Factors Affecting the Competencies of Quantity Surveyors in Tendering for Construction Projects in Cambodia

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Abstract

Quantity surveyors are involved in every stage of construction project, particularly in developing countries such as Cambodia's construction industry, where they play a crucial role in managing costs from the initiation as in tendering phase to the closure of the project. Despite their importance, issues such as a high risk of failure during tendering, poor cost management and cost overruns are still prevalent. This is largely attribute to a lack of competency among quantity surveyors who rely on traditional skills, hindering their ability to compete in an emerging market. To address these issues, especially those related to tendering, this research aimed to determine the factors affecting quantity surveyor competencies in the tendering procedure. Data collections were gathered through online surveys from 416 civil engineers with varying levels of experience and analyzed through exploratory factor analysis. Results showed that six group factors influencing quantity surveyor's competencies in tendering procedure were identified: 1. technical factors in cost estimating and information technology (17 items); 2. technical factors in construction methodology and site analysis group (8 items); 3. managerial factors impacting project success (contract, schedule, stakeholders, cost, and manpower management planning) (18 items); 4 managerial factors in soft skill (9 items); 5 attitude (4 items); 6. external factors in education and training, experience and market. The finding helps Cambodians civil engineers who work as quantity surveyor to understand the significant influencing factors to be strengthen their competencies in practicing in tendering construction project.

Keywords: Quantity Surveyor, Tendering Construction Project, Competency, Cambodia

1. Introduction

Quantity surveyor is one of the most critical roles in the construction project[1] and involved throughout the lifecycle of the project[2], especially in tendering procedure of the construction project[3].

Quantity surveyors' competencies in Cambodia are still lacking in the construction sector[4], particularly in tendering phase. By various researches, Cambodia is poor in construction management[5-7]. Quantity surveyors play an important role in the construction field, their construction management knowledge, mainly cost-related aspects[8]. Besides, quantity surveyor is a specialist who is crucial to construction and can make construction projects successful, cost-effective solutions that add value to the final product are more practical[9]. However, the construction business generates a lot of waste, and building operating costs are greater than they should be[10]. Poor construction cost management is reflected in the money lost in high-generated waste and high operating costs. In Cambodia, the main person to work in this area is quantity surveyor, who play the significant role from initial phase until closing phase, as cost manager or construction economic. But, because no academic institutes provide skill training and expertise in the domain of quantity surveying, and no local institutes have created any standard for quantity surveying service, many quantity surveying services are given by other practitioners[11]. Furthermore, [7] discovered that the majority of Cambodia construction businesses lack practitioners to control project costs due to a shortage of human resources in terms of both availability and competencies. Moreover, in tendering phase it's the most important for construction project. Subcontractor try many ways to operate this procedure and the significant person to responsible for this process is quantity surveyor. However, lack of

quantity surveyor competencies on tendering in the medium construction project is a concern for subcontractor/consultant/developer, as example they will get loss the award of tendering project. By pointing out from many research form Cambodia and global, there are many concerned from the construction operation as: majority of quantity surveyors' competencies are below industry requirements[12] quantity surveyor instructors and practices are mostly centered on "traditional" core competencies. Quantity surveyors also trailing current market expectations, especially in emerging areas such as Malaysia[13]. And in South Africa the primary obstacles facing the profession include overcoming an unwillingness to take on new duties outside of core QS services, as well as a lack of relevant QS skills[14]. Furthermore, they found that incapacity to perform additional tasks beyond basic QS services and a lack of relevant QS experience among the incoming generation of professionals[14].

Cambodia, being a developing country, is confronted with a range of challenges during the construction project, particularly during the tendering phase which is considered a crucial stage. Therefore, it is essential for Cambodian to implement effective construction cost control measures and address the issue currently affecting the construction industry.

The aimed of this research is to determine the factors influencing on quantity surveyors' competencies on tendering procedure and lack of this research area in Cambodia is the main motivation to conducting this study.

2. Literature review

2.1 Quantity surveyor competencies

Quantity surveyor was once known for providing reactive cost advice to clients, such as cost planning, procurement advice, contract administration, and contractual claim settlement however, today, QS's role has evolved to become more proactive, requiring it to provide value of services to meet the needs of clients[15]. Quantity surveying integrates engineering, construction, and economics into one career. To be competent, we must be able to utilize a set of related knowledge, skills, and abilities to successfully complete a task[16]. Many standards from global have released the manual for quantity surveyor competencies like: Royal institute of chartered surveyors (RICS), Australian institute of quantity surveyors (AIQS), Pacific association of quantity surveyor (PAQS), Singapore institute of surveyors and valuers (SISV) etc.

In summary, quantity surveyors require a range of technical, managerial, and interpersonal competencies (soft skills) to carry out their duties effectively. These include technical knowledge, cost estimation procurement, communication and ethic.

2.2 Influencing factors of quantity surveyor competencies

Cambodian quantity surveyors' competencies reveal none of research in this area. However, from numerous literature review found many factors.

The role of quantity surveyor (QS) in tendering procedure is crucial for successful project tendering and award including project delivery. Factors influencing the competency of quantity surveyors include personal factors such as experience, education, and training, as well as organizational factors such as source of availability and management support[17–22]. Additionally, knowledge and skills in areas such as procurement, construction technology, and cost management are crucial[8], [16], [23–30], as is the utilization of technology and software[8], [27], [31], [32].

3. Materials and methods

This research is an exploratory research that aims to identify the highly critical factors affecting quantity surveyor's competencies in tendering procedure of construction project in Phnom Penh Cambodia for the medium and large construction project.

3.1 Population and sample size

Population are those civil engineers who have registered at the board of engineers in Cambodia and work only private sector in related fields from various positions such as construction director/manager, general manager/owner of the construction company, general project manager/project manager, quantity surveyor in all positions(officer-manager), procurement manager, site manager/supervisor, technical manager, planning and cost engineer and others related position. According to the board of Engineers Cambodia, 2023 (BEC) there are 6468 civil engineers were registered. By knowing the population size, Taro Yamane's 1973[33] formula was adopted to calculated the sample size as shown (1):

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

where n: sample size of respondents

N: population size (6468)

e: level of precision (a 95% confidence level or 5% was assumed).

So $n = \frac{6468}{1+6468(0.05)^2} = 378$ respondents

Therefore, at least 378 respondents are required and added 10% to archived the sample size[34], total amount is 416 respondents.

3.2 Instrument design

The questionnaires design was developed as an instrument design in this research.

The questionnaire structure was classified into 3 parts as below:

Part 1: Collect the respondent's demographic (gender, age, education, position, working experience, size of project, register board of engineer)

Part 2: Collect problems which are key issues for quantity surveyor's competencies in tendering procedure.

Part 3: Collect the factors affecting the quantity surveyor's competencies in tendering procedure which measure on frequency and impact level of factors and five Likert-scale were used.

To get more clearly and accurately of primary data, the questionnaire's structure was assessed for face validity via online interviewed by five experts to check the index of Item-Objective Congruence (IOC).

Experts selection are in the four criteria:

1. Experts are national professional engineers who have been licensed by the board of engineers, in Cambodia or have at least ten years of experience in the field [18] of civil engineering on the project tender or have the project management professional (PMP) certification.

2. Experts have extensive skills and knowledge in the field of civil engineering, especially in project tender or project management [35].

3. Experts with current or direct experience in the field of civil engineering [36].

4. Experts willing to participate in the research [37]

3.3 Data collection

Data collection in this study was collected via an online study survey on google link forms both pilot study and main study. Because of COVID-19, travel is restricted, and the online survey become to be the quickest and most effective way to gather the data. Furthermore, it is the one of survey platforms that has the potential could obtain a large number of practitioners. Additionally, several advantages of using this method such as time and cost saving were included[38].

Questionnaires form also including the participants of information sheet and terms and conditions in the first page of google link form and were sent out to the group of sample size.

Three sampling methods were used for collecting the data. Firstly, the convenient sample method was used to collect from the sample size who are conveniently involved in research by sending emails with the survey link form which was attached with a permission letter in data collection to 95 private construction companies located in Phnom Penh Cambodia. Participants can access it directly by clicking on the link after distribution from the companies. Secondly, the snowball method was used. The chain sampling technique is commonly referred to as the sampling technique in which the researcher asks respondents to invite other participants like their colleagues and friends or team work. Lastly, the anonymous links were uploaded to social media as in Cambodia engineering construction groups including description aims of the research and invite group members to join the survey form.

After spending 35days for data collection researcher received the target of sample size 416.

3.4 Data analysis

This research is in the type of quantitative research. After completing data collection, the data were recorded in the excel worksheet in each question from the google link form. Data from excel sheet keep as a raw data and imported to the statistical package for social science (SPSS 25 version) for Windows software package was used to analysis the data and test psychometric properties of the questionnaire. Furthermore, to examine the validity and the reliability of components an exploratory factors analysis was applied. In addition to determine the reliability of the instruments, assess the internal consistency of the factor and determine their best fit on multiple factors, Cronbach's alpha coefficients were calculated. Given that the instrument was new, a higher cut-off 0.7 was use. Moreover, the study employed the correlation matrix and multicollinear testing to identify and exclude highly correlated independent variables, which may result in multicollinearity issues. Multicollinearity is a statistical phenomenon where two or more independent variables in a multiple regression model have a high correlation coefficient above approximately 0.8. The p-value for this study was set at 0.05.

4. Findings and discussion

As a result, the descriptive data of all respondents' demographic were represented as shown in Table 1.

Table 1 Respondents' demographic result

Variables	Frequency	%
Position		
QS officer	106	25.5
Senior QS	91	21.9
Planning and cost Engineer	15	3.6
QS manager	23	5.5
General Project Manager/Project manager	35	8.4
Site manager/supervisor	61	14.7
Construction director/manager	17	4.1
General manager	3	0.7
Procurement manager	2	0.5
Others	63	15.1
Working experience		
1-3 years	99	23.8
3-5 years	140	33.7
5-10 years	125	30.0
>10 years	52	12.5
Age		
<25 years	35	8.4
25-30 years	204	49.0
30-35 years	157	37.7
40-50 years	20	4.8
Education		
Bachelor	319	76.7
Master	90	21.6
PhD and Postdoctoral	7	1.7
	232	55.8
Size of project		
Medium project	118	28.4
Large project	66	15.9
Medium and large project		
Registered at board of engineer Cambodia (BEC)	416	100
Yes	56	13.5
Gender	360	86.5
Female		
Male		

The respondent's demographic is summarized in Table 1. All respondents are registered at the board of engineers Cambodia, 100%. 86.5% of respondents are male and highest rank of age is 25-30 are 49%, 76.7% are bachelor student. Among the respondents, 25.5 % are quantity surveyor officer, 21.9 % are senior QS, 3.6% are planning and cost engineer, 5.5% are QS manager in total of respondents from QS's field is 56.49%. Furthermore, 3.4% are general project manager or PM, 14.7% are site manager/supervisor, 4.1% are construction director/manager, 0.7% are general manager, 0.5% are procurement manager and others respondents are 15.1%. In addition, 33.7 % are highest rank of 3.-5 years' experience, and 55.8% are working in the medium construction project.

The total variance explained of factors affecting quantity surveyor's competencies in tendering procedure of construction project as shown in Table 2.

Table 2: Total variance explained of factors affecting quantity surveyor's competencies in tendering procedure

Component	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	28.917	40.728	40.728	28.917	40.728	40.728	9.606	13.530	13.530
2	3.701	5.212	45.940	3.701	5.212	45.940	8.551	12.044	25.574
3	2.856	4.022	49.962	2.856	4.022	49.962	8.301	11.692	37.266
4	2.583	3.638	53.600	2.583	3.638	53.600	7.445	10.486	47.752
5	2.008	2.828	56.428	2.008	2.828	56.428	5.971	8.410	56.162
6	1.731	2.438	58.866	1.731	2.438	58.866	1.920	2.704	58.866
7	1.532	2.158	61.024						
8	1.292	1.820	62.843						
9	1.231	1.734	64.578						
10	1.161	1.636	66.214						
11	1.141	1.607	67.820						
12	1.058	1.491	69.311						
13	1.020	1.436	70.747						
14	.977	1.376	72.124						
15	.936	1.319	73.443						
16	.832	1.172	74.615						

Table 2: Total variance explained of factors affecting quantity surveyor's competencies in tendering procedure (continued)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
17	.787	1.109	75.724						
18	.759	1.068	76.792						
19	.697	.981	77.773						
20	.665	.936	78.710						
21	.651	.917	79.627						
22	.628	.885	80.512						
23	.587	.827	81.339						
24	.569	.801	82.140						
25	.564	.795	82.934						
26	.535	.753	83.688						
27	.520	.733	84.421						
28	.503	.709	85.129						
29	.464	.653	85.783						
30	.459	.647	86.429						
31	.441	.621	87.050						
32	.429	.604	87.654						
33	.402	.566	88.220						
34	.379	.534	88.754						
35	.368	.519	89.273						
36	.362	.510	89.783						
37	.351	.494	90.277						
38	.341	.480	90.757						
39	.332	.467	91.224						
40	.326	.460	91.684						
41	.318	.448	92.133						
42	.309	.435	92.568						
43	.302	.425	92.993						
44	.297	.418	93.411						
45	.288	.405	93.816						
46	.267	.376	94.192						
47	.264	.373	94.565						
48	.248	.350	94.915						
49	.239	.337	95.252						
50	.233	.328	95.579						
51	.223	.314	95.893						
52	.223	.313	96.207						
53	.208	.293	96.500						
54	.205	.288	96.788						
55	.189	.266	97.053						
56	.180	.253	97.307						
57	.169	.238	97.545						
58	.165	.233	97.778						
59	.161	.227	98.005						
60	.151	.213	98.218						
61	.147	.207	98.425						
62	.146	.205	98.631						
63	.137	.193	98.824						

Table 2: Total variance explained of factors affecting quantity surveyor's competencies in tendering procedure (continued)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
64	.129	.182	99.006						
65	.127	.179	99.185						
66	.115	.163	99.348						
67	.109	.153	99.501						
68	.103	.145	99.646						
69	.096	.135	99.782						
70	.084	.119	99.901						
71	.071	.099	100.000						

Extraction Method: Principal Component Analysis.

As a result, answer with an eigenvalue greater than 1 and a total of six components accounting for approximately 58.866 percent of the variance in responses were extracted. Such findings were also confirmed by the total variance explained in Table 2. All 71 items were grouped into six critical dimensions.

Table 3 The result of the factors loading, percentage of variance explained, and cumulative percentage of variance.

Items	Factor loading	% of Variance explained	Cumulative % of variance
Dimension 1: Technical Factors in Cost Estimating and Information Technology (17 items)		51.753	51.753
- Reviewing quotations prices (materials, equipment, labor) from subcontractors and suppliers or from historical quotation of previous projects	0.771		
Pricing analysis and technique (materials, labor and equipment)	0.766		
Quantitative risk (Material wastage coefficient, calculation of materials %wastage for construction quantity)	0.764		
Overhead cost and risk cost	0.762		
Knowledge of factors affecting costs: type/function of project	0.751		

Table 3 The result of the factors loading, percentage of variance explained, and cumulative percentage of variance (continued)

Items	Factor loading	% of Variance explained	Cumulative % of variance
Qualitative risk (Labor variation coefficient based on quality required), quality of work (Price based on: medium level, good level, excellent level	0.747		
Rates of buying/rental of plant and machinery and its functionality.	0.741		
Understanding the scope of works and project timeline	0.737		
Knowledge of factors affecting costs: type of structure (steel, concrete, brick, timber, masonry)	0.732		
Correct material price and forecasting fluctuation	0.729		
Bond/warranty arrangements	0.711		
Knowledge of factors affecting costs: client requirements (defect liability period, contract agreement, etc.)	0.710		
Insurance of heavy construction equipment	0.695		

Table 3 The result of the factors loading, percentage of variance explained, and cumulative percentage of variance (continued)

Items	Factor loading	% of Variance explained	Cumulative % of variance
Mark up policies and % (general and project-wise, special or normal conditions applied)	0.685		
Knowledge of factors affecting costs: site conditions (site clearance, debris or waste, demolition, tree, etc.)	0.669		
Basic supporting tools/software: advanced excel, Au AutoCAD, BLUEBEAM revue, etc.	0.663		
BIM (Revit, ArchiCAD...)	0.567		
Dimension 2: Technical Factors in construction methodology and site analysis group (8 items)		55.190	55.190
Adequate knowledge of labor and material specifications	0.797		
Read /check/compare all tender drawings with specifications and check for the discrepancy	0.796		
Adequate knowledge of quantity surveying (quantity take off, accurate measurement of quantity)	0.789		
Ability to understand/read technical drawings (Structure, Architecture, MEP, and Interior)	0.749		
Ability to review/evaluate/analyze the calculated quantity for high proficiency	0.746		
Sufficient knowledge of construction methodology	0.732		

Table 3 The result of the factors loading, percentage of variance explained, and cumulative percentage of variance (continued)

Items	Factor loading	% of Variance explained	Cumulative % of variance
Adequate knowledge of site visit observations for analysis in temporary work (temporary office, site fencing, site warehouses, toilets...)	0.664		
Ability to visit the site to analyze the actual construction situation (Site features, sloping site / in a congested area, open field / flat...)	0.656		
Dimension 3: Managerial Factors impacting project success (Contract, Schedule, Stakeholders, Cost, and Manpower management planning) (9 items)		52.953	52.953
Ability to develop supplier relationships	0.772		
Identify stakeholders (Owner, suppliers...)	0.754		
Ability to analysis in supplier's selection (Ex: charge in transportation service, tax, etc.)	0.750		
Client care, client retention skills to reduce complaints and build consumer loyalty	0.750		
Plan Schedule Management (Planning process)/ Construction master schedule/timeline	0.748		
Estimate resources, tools, and equipment duration incorporating with price.	0.744		
Define work plans and sequence of works	0.743		
Plan Cost	0.740		

Table 3 The result of the factors loading, percentage of variance explained, and cumulative percentage of variance (continued)

Items	Factor loading	% of Variance explained	Cumulative % of variance
Workmanship management	0.735		
Manpower management planning (Labor rate)	0.733		
Be able to understand tendering documents (RFP, RFQ, ITB, TOR)	0.730		
Knowledgeable of payment	0.730		
Effective information flow of project	0.715		
Be able to coordinate in stakeholders preparing bidding documents (financial proposal, technical proposal, quotation)	0.704		
Knowledgeable of contracting documents (FIDIC, RIBA, AIA type of contract: contract for construction, contract for consultant, contract for design, lumpsum.	0.704		
Capital allowances	0.684		
Cost-benefit analysis (ex. Availability of cost of all fields of specialization in a project team...)	0.678		
Proper section of sub-contractors and/or quotations	0.676		
Dimension 4: Managerial factors in soft skills (9 items)		69.261	69.261
The ability to carry integrity in professional practice	0.863		
Leadership skill (The ability to show and manage the teams in various activities, understand concept of leadership, ability to lead projects)	0.860		
Responsibility (Be able to admit when you are wrong, etc.)	0.860		
Critical Thinking and Problem-Solving Skills (think critically, logically, creatively &analytically, analyze problems and make judgments, focus on task work, etc.)	0.849		
Work delegation	0.834		
Self-time punctual	0.832		
Teamwork skills	0.827		
Self Confidence (ensuring self-management behavior: self-consciousness/ self-result evaluation)	0.782		
Communication skills &Negotiation skills (To be friendly and approachable, good listener and responder, etc.)	0.777		
Dimension 5: Attitude (4 items)		*74.563*	*74.563*
Self-motivated at work	0.871		
Clarity	0.868		
Patience	0.864		
The ability to organize activities in term	0.850		
Dimension 6: External factors in education and training, experience and market condition (15 items)		51.437	51.437
Tendering technology (Knowledge of tendering technologies, process, and building materials)	0.789		
Knowledge of law, regulations, and guidelines related to construction (Ex. CDM regulations awareness)	0.787		

Table 3 The result of the factors loading, percentage of variance explained, and cumulative percentage of variance (continued)

Items	Factor loading	% of Variance explained	Cumulative % of variance
Standard of workmanship, labor laws, qualification/productivity of local labors	0.783		
Conduct rules, ethics, and professional practice	0.774		
On-the-job training (acquisition of specific skill)	0.769		
Research & Development	0.747		
Competitor analysis (standard competitor's company, tendering price, etc.)	0.728		
Level of competition and level of construction activity	0.720		
Market conditions (Ex. interest rate/inflation rate, stability of market conditions, currency exchange fluctuation...)	0.711		
Source and availability of material and equipment, supply ability, and period	0.701		
Experience in similar projects and construction types	0.700		
Experience in local practices, local market price, and resources (material and labor)	0.665		
University educational academic (QS skills)	0.655		
Experience in site construction	0.649		
Good academic from university or institution	0.534		

4.1. Technical factors in cost estimating and information technology

The technical factors in cost estimating and information technology consist of 17 items, but only one of them,

"reviewing quotations prices (materials, equipment, labor) from subcontractors and suppliers or from historical quotation" of previous projects", can support the highest loading factor 0.771. Reviewing quotations prices from subcontractors and suppliers, or historical quotation, is an important step in the cost estimating process for construction

project. Technical factors and the use of information technology are important influencing factors that affect the competencies of quantity surveyor in tendering procedure. This required a deep understanding of materials quality, labor requirements, industry standards, and best practices. The use of information technology can assist in the comparison of different quotations, allowing for more accurate and informed decision-making[39].

4.2. Technical factors in construction methodology and site analysis group

The technical factors in construction methodology and site analysis group consist of 8 items. The highest loading factor is 0.797 "adequate knowledge of labor and material specifications". In the field of quantity surveyor, understanding technical factors such as construction methodology and site analysis is important during the tendering process. One critical competency for quantity surveyors is having sufficient knowledge of labor and material specification, which are important components of construction project. According to a study [40] labor and

material specifications are among the most important technical factors that influence the success of the tendering procedure in construction projects. The study also found that quantity surveyor who possess expertise in these areas are more likely to success in the tendering process. This is the crucial assess bids more accurately and ensure that the chosen contractor meets project requirements, leading to the successful completion of construction projects.

4.3. Managerial factors impacting project success (contract, schedule, stakeholders, cost, and manpower management planning)

The managerial factors impacting project success (contract, schedule, stakeholders, cost, and manpower management planning) classified into 18 variables, but only the "ability to develop supplier relationships" item can

maintain the highest factor loading 0.772. The ability to develop supplier relationships is a crucial managerial factor that can impact project success in tendering procedure. effective supplier relationship management (SRM) can enhance the quality of goods and service, reduce costs, and increase innovation in the procurement process[41]. In the context of quantity surveyor competencies, the ability to develop suppliers' relationships is an important skill that can contribute to the successful completion of projects. Quantity surveyors need to possess this competency to effectively manage the procurement possess and ensure that suppliers meet the projects' requirements and objectives.

4.4. Managerial factors in soft skill

The managerial factors in soft skill comprises 9 items. The most important one is "the ability to carry integrity in professional practice" with the highest loading factor 0.863. The integrity and ethical behavior of quantity surveyors are significant in the tendering process and influence the quality of the final product [44]. Beside integrity, soft skills such as communication, team work, leadership, and time management are also critical in the competencies of quantity surveyors during tendering. These skills are essential for ensuring the success of the tendering process and the timely and budget-friendly completion of the project.

4.5. Attitude

The attitude factors categorized into 4 items. The significant one is "Self-motivated at work" which have highest loading factor 0.871. self-motivation is an important attitude factors in the workplace, as it positively correlates with job satisfaction, job performance, and organizational commitment. Self-motivated employee tends to have a strong work ethic, are proactive in problem-solving, and are more likely to take on challenging tasks, resulting in higher job satisfaction and improved job permeance. Conversely, employee who lack self-motivation may struggle to stay focused and engaged in their work, leading to poor job performance and decreased job satisfaction. Employee should encourage and reward self-motivation in the workplace[42].

4.6. External factors in education and training, experience and market condition

The external factors in education and training, experience and market condition consist of 15 items. The crucial one is "Tendering technology (Knowledge of tendering technologies, process, and building materials)" with the highest loading factor 0. 789.The tendering technology is an important external factor in the construction industry. It involves knowledge of tendering technologies, processes, and building materials. This knowledge is necessary to prepared and submit completive bids for construction projects. Education and training, as well as experience, play a critical role in developing this knowledge. Market conditions, such as the level of competition and the availability of projects, also impact the tendering procedure. Overall, a deep understanding of tendering technology is crucial for success the construction industry. As noted by[43] "knowledge of tendering procedures and technologies is essential for the efficient functioning of the construction industry.

5. Conclusion

The discovery conveys six dimensions of 71 key factors that have a significant affecting on quantity surveyor's competencies in tendering procedure of construction project as such as : (1) technical factors in cost estimating and information technology (17 items); (2) technical factors in construction methodology and site analysis group (8 items); (3) managerial factors impacting project success (contract, schedule, stakeholders, cost, and manpower management planning) (18 items); (4) managerial factors in soft skill (9 items); (5) attitude (4 items); (6) external factors in education and training, experience and market condition. The research should be accepted as a good model doing future work effectively if it includes completed and theoretical practical and exact data from reliable sources and is implemented in a well-planned and scientific way under the supervision of a qualified working group, experts, and researchers. Furthermore, the expected outcome and factors affecting quantity surveyor's competencies in tendering procedure of construction project can be used as deciding factors selecting only the best of newly proposal to be implemented in practice.

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