arabia (KSA) construction industry.

The roadmap of this study going forward, establishes the definition of project failure in the construction industry. Second, this study looks at the frequency of occurrence of prior research on the twelve previously mentioned organizational and external factors to support the construction of the survey instrument distributed to the respondents. Third, this research will layout the current state of the construction in KSA in terms of the number of existing companies, private and publicly traded the market capitalization on the Tadawul (The Saudi Exchange) and the common organizational practices within the construction industry. Once all twelve variables are established and represented on the survey instrument, a principle component analysis (PCA), to include Descriptives and a correlation will be conducted. Finally, the findings will be presented as a tool to be applied to construction projects in KSA to access the level of organizational and external factors' impact asa risk assessment of project failure.

Research Questions

The research questions established in this study were developed from the underpinnings of the prior studies related to the organizational and external environmental factors of company health, unrealistic stakeholders' expectations, development process gaps, process non-adherence, productivity and infrastructure inadequate tools, inadequate training, project resources, insufficient funds, competitive threats, and team physical proximity (Bissonette, 2016; Hughes, Rana, & Simintiras, 2017; Moshodi, Coetzee, Fourie, & Africa, 1996; Oehmen, Olechowski, Robert Kenley, & Ben-Daya, 2014; Olander, 2007; Olechowski, Oehmen, Seering, & Ben-Daya, 2016; Van Thuyet, Ogunlana, & Dey, 2007). Figure 1 shows a conceptual diagram of how the item question category comprises each research question.

The first research question:

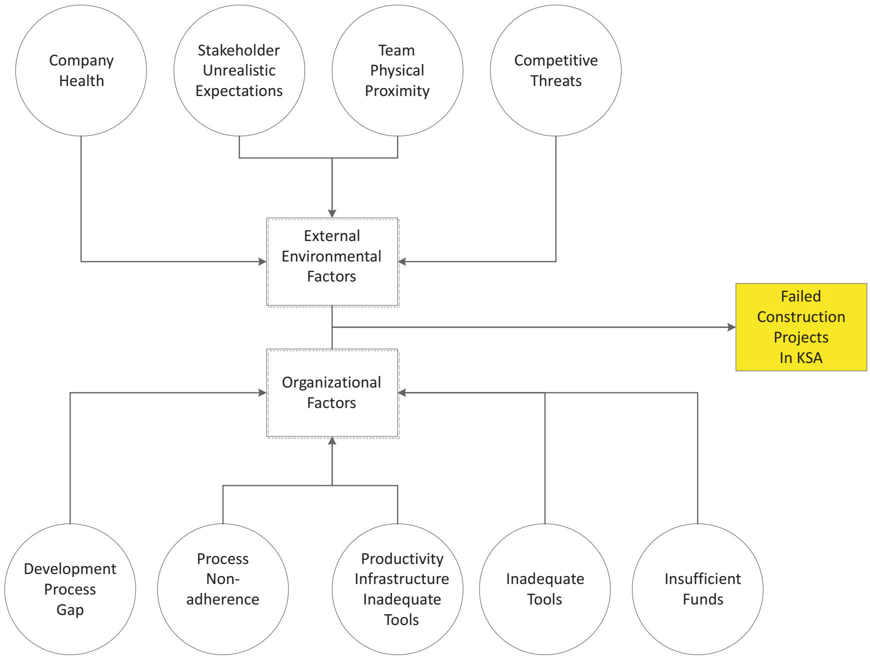
Can the external factors of company health, unrealistic stakeholders' expectations, team physical proximity, and competitive threats be used as a risk assessment instrument for assessing the level of contribution on project failures in the Kingdom of Saudi Arabia (KSA) construction industry?

This question focuses on the external factors that contribute to project failures.

The second research question:

Can the organizational factors of development process gaps, process non-adherence, productivity and infrastructure inadequate tools, inadequate training, project resources, insufficient funds be used as a risk assessment instrument for assessing the level of contribution on project failures in the Kingdom of Saudi Arabia (KSA) construction industry?

Figure 1: Conceptual Diagram



This question targets the OPAs that reside in the cost structure and their association with project failures.

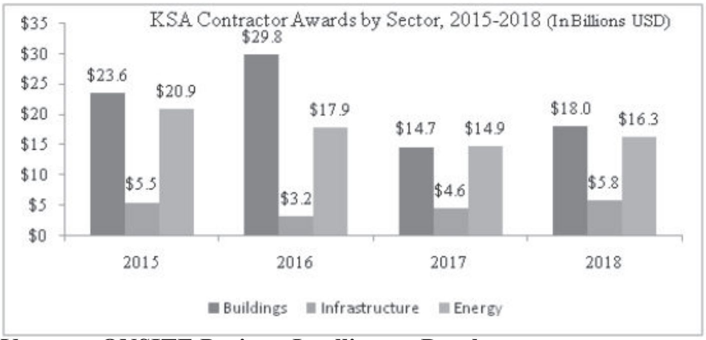
This research aims to address the contribution of organizational process assets in project failures outside to the common project management pitfalls mentioned in prior research (Boghossian, 2002; Hughes, Rana, & Simintiras, 2017; Ikediashi et al., 2014). To accomplish this objective an analysis of the KSA construction industry and the utilization of their organizational process assets must be discussed. Furthermore, an explanation of the basis for the selected questions for the survey will be discussed.

INDUSTRY AND LITERATURE REVIEW

KSA Construction industry

As of June 2018, KSA has 720 active construction projects valued at an estimated $40 Billion USD (Onsite, 2018). The construction industry in KSA is categorized into three sections, buildings, infrastructure, and energy with the buildings section forecast to receive $18 Million on the estimated $40Million in 2018. Figure 2 below shows the breakdown of 2018 projected spending.

1 Figure 2: Historical and Current KSA Contractor Awards by Sector



Source: Ventures ONSITE Projects Intelligence Database: www.venturesonsite.com

Since 2015 the construction industry in KSA has steadily grown and is expected to receive 27% of the construction projects award in the Middle East for2018 (Bhati, 2018).

With the expected inflow of capital, the significance of this study warrants investigation into just how prepared construction organizations in KSA are to successfully complete projects awarded.

Before discussing prior support of the variables used to identify risk, it needs to be stated what constitutes a failed project. In general, a failed project is a project that violates one of the four areas of possible risk occurrence of a project (Heagney, 2012; Pinto & Slevin, 1988). The project schedule, scope, cost and quality reflect areas whereby the occurrence of risk occurs and the violation in these areas reflect a project being delayed, out of scope, over budget, fails to meet customer expectations or all of the above mentioned. Construction projects in KSA are not immune to theses violations and would definitely be classified as failed if one of these violations occurred. Therefore, the contrary of these four violations represent project success.

A project is deemed successful if it is completed on time, within budget, within scope, and the customer is satisfied with the end results(Heagney, 2012; Pinto & Slevin, 1988). This definition of project success is at a very fundamental level of project management. However, in today's world of project management this definition becomes very complex when multiple stakeholders are considered. Projects that have multiple stakeholders may interpret project success different than other stakeholders(Jiang, Klein, & Ellis, 2002; Lagerstrom, von Wurtemberg, Holm, & Luczak, 2012; Suttrfield, Friday-Stroud, & Shivers-Blackwell, 2006). Multiple stakeholders create unrealistic stakeholder expectations which is one of the variables in the theoretical risk assessment instrument in this study(Hughes et al., 2017; Moshodi, Coetzee, Fourie, & Africa, 1996; Olander, 2007).

PMI cites over forty-five processes in direct relations to managing projects with at least forty-five processes requiring an input or output to organizational process assets (PMI, 2018).

Organizational process assets (OPAs) reside within the cost structure of organizations and is leveraged by PM's to successfully complete their projects. Therefore, it is also viewed that OPAs are also factors much like the project schedule, scope, and budget that are potential risks of project failures(Bissonette, 2016). It is under this viewpoint that this study lays out risk factors that originates from the organization as oppose to the lack of project management processes neglect.

Twelve factors that impact project failures which are the basis for how questions were selected for the measurement of instrument (Bissonette, 2016). However, extended research supported nine out of the twelve factors for this study and the use of Principal Component Analysis (PCA) as the statistical process used. All twelve factors are outlined later in this study to include the nine deemed significant for PCA.

Development Process Gaps

Development process gaps (DPG) were identified as a factor resulting from employee turnover (Bissonette, 2016). The results of DGP leaves a void in critical organizational knowledge that affects process changes, which in turn could have detrimental effects (Oehmen et al., 2014). To measure for the impact of this factor in this study, three questions were constructed as part of the 45-Item Questionnaire as follows:

How often is there a change in management at your organization?

How often is there a change of supervisors or project managers during a construction project?

How often do experienced supervisors or project managers make mistakes on construction projects?

These three questions were critical in assessing the impact of key employees by identifying the extent of organizational knowledge and the frequency of organizational changes in management.

Process Non-Adherence

Process non-adherence (PNA) is another factor Bissonette (2016) mentions, but as it relates to knowingly deviating from the product development process. Two key questions were added to the questionnaire instrument to measure the extent of deviation given deadlines.

How often have you worked under "tight" deadlines on a construction project?

How often have you worked on construction projects and did not follow standard construction procedures or processes?

These two questionnaires were taking from the underpinnings of Oehmen et al. (2014) methodology of conducting a survey to measure the impact of process non-adherence. Their survey instrument was constructed as a 171-Item Questionnaire which was given to 381 respondents. The area of process non-adherence was under the category of quality of decision making and sub-category of risk management influences tradeoffs. From the 381 respondents, 60 associated organizational risk to management influences.

Productivity and Infrastructure Inadequate Tools

Bissonette (2016) identified productivity infrastructure tools as tools the organizations would be rendered uncompetitive if they did not have them. Othman &Harinarain (2009) went further on the impact of this factor in their study on managing risk of monitoring and controlling the servicing of building contracts in South Africa. Building contracts in South Africa included a multitude of suppliers, subcontractors and construction consultants. Othman &Harinarain (2009) used a questionnaire taken by nine companies. Their study had a common aim of risks related to technical management and failure caused by lack of it. Their conclusion identified the lack of systems to prevent final payment settlements. To address this factor in this study, two questions were added to the 45-Item Questionnaire as follows:

1. How often are process changes made to standard operating procedures for construction projects?

2. How often are more advanced project management “best practices” tools and techniques (i.e., an earned value

management system (EVMS) that supports effective cost and schedule management) implored?

Competitive Threats

Another factor that was included in this study was competitive threats. Bissonette (2016) looked at this factor from the customer's perspective. Although there were no prior literature of competitive threats in the KSA construction industry, two questions were added focusing on the common external and internal activities pertaining to construction project bids in KSA (Bhati, 2018; Ikediashi, Ogunlana, &Alotaibi, 2014)..

1. How often is your organization competing for bids on construction projects with competitors?

2. How often is your organization permitting internal competition on construction projects?

Competitive Health

Another factor that was included in this study was competitive threats. Bissonette (2016) looked at this factor from the customer's perspective. Although there was no prior literature of competitive threats in the KSA construction industry, two questions were added focusing on the common external and internal activities pertaining to construction project bids in KSA (Bhati, 2018; Ikediashi, Ogunlana, & Alotaibi, 2014). However, Taghipour, Seraj, & Hassani (2015) takes it further in their study with findings, based on both archival data and questionnaire given to employees in two municipalities in Tehran. Their findings showed lack of handling financial instruments was the biggest risk identified. To account for company health in this study three questions were added.

1. How often is your organization cancelling ongoing construction projects?

2. How often does your organization institute cost cutting initiatives?

3. How often your organization does changes to its business strategy?

Team Physical Proximity and Unrealistic Stakeholder Expectations

Other questions were added aimed at measuring team physical proximity and unrealistic stakeholder expectations. Momani&Fadil (2013) focused on these two factors from the perspective of economic circumstances and human behavior. Their study used a 80-Item Questionnaire given to 70 respondents at a commercial construction forum held in Jeddah City in May 2011. The findings showed that the financial stakeholders understood potential risk due to human factors more so than all other participants from other industries (Moshodi et al., 1996; Olander, 2007; Xia, Zhong, Wu, Wang, & Wang, 2017). The study further concluded that business continuity awareness must be consistently promoted across all commercial construction projects in KSA.

In terms of actual effect of location Van Thuyet et al. (2007) conducted study whereby six of Petro Vietnam subsidiaries specializing in oil and gas projects were given a questionnaire aimed at risk identification of the top ten risks in the Vietnamese oil and gas industry. The response rate was 60% based on 72 employees issued the questionnaire. Improper selection of project location and resettlement costs were among the top ten on the second tier of risk identified. The findings showed that both improper selection of project location and resettlement costs issues produced risk index scores of 33% and 35% respectively. To account for any effects to team proximity and additional cost as result of its impact, the following questions were included as part of the 45-Item Questionnaire:

1. How often is your construction projects located 200KM or more from your place of residence?

2. How often is your construction projects located outside KSA?

3. How often is your construction projects located 200KM or more from your team-members or colleagues places of residencies?

Research Methodology

This research has the underpinning of Bissonette (2016), Hughes, Rana, &Simintiras, (2017), Moshodi, Coetzee, Fourie, & Africa (1996), Oehmen, Olechowski, Robert Kenley, & Ben-Daya (2014); Olander (2007), Olechowski, Oehmen, Seering, & Ben-Daya (2016), Van Thuyet, Ogunlana, &Dey (2007) to construct a 45-Item Questionnaire that aims to group the twelve factors previously introduced using PCA, into a small set of factors. The small set of factors represent set values of linearly uncorrelated variables that can be used in further studies whereby regression analysis is used to determine influence on construction projects success or failure. This research aims to conduct a data reduction and ranking of new factors that construction organizations in KSA can use to increase overall project success.

As previously stated, 70 respondents were given the 45 Item-Questionnaire. From the 70 respondents, 68 were completed and used to conduct a descriptives, correlation and anti-correlation analysis, and PCA. Table 1 and Figures 3 thru 5 show the demographic breakdown of the respondents. The majority of the respondents had bachelor's degrees between the ages of 36 and 50. The organizational activities performed were more towards contracting as oppose to project management in the construction industry.

Results

As previously mentioned, Table 2 outlines all twelve factors. The results of this study are shown on Tables 3 thru 6. Table 3 shows a significance on the KMO and Bartlett's Test of .807. Bartlett's test of sphericity was statistically significant at ($p < .0005$), indicating that the data was likely factorizable. The KMO and Bartlett's Test inconjunction with anti-image correlation, Table 7 in Appendix A, was used to determine the number of significant components to retain.

Out of the 45 variables initially entered, 20 were retained for PCA inclusion. The basis for retaining a variable for inclusion was a R $\geq$ .3 with any other variable in the table (Lund & Lund, 2015). Table 4 shows the results of the Varimax rotation of the 20 variables, the five factors and their communalities.

Table 5 shows that the PCA revealed five components that had eigen values greater than one and which explained 27.7%, 15.1%, 13.6%, 11.6% and 7.4% of the total variance, respectively. The five-component solution explained 75.4% of the total variance. A Varimax orthogonal rotation was employed to aid interpretability. The interpretation of the data was consistent with the personality attributes as the questionnaire was designed to measure with strong loadings of external environment items on Factors 1 and 4, organizational items on Factors 2, 3, and 5. Factor loadings and communalities of the rotated solution are presented in Table 6.

Factor 1

Figure 6 shows this factor consists of six items that focus mainly on competitive threats, team physical proximity, and development process gaps. The internal reliability as a single factor is (α=.40) too low for acceptance. However, if grouped into the three categories of on competitive threats, team physical proximity the internal reliabilities of .86, .74, and .68 respectively.

Factor 2

Factor 2 consists of three items, company health, process non-adherence, and development process gaps. The internal reliability as a single factor is (α=.77). Figure 7 shows how negligence in following standard processes by management contributes to cancelled or failed construction projects in Factor 2.

Factor 3

Factor 3 consists of two items, productivity and infrastructure inadequate tools and process non-adherence. The internal reliability as a single factor is (α = .73). Figure 8 shows how Factor 3 revealed the lack of leveraging systems under time constraints, contribute to failed construction projects.

Factor 4

In Figure 9 it shows Factor 4 consists of two questions related to unrealistic stakeholder expectations with regards to ensuring requirements for construction projects are met. Both questions reference the client and project manager as the primary stakeholders. The internal reliability as a single factor is (α = .73).

Factor 5

In Figure 10 it shows Factor 5 consists of two items that are from productivity and infrastructure inadequate tools category. Both questions focus on standard operating procedures adherence and changes. The internal reliability as a single factor is (α = .73).

4.6.1 Table 1 Demographic Characteristics of Participants (N = 68)

Characteristics	*n*	%
Age		
17 -24	1	1.5%
25 -35	18	26.5%
36 -50	39	57.4%
50+	10	14.7%
Education		
No Formal Education	1	1%
High School Diploma	8	12%
Bachelor's degree	59	87%
Organization Activity		
Contracting	38	56%
Construction & PM	30	44%
Experience (Average)		
20 years		
Tenure (Average)		
12 years		

Figure 3: Demographic Characteristics (Age)

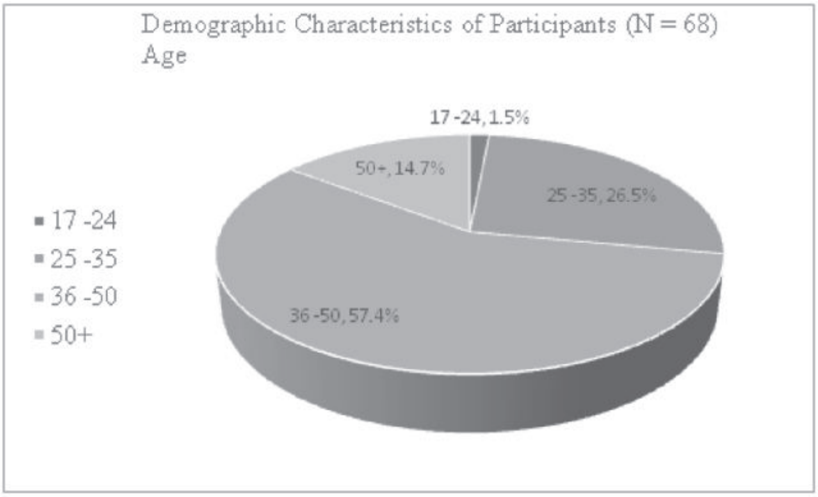


Figure 4: Demographic Characteristics (Education)

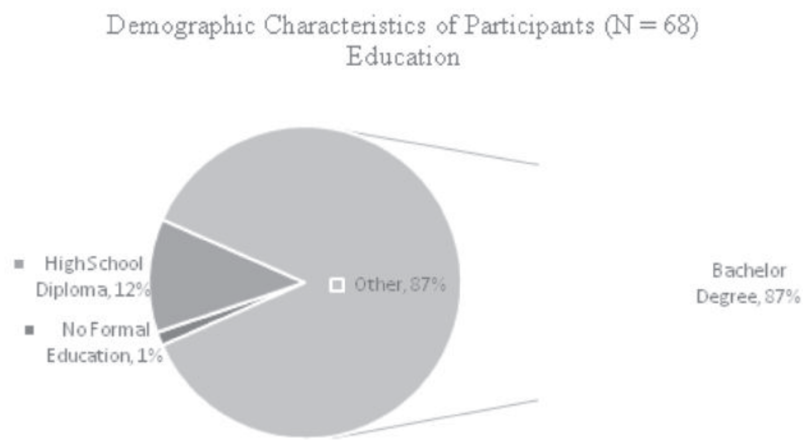


Figure 5: Demographic Characteristics (Organizational Activity)

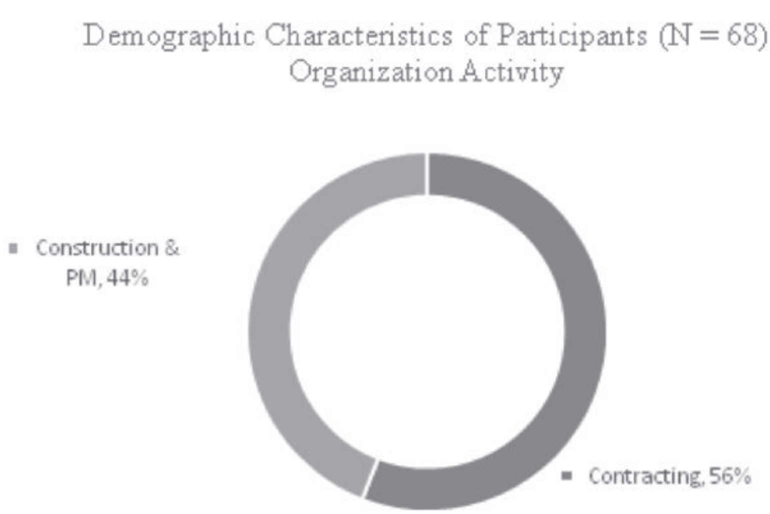


Table 2: 45-Item Questionnaire Variables

Independent Variable	Definition	Reference
Industry Mismatch	Product development processes are established in one industry but not in another [3].	Bissonette, M.(2016)
Market Mismatch	Product development processes are established in one market but used in another which it is not suitable for [3].	Bissonette, M.(2016)
Development Process Gaps	Obviously, employee turnover can leave a void in "corporate history" or "tribal knowledge" that could result in an unfounded process change that turns out to be potentially detrimental to product quality and customer expectations [16].	Oehmen, J., Olechowski, A., Kenley, R., & Ben-Daya, M.(2014)
Process Nonadherence	In the heat of the battle (e.g., to meet deadlines) someone on the frontlines could decide to purposely omit a product development process step that he or she believes is not absolutely necessary [16].	Oehmen, J., Olechowski, A., Kenley, R., & Ben-Daya, M.(2014)
Productivity and Infrastructure Inadequate Tools	The advent of computer and information technology has yielded productivity and infrastructure tools, without which organizations would be rendered uncompetitive in so many of their business endeavors. In addition, given the number of options available, selecting the most appropriate tools, and then implementing them effectively, can be a huge undertaking [20].	Ayman and Harinarain; ActaStructilia 2009: 16(1)
Inadequate Training	Project teams can have access to all the best productivity and infrastructure tools available, but if the workforce personnel who are expected to use them are not adequately trained, these tools could be ineffective and the project can suffer as a result [8].	Ikediashi, Ogunlana&Alotaibi (2014)

Table 2 (Continued)

Variable	Definition	Reference
Project Resources	Project resources typically fall into four general categories: funds, time, furnished equipment and facilities, and personnel. Within matrix organization structures, all project resources are typically provided by stakeholders outside the team—customers, sponsors, organizational management, and functional managers [3].	Augustine et al. (2013)(Augustine, Ajayi, Ade, & Edwin, 2013)
Insufficient Funds	Even if the project team is provided all the funds requested for the baseline project plan, they may not suffice. As noted in Chapter 5, all project reserves are not typically built into the project baseline [13].	Momani, N. M., &Fadil, A. S. (2013)
Competitive Threats	Most product development projects in the business world do have to be concerned about competition. Commercial/consumer products and services businesses are typically looking for competitive advantages at all times [3].	Bissonette, M.(2016)
Company Health	An organization's long-term viability can cause financial disruptions and project cancellations in response to cost-cutting initiatives and/or changes in business strategy [25].	Van Thuyet, N., Ogunlana, S. O., &Dey, P. K. (2007)
Team Physical Proximity	The impact of physical proximity; The two extremes are collocated teams and dispersed teams. Dispersed teams tend to require significant management overhead [13].	Momani, N. M., &Fadil, A. S. (2013)
Unrealistic Stakeholder Expectations	This is not healthy (especially for the project team) if one or more of the key stakeholders (i.e., customers and organizational management) plan to hold the project manager and the team to rigid requirements (i.e., for completing the project scope on schedule and within budget without compromise to product quality) nonetheless [14].	Moshodi, T., Coetzee, C., &Fourie, K. (2016)

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.807
Bartlett's Test of Sphericity	Approx. Chi-Square	907.226
	df	190
	Sig.	.000

Table 4: Factor Loadings from PCA: Communalities, Eigenvalues, and Percentages of Variance for Items of Construction Questionnaire

Factors	Factor Loadings					Communalities
	F1	F2	F3	F4	F5	
CPMT36	.83	.26	-.16		.17	.81
TPP42	-.80	.20	-.16			.71
CPMT35	.80	.30	.19	-.18	.17	.82
TPP40	-.78	.31	-.21	-.36		.87
DPG8	-.76	-.15	-.41	-.19	-.15	.83
DPG9	-.72	-.24	-.13	.37		.72
TPP41	-.66	.32	-.27	.36		.75
PNA16	.64	-.19	.46	.20		.69
USE43	.57	.20	.15	.55	.12	.70
CMPH37	.15	.85		-.16		.78
PNA15	.36	.74	.30	-.17		.81
DPG12	-.33	.73	-.14	-.22	-.22	.77
PIIT29	.22		.73	.12	.14	.63
PNA14	.49		.73		-.15	.79
PNA17		.47	.66		-.14	.68
ITRN32	.15	-.29	.61	.45	.44	.86
USE45		-.19		.78		.65
USE44	-.24	-.22	.22	.75		.73
PIIT25	.27	-.12			.83	.79
PIIT28	-.15	.49	.23		.60	.69
Eigenvalues	5.55	3.02	2.72	2.32	1.47	
% of variance	27.77	15.10	13.58	11.59	7.36	

CPMT = Competitive Threats, TPP = Team Physical Proximity, DPG = Development Process Gaps, PNA = Process Non - Adherence, USE - Unrealistic Stakeholder Expectations, CMPH = Company Health, PIIT = Productivity and Infrastructure Inadequate Tools, ITRN = Inadequate Training

Figure 6: Factor 1 - Rotated Component Matrix Results (CPMT36, TPP42, CPMT35, TPP40, DPG8, DPG9, TPP41, PNA16, & USE43)

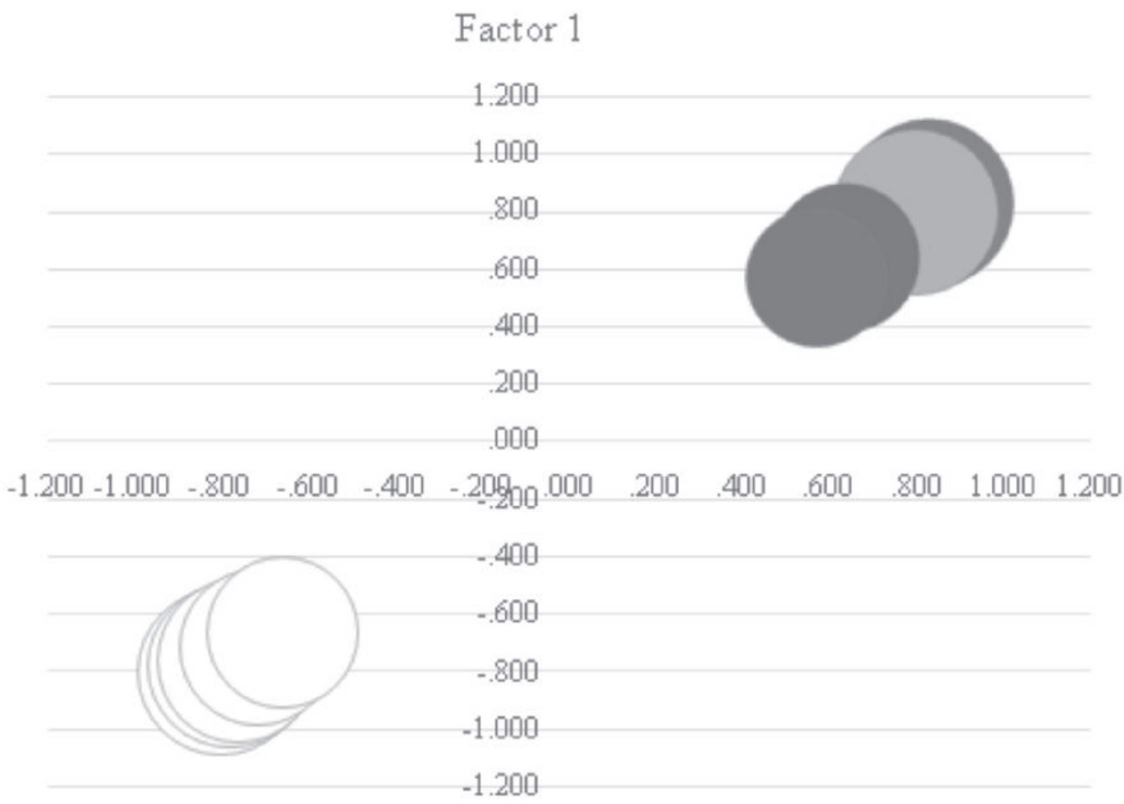


Figure 7: Factor 2 - Rotated Component Matrix Results (CMPH37, PNA15, & DPG12)

Figure 8: Factor 3 - Rotated Component Matrix Results (PIIT29, PNA14, PNA17, & ITRN32)

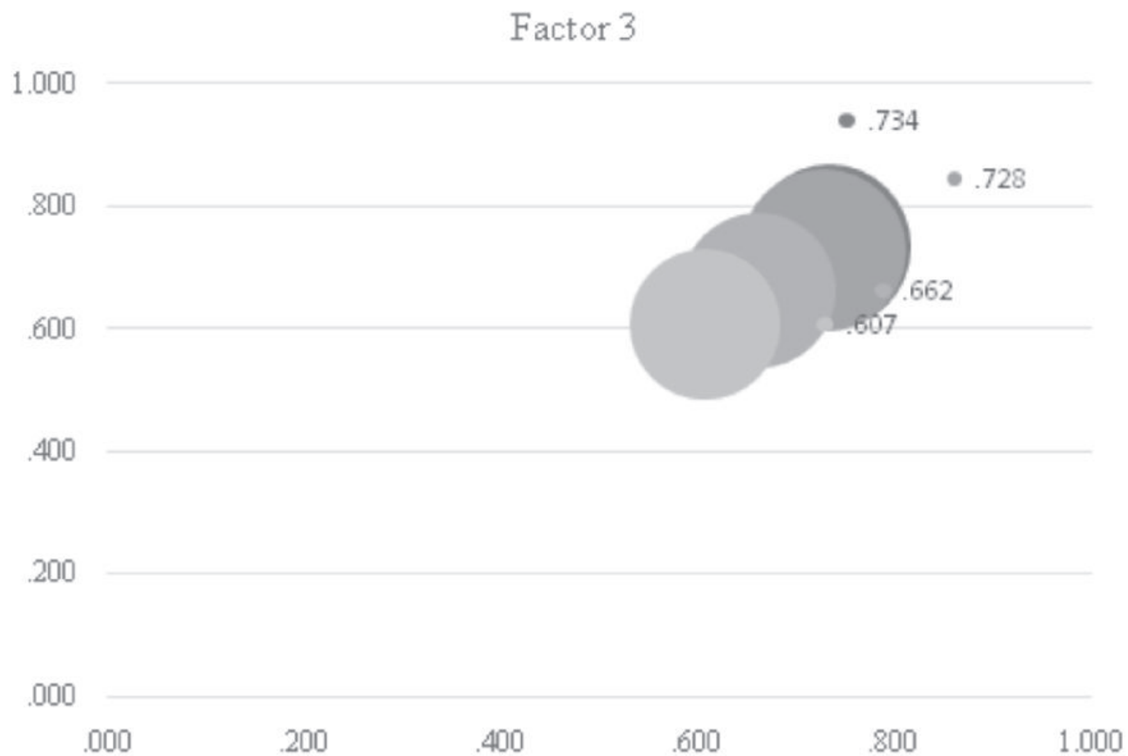


Figure 9: Factor 4 - Rotated Component Matrix Results (USE44&USE45)

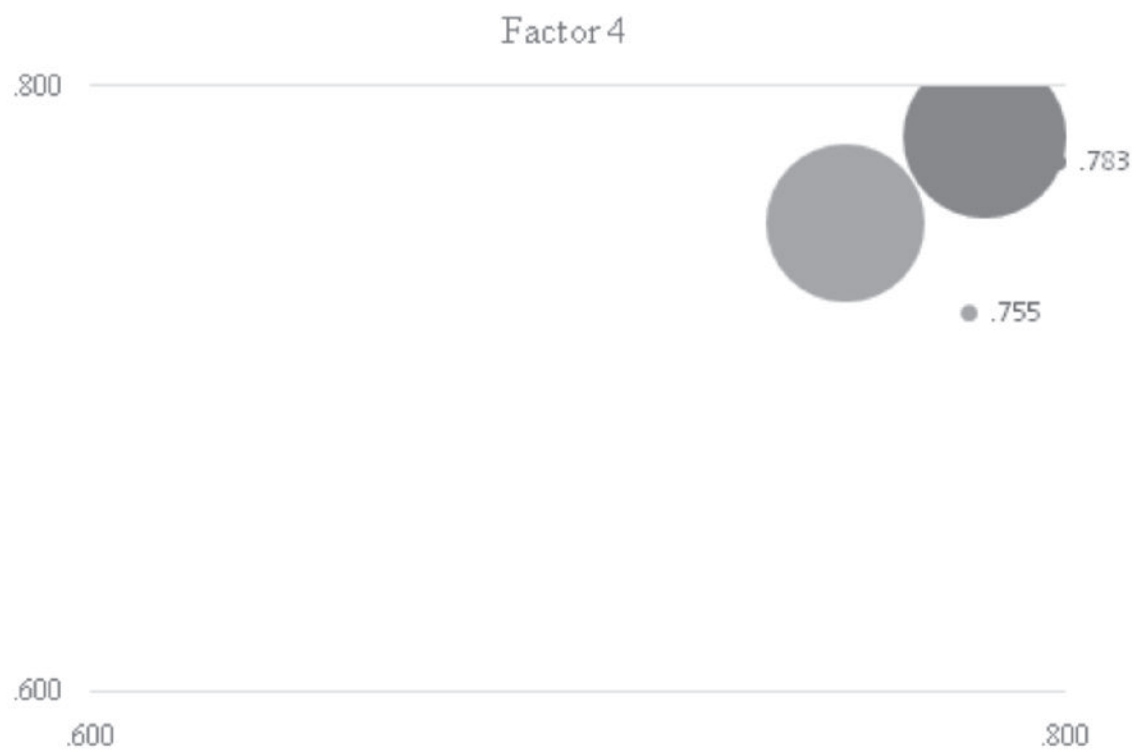


Figure 10: Factor 5 - Rotated Component Matrix Results (PIIT25 &PIIT28)

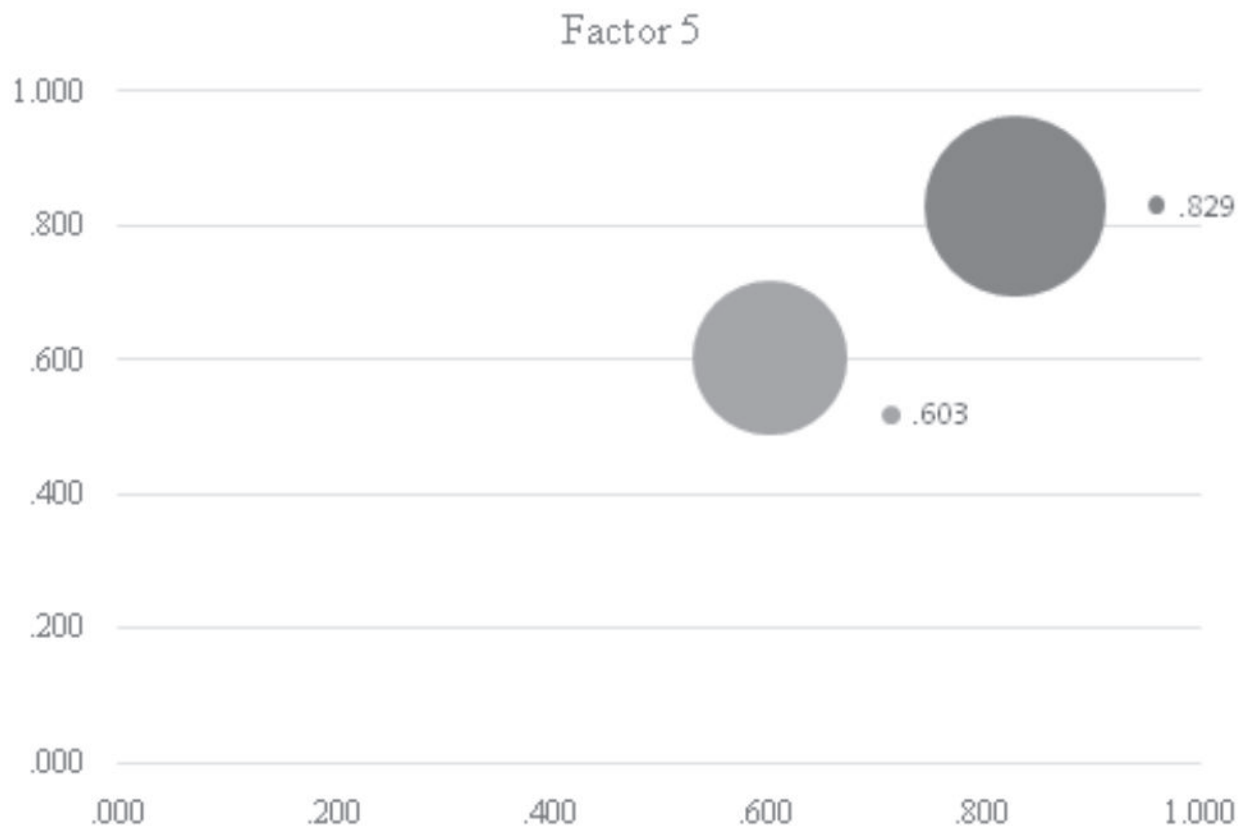


Figure 11: Rotated Component Matrix (Sums of Squared Loadings)

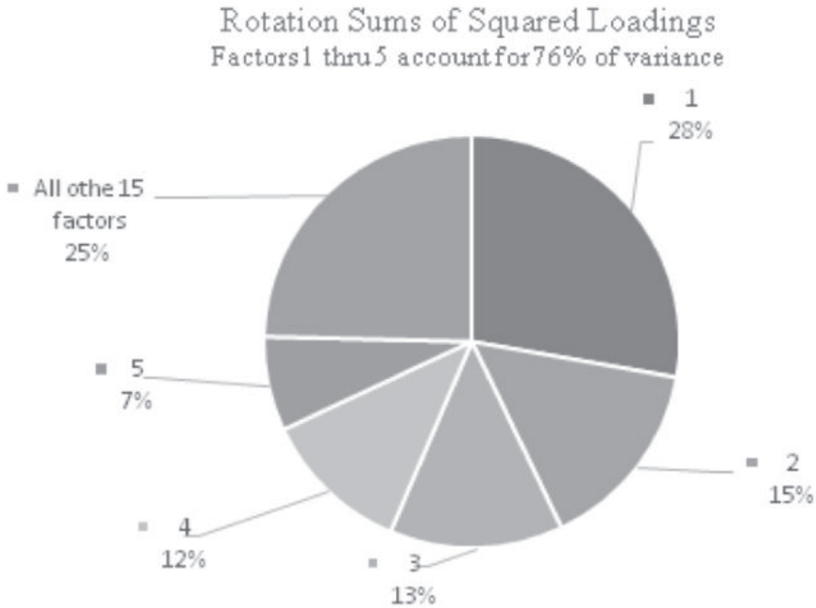


Table 5: Summary of Eigenvalues, Percentages of Variance, and Cumulative Percentages for Factors of the 45-Item Construction Questionnaire

Factor	Total	% of Variance	Cumulative %
F1	5.55	27.77	27.77
F2	3.02	15.10	42.87
F3	2.72	13.58	56.44
F4	2.32	11.59	68.03
F5	1.47	7.36	75.40

Table 6: PCA with Varimax Rotation and Coefficient Alphas for Factors 1 thru 4 for the

45-Item Construction Questionnaire

Factor	Variables	Question	Factor Loading	Alpha (α)
F1	CPMT36	How often is your organization permitting internal competition on construction projects?	0.83	0.86
	CPMT35	How often is your organization competing for bids on construction projects with competitors?	0.80	

Factor	Variables	Question	Factor Loading	Alpha (α)
F1	TPP42	How often are your construction projects located 200KM or more from your team-members or colleagues places of residencies?	-0.80	0.74
	TPP40	How often are your construction projects located 200KM or more from your place of residence?	-0.78	

Factor	Variables	Question	Factor Loading	Alpha (α)
F1	DPG8	How often is there a change in management at your organization?	-0.76	0.68
	DPG9	How often is there a change of supervisors or project managers during a construction project?	-0.72	

Factor	Variables	Question	Factor Loading	Alpha (α)
F2	CMPH37	How often is your organization cancelling ongoing construction projects?	0.85	0.77
	PNA15	How often have you worked on construction projects and did not follow standard construction procedures or processes?	0.74	
	DPG12	How often do experienced supervisors or project managers make mistakes on construction projects?	0.73	

Factor	Variables	Question	Factor Loading	Alpha (α)
F3	PIIT29	How often are more advanced project management "best practices" tools and techniques (i.e., an earned value management system (EVMS) that supports effective cost and schedule management) implored?	0.73	0.73
	PNA14	How often have you worked under "tight" deadlines on a construction project?	0.73	

Factor	Variables	Question	Factor Loading	Alpha (α)
F4	USE45	How often does your client or customer ensure that all requirements (i.e., project scope, schedule or budget) of a construction project are fulfilled no exceptions?	0.78	0.73
	USE44	How often does your supervisor or project manager ensure that all requirements (i.e., project scope, schedule or budget) of a construction project are fulfilled no exceptions?	0.75	
Factor	Variables	Question	Factor Loading	Alpha (α)
F5	PIIT25	How often are process changes made to standard operating procedures for construction projects?	0.83	0.73
	PIIT28	How often do non-adherence to standard processes result in successful completion of construction projects?	0.60	

Conclusion

The aim of this study was to develop a framework for identifying external and organizational factors that contribute to project failures in the construction industry in KSA. The study employed a quantitative online survey method of research to elicit responses from 68 respondents who practice professionally as part of the construction industry in Hail, Saudi Arabia. Both descriptive and inferential statistical tools were used to analyze collected data. Twenty (20) out of the 45 items used for the survey were found to be significant for explaining the external and organizational factors impact on construction project failure in KSA.

In terms of Research Question 1 which states:

Can the external factors of company health, unrealistic stakeholders' expectations team physical proximity, and competitive threats be used as a risk assessment instrument for assessing the level of contribution on project failures in the Kingdom of Saudi Arabia (KSA) construction industry?

All of the external items under these four categories were included in the Varimax rotation of the PCA. Furthermore, all the four had high factor loadings and therefore can be used as a risk assessment instrument. However, it must be analyzed under context of how the items relate to each other as seen in Table 8, Appendix C with the Spearman Correlation results.

For example, Table 8 shows a strong positive relationship between competing for bids on construction projects and the location of the project in relation to construction team members residence. The rs = .58 between CPMT35 and TPP42 highlights this relationship as a possible risk to project failure if not concerned when bidding for new construction projects. Location of construction projects in relation to construction project team's residences was and identified risk mentioned in both Momani&Fadil (2013) and Van Thuyet et al. (2007).

Research Question 2 states:

Can the organizational factors of development process gaps, process non-adherence, productivity and infrastructure inadequate tools, inadequate training, project resources, insufficient funds be used as a risk assessment instrument for assessing the level of contribution on project failures in the Kingdom of Saudi Arabia (KSA) construction industry?

The organizational factors can be used as a risk assessment instrument for identifying non-project management contributors to project failures in terms of lessons learned. The factors that comprised organizational items can be used as areas of risk from the organizational process assets leveraged to complete the project. Their factor loadings were very high on Factors 1 and 2 and comprised Factor 3 solely. The rs between DPG8 and PNA14 shows a strong negative relationship of -.68. The negative relationship signals an affect between management organizational changes and the ability to meet ongoing construction project deadlines. This further highlight lack of succession planning between old and new management as a risk of construction project failures. The rs between DPG8 and PIIT29 also shows a negative relationship of -.54. This shows the breadth of development process gaps throughout the cost structure of the organization and its impact on construction project failures.

Another type of relationship between organizational and external factors that show an effect on construction project failures is CMPH37 and PNA15. Both items load high on Factor 2 and havears = .65. This positive relationship shows how not following standard construction procedures or processes may lead to the cancelling of ongoing construction projects. The fact that both items are from different factor categories show how revealing a risk instrument with combined organizational and external factors can be.

The strong negative relationship between CPMT36 and DPG8 whereby rs = 61 shows the effect of organizational changes in management impacts internal competition. Although both items loaded high on Factor 1, the internal reliability could not be determined due the existence of negative values. This further translates into the context of how internal competition is promoted and perceived within the organizations, who participated in the survey for this study, being unknown.

In summary the organizational and external factors represent other aspects that impact construction project failures in KSA beyond the common project management risks tied to the triple constraints. The risk assessment instrument resulting from the PCA and Spearman Correlation performed on the 45-Item Questionnaire has two limitations that must be mentioned and address as recommendations for further study.

The 45-Item Questionnaire reflects the contributors of risks from the organizational and external factors as experienced by the participants. Therefore, the strength and significance of the results reflect the organizations that the participants are employed by. It is recommended to use the 45-Item Questionnaire results from multiple participants across multiple construction organizations in order to increase the possibility of more variable loadings on the factors. For example, the industry and market mismatch, inadequate training, insufficient funds, and project resources did not have high correlations in Table 7 to warrant inclusion in the PCA based on the 68 participants. However, expanding the dataset would increase the chance of variables removed in this study, included of further studies.

Another aspect to consider when using the 45-Item Questionnaire is that it shows the areas for possible impact on failed construction projects. It does not measure the impact of these items on failed construction projects. The measure of impact requires multiple discriminate regression on archived construction projects with defined success or failed status (Jones, 2018). This is recommended for future studies on construction projects in KSA.

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Appendix A

Table 7: Anti Image Correlations

		DPG8	DPG9	DPG10	DPG11	DPG12	DPG13	PNA14	PNA15	PNA16	PNA17	PNA18	PNA19	PIIT20
Anti-image Correlation	DPG8	.834	-.191	.025	.142	-.193	.099	.434	.060	.009	-.084	.202	.223	-.248
	DPG9	-.191	.687	.014	.010	-.094	-.335	-.082	.461	-.263	.051	.077	.326	.119
	DPG10	.025	.014	.591	.014	-.228	.323	-.270	.020	.191	.226	.436	-.082	.272
	DPG11	.142	.010	.014	.606	.205	.050	-.002	-.203	-.147	.031	.312	-.175	-.258
	DPG12	-.193	-.094	-.228	.205	.671	-.225	-.042	-.584	-.103	-.077	.160	-.335	-.174
	DPG13	.099	-.335	.323	.050	-.225	.586	-.312	-.036	.499	-.098	.058	-.155	.037
	PNA14	.434	-.082	-.270	-.002	-.042	-.312	.727	-.011	-.021	-.353	-.325	.290	-.153
	PNA15	.060	.461	.020	-.203	-.584	-.036	-.011	.680	.005	-.114	-.247	.392	.317
	PNA16	.009	-.263	.191	-.147	-.103	.499	-.021	.005	.757	-.385	-.345	-.041	.278
	PNA17	-.084	.051	.226	.031	-.077	-.098	-.353	-.114	-.385	.681	.322	-.186	-.129
	PNA18	.202	.077	.436	.312	.160	.058	-.325	-.247	-.345	.322	.758	-.231	-.180
	PNA19	.223	.326	-.082	-.175	-.335	-.155	.290	.392	-.041	-.186	-.231	.473	.359
	PIIT20	-.248	.119	.272	-.258	-.174	.037	-.153	.317	.278	-.129	-.180	.359	.344
	PIIT21	.025	.443	-.041	-.075	.006	-.395	-.117	.179	-.427	.225	.179	.190	-.010
	PIIT22	-.159	-.472	-.041	.094	.293	.354	.005	-.416	.407	-.173	-.209	-.310	-.235
	PIIT23	.007	.031	-.079	.168	-.129	-.094	.014	.021	-.105	.160	.024	-.084	-.325
	PIIT24	-.334	.212	-.028	-.037	.099	-.362	-.183	.018	-.465	.277	.162	-.068	.004
	PIIT25	.039	.064	-.013	.199	.190	.045	.114	-.155	-.040	.016	.149	-.081	-.021
	PIIT26	.363	-.187	-.355	-.130	-.135	-.233	.497	.037	.116	-.174	-.337	.273	-.108

		PIIT21	PIIT22	PIIT23	PIIT24	PIIT25	PIIT26	PIIT27	PIIT28	PIIT29	PIIT30	ITRN31	ITRN32
Anti-image Correlation	DPG8	.025	-.159	.007	-.334	.039	.363	-.272	-.016	-.038	.090	.221	.012
	DPG9	.443	-.472	.031	.212	.064	-.187	.248	-.324	.134	-.221	-.138	-.201
	DPG10	-.041	-.041	-.079	-.028	-.013	-.355	.170	.034	-.172	.151	.001	-.372
	DPG11	-.075	.094	.168	-.037	.199	-.130	.267	-.008	-.258	.151	.158	-.087
	DPG12	.006	.293	-.129	.099	.190	-.135	.031	.044	.143	-.085	-.160	.240
	DPG13	-.395	.354	-.094	-.362	.045	-.233	.267	.244	-.345	.296	.272	-.205
	PNA14	-.117	.005	.014	-.183	.114	.497	-.511	-.057	.004	-.110	.034	.144
	PNA15	.179	-.416	.021	.018	-.155	.037	.068	-.232	-.062	-.021	.009	.031
	PNA16	-.427	.407	-.105	-.465	-.040	.116	-.105	.057	-.052	.315	-.154	.016
	PNA17	.225	-.173	.160	.277	.016	-.174	.243	.024	.111	.118	.146	-.196
	PNA18	.179	-.209	.024	.162	.149	-.337	.331	-.078	-.154	.052	.207	-.320
	PNA19	.190	-.310	-.084	-.068	-.081	.273	-.344	-.161	.158	-.432	-.219	-.189
	PIIT20	-.010	-.235	-.325	.004	-.021	-.108	-.055	-.056	.045	-.163	-.337	-.060
	PIIT21	.520	-.682	.160	.445	-.020	-.075	-.071	-.039	.094	-.338	-.193	-.104
	PIIT22	-.682	.483	-.053	-.438	.070	-.007	-.071	.313	.018	.262	-.018	.096
	PIIT23	.160	-.053	.602	.210	-.008	.135	.134	-.105	-.038	.004	.068	.095
	PIIT24	.445	-.438	.210	.438	-.424	.055	.016	-.099	-.041	-.446	.132	-.012
	PIIT25	-.020	.070	-.008	-.424	.704	-.315	.184	-.028	.106	.151	-.125	-.163
	PIIT26	-.075	-.007	.135	.055	-.315	.529	-.744	-.025	.069	-.236	.058	.112

		PRJRES33	INF34	CPMT35	CPMT36	CMPH37	CMPH38	CMPH39	TPP40	TPP41	TPP42	USE43	USE44	USE45
Anti-image Correlation	DPG8	-.159	.107	.068	.025	.222	-.305	-.113	-.364	-.054	-.121	.073	-.220	.028
	DPG9	-.015	.076	.070	.143	.030	-.218	.003	-.088	-.409	.187	-.182	-.102	.018
	DPG10	.033	.294	-.263	-.021	-.333	.046	.110	-.074	-.203	.225	-.047	.121	-.095
	DPG11	-.180	.208	-.231	.103	-.236	.291	.161	-.126	-.325	-.314	.291	.296	-.430
	DPG12	-.098	-.071	.009	.391	-.387	.205	.312	-.035	.242	-.057	.062	.216	-.212
	DPG13	.235	.160	-.106	-.413	-.057	-.024	.083	-.212	-.029	.000	.028	-.066	-.034
	PNA14	-.140	.056	.006	.073	.274	-.084	-.115	.193	.269	-.394	-.025	.056	.045
	PNA15	.001	-.112	.242	-.336	.197	-.225	-.367	-.137	-.249	.184	-.243	-.166	.242
	PNA16	-.161	.170	-.247	-.236	.083	.063	.187	.180	.157	-.138	-.088	.029	.176
	PNA17	.078	-.258	-.030	.219	-.017	-.080	-.167	-.183	-.199	.263	.102	-.040	-.137
	PNA18	-.090	.115	-.132	.313	-.415	-.042	.013	-.176	-.236	.304	.177	-.016	-.385
	PNA19	.046	.116	.103	-.168	.213	-.247	-.002	-.105	-.142	-.073	-.408	.094	.309
	PIIT20	-.086	-.028	.116	-.068	-.150	-.200	.136	.032	.036	.284	-.458	.268	.290
	PIIT21	.055	-.126	.126	.235	-.050	-.186	-.083	-.387	-.352	.446	.005	-.185	.114
	PIIT22	-.008	.111	-.223	-.241	.082	.288	.227	.157	.348	-.420	.095	.232	-.049
	PIIT23	-.013	-.189	-.224	.156	.102	.360	-.072	.081	-.159	.004	.422	-.074	-.402
	PIIT24	.034	-.053	.236	.275	-.290	.182	-.226	.020	-.072	.355	-.107	.092	-.203
	PIIT25	.036	-.178	-.234	.029	-.002	.032	.163	-.106	.006	-.103	.205	.124	-.184
	PIIT26	-.215	-.029	.126	.016	.328	-.167	-.198	.063	.117	-.186	-.125	-.061	.122

	DPG8	DPG9	DPG10	DPG11	DPG12	DPG13	PNA14	PNA15	PNA16	PNA17	PNA18	PNA19	PIIT20
PIIT27	-.272	.248	.170	.267	.031	.267	-.511	.068	-.105	.243	.331	-.344	-.055
PIIT28	-.016	-.324	.034	-.008	.044	.244	-.057	-.232	.057	.024	-.078	-.161	-.056
PIIT29	-.038	.134	-.172	-.258	.143	-.345	.004	-.062	-.052	.111	-.154	.158	.045
PIIT30	.090	-.221	.151	.151	-.085	.296	-.110	-.021	.315	.118	.052	-.432	-.163
ITRN31	.221	-.138	.001	.158	-.160	.272	.034	.009	-.154	.146	.207	-.219	-.337
ITRN32	.012	-.201	-.372	-.087	.240	-.205	.144	.031	.016	-.196	-.320	-.189	-.060
PRJRES33	-.159	-.015	.033	-.180	-.098	.235	-.140	.001	-.161	.078	-.090	.046	-.086
INF34	.107	.076	.294	.208	-.071	.160	.056	-.112	.170	-.258	.115	.116	-.028
CPMT35	.068	.070	-.263	-.231	.009	-.106	.006	.242	-.247	-.030	-.132	.103	.116
CPMT36	.025	.143	-.021	.103	.391	-.413	.073	-.336	-.236	.219	.313	-.168	-.068
CMPH37	.222	.030	-.333	-.236	-.387	-.057	.274	.197	.083	-.017	-.415	.213	-.150
CMPH38	-.305	-.218	.046	.291	.205	-.024	-.084	-.225	.063	-.080	-.042	-.247	-.200
CMPH39	-.113	.003	.110	.161	.312	.083	-.115	-.367	.187	-.167	.013	-.002	.136
TPP40	-.364	-.088	-.074	-.126	-.035	-.212	.193	-.137	.180	-.183	-.176	-.105	.032
TPP41	-.054	-.409	-.203	-.325	.242	-.029	.269	-.249	.157	-.199	-.236	-.142	.036
TPP42	-.121	.187	.225	-.314	-.057	.000	-.394	.184	-.138	.263	.304	-.073	.284
USE43	.073	-.182	-.047	.291	.062	.028	-.025	-.243	-.088	.102	.177	-.408	-.458
USE44	-.220	-.102	.121	.296	.216	-.066	.056	-.166	.029	-.040	-.016	.094	.268
USE45	.028	.018	-.095	-.430	-.212	-.034	.045	.242	.176	-.137	-.385	.309	.290

	PIIT21	PIIT22	PIIT23	PIIT24	PIIT25	PIIT26	PIIT27	PIIT28	PIIT29	PIIT30	ITRN31	ITRN32
PIIT27	-.071	-.071	.134	.016	.184	-.744	.533	-.167	-.135	.329	.150	-.068
PIIT28	-.039	.313	-.105	-.099	-.028	-.025	-.167	.709	-.036	-.116	.127	-.207
PIIT29	.094	.018	-.038	-.041	.106	.069	-.135	-.036	.813	-.026	-.234	-.088
PIIT30	-.338	.262	.004	-.446	.151	-.236	.329	-.116	-.026	.501	.016	.022
ITRN31	-.193	-.018	.068	.132	-.125	.058	.150	.127	-.234	.016	.612	-.197
ITRN32	-.104	.096	.095	-.012	-.163	.112	-.068	-.207	-.088	.022	-.197	.784
PRJRES33	.055	-.008	-.013	.034	.036	-.215	.142	.075	-.092	-.030	.244	-.151
INF34	-.126	.111	-.189	-.053	-.178	-.029	.003	-.047	-.318	-.079	.011	-.267
CPMT35	.126	-.223	-.224	.236	-.234	.126	-.085	-.030	.018	-.163	.169	.194
CPMT36	.235	-.241	.156	.275	.029	.016	.057	-.167	.202	-.160	-.149	.117
CMPH37	-.050	.082	.102	-.290	-.002	.328	-.186	-.038	.192	.171	.031	.121
CMPH38	-.186	.288	.360	.182	.032	-.167	.171	-.120	-.144	.091	-.020	.110
CMPH39	-.083	.227	-.072	-.226	.163	-.198	.028	.065	.098	.083	-.466	-.200
TPP40	-.387	.157	.081	.020	-.106	.063	.003	-.222	.028	.027	.023	.208
TPP41	-.352	.348	-.159	-.072	.006	.117	-.274	-.037	.098	.066	-.012	.316
TPP42	.446	-.420	.004	.355	-.103	-.186	.176	.014	.001	-.195	-.080	-.080
USE43	.005	.095	.422	-.107	.205	-.125	.230	.007	-.103	.199	.165	.138
USE44	-.185	.232	-.074	.092	.124	-.061	-.029	.089	.033	-.051	-.172	-.248
USE45	.114	-.049	-.402	-.203	-.184	.122	-.333	.159	.187	-.101	-.250	-.011

	PRJRES33	INF34	CPMT35	CPMT36	CMPH37	CMPH38	CMPH39	TPP40	TPP41	TPP42	USE43	USE44	USE45
PIIT27	.142	.003	-.085	.057	-.186	.171	.028	.003	-.274	.176	.230	-.029	-.333
PIIT28	.075	-.047	-.030	-.167	-.038	-.120	.065	-.222	-.037	.014	.007	.089	.159
PIIT29	-.092	-.318	.018	.202	.192	-.144	.098	.028	.098	.001	-.103	.033	.187
PIIT30	-.030	-.079	-.163	-.160	.171	.091	.083	.027	.066	-.195	.199	-.051	-.101
ITRN31	.244	.011	.169	-.149	.031	-.020	-.466	.023	-.012	-.080	.165	-.172	-.250
ITRN32	-.151	-.267	.194	.117	.121	.110	-.200	.208	.316	-.080	.138	-.248	-.011
PRJRES33	.848	-.058	.045	-.201	.040	.163	-.104	-.053	.166	-.009	.044	-.291	-.070
INF34	-.058	.854	-.282	-.070	-.182	.018	.225	.059	-.178	-.118	-.191	.116	.010
CPMT35	.045	-.282	.814	-.305	-.030	-.209	-.352	-.186	.291	.166	-.265	-.039	.123
CPMT36	-.201	-.070	-.305	.725	-.270	-.073	.242	.176	-.057	.232	.095	.028	-.187
CMPH37	.040	-.182	-.030	-.270	.688	-.309	-.273	-.045	-.055	-.184	-.010	-.244	.295
CMPH38	.163	.018	-.209	-.073	-.309	.624	.074	.221	.157	-.298	.301	.228	-.393
CMPH39	-.104	.225	-.352	.242	-.273	.074	.650	-.079	-.003	-.134	-.142	.242	.122
TPP40	-.053	.059	-.186	.176	-.045	.221	-.079	.848	.230	-.342	.233	.098	-.102
TPP41	.166	-.178	.291	-.057	-.055	.157	-.003	.230	.726	-.277	-.131	-.055	.008
TPP42	-.009	-.118	.166	.232	-.184	-.298	-.134	-.342	-.277	.725	-.145	-.158	.057
USE43	.044	-.191	-.265	.095	-.010	.301	-.142	.233	-.131	-.145	.696	-.142	-.449
USE44	-.291	.116	-.039	.028	-.244	.228	.242	.098	-.055	-.158	-.142	.681	-.232
USE45	-.070	.010	.123	-.187	.295	-.393	.122	-.102	.008	.057	-.449	-.232	.475

Appendix B
Table 8: Spearman's Correlation

	DPG8	DPG9	DPG12	PNA14	PNA15	PNA16	PIIT25	PIIT28	PIIT29	CPMT35	CPMT36	CMPH37	TPP40	TPP41	TPP42	USE44	USE45
DPG8	1.000	.593**	.248*	-.675**	-.474**	-.596**	-.182	-.141	-.544**	-.689**	-.605**	-.258*	.686**	.379**	.599**	.000	-.066
DPG9	.593**	1.000	.037	-.377**	-.601**	-.380**	-.217	.000	-.256*	-.663**	-.568**	-.335**	.305*	.484**	.512**	.409**	.293*
DPG12	.248*	.037	1.000	-.180	.376**	-.476**	-.274*	.294*	-.137	-.108	-.216	.539**	.588**	.317**	.391**	-.285*	-.228
PNA14	-.675**	-.377**	-.180	1.000	.360**	.504**	-.164	-.021	.597**	.490**	.331**	.126	-.477**	-.468**	-.431**	.014	.121
PNA15	-.474**	-.601**	.376**	.360**	1.000	.196	.088	.381**	.343**	.542**	.450**	.646**	.016	-.114	-.237	-.228	-.251*
PNA16	-.596**	-.380**	-.476**	.504**	.196	1.000	.225	-.053	.359**	.502**	.402**	-.011	-.567**	-.457**	-.545**	.170	.239*
PIIT25	-.182	-.217	-.274*	-.164	.088	.225	1.000	.171	-.014	.264*	.241*	-.068	-.143	-.192	-.233	-.060	.124
PIIT28	-.141	.000	.294*	-.021	.381**	-.053	.171	1.000	.150	.120	.066	.390**	.214	.266*	.106	-.084	-.144
PIIT29	-.544**	-.256*	-.137	.597**	.343**	.359**	-.014	.150	1.000	.331**	.215	.126	-.351**	-.209	-.265*	.131	.122
CPMT35	-.689**	-.663**	-.108	.490**	.542**	.502**	.264*	.120	.331**	1.000	.802**	.447**	-.383**	-.582**	-.581**	-.341**	-.147
CPMT36	-.605**	-.568**	-.216	.331**	.450**	.402**	.241*	.066	.215	.802**	1.000	.352**	-.459**	-.492**	-.559**	-.234	-.117
CMPH37	-.258*	-.335**	.539**	.126	.646**	-.011	-.068	.390**	.126	.447**	.352**	1.000	.251*	.099	.062	-.273*	-.308*
TPP40	.686**	.305*	.588**	-.477**	.016	-.567**	-.143	.214	-.351**	-.383**	-.459**	.251*	1.000	.448**	.700**	-.249*	-.295*
TPP41	.379**	.484**	.317**	-.468**	-.114	-.457**	-.192	.266*	-.209	-.582**	-.492**	.099	.448**	1.000	.624**	.248*	.136
TPP42	.599**	.512**	.391**	-.431**	-.237	-.545**	-.233	.106	-.265*	-.581**	-.559**	.062	.700**	.624**	1.000	.043	.005
USE44	.000	.409**	-.285*	.014	-.228	.170	-.060	-.084	.131	-.341**	-.234	-.273*	-.249*	.248*	.043	1.000	.528**
USE45	-.066	.293*	-.228	.121	-.251*	.239*	.124	-.144	.122	-.147	-.117	-.308*	-.295*	.136	.005	.528**	1.000

Appendix C

Table 9: Total Explained Variance

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.734	33.668	33.668	6.734	33.668	33.668	5.553	27.766	27.766
2	3.623	18.113	51.782	3.623	18.113	51.782	3.020	15.100	42.866
3	2.298	11.488	63.270	2.298	11.488	63.270	2.715	13.577	56.443
4	1.412	7.062	70.332	1.412	7.062	70.332	2.318	11.591	68.034
5	1.013	5.067	75.399	1.013	5.067	75.399	1.473	7.365	75.399
6	.732	3.662	79.061						
7	.632	3.159	82.221						
8	.546	2.728	84.948						
9	.502	2.512	87.460						
10	.418	2.088	89.548						
11	.374	1.870	91.418						
12	.333	1.667	93.085						
13	.298	1.490	94.575						
14	.264	1.319	95.895						
15	.204	1.018	96.912						
16	.176	.878	97.790						
17	.153	.765	98.556						
18	.130	.651	99.206						
19	.089	.446	99.652						
20	.070	.348	100.000						