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Identification of Key Quality Attributes in Gas Pipeline Transmission Projects Using Repertory Grid Method

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ABSTRACT

The purpose of this study is to identify the key quality attributes in gas transmission projects.

By applying Kelly's personal constructs theory and repertory grid methodology as well as conducting interviews with 20 managers and experts of gas transmission projects, as many as 284 quality constructs have been identified. These constructs were classified into 40 categories by using content analysis, and they were subsequently analyzed with statistical methods. By applying the statistical analysis nine quality attributes include, compliance with the standards, competence, appropriateness in design and engineering, effective supervision, sound execution, desirability, convergence, accountability and integration were identified. These construct as the main factors affecting the quality of gas transmission projects.

In this study, the data were collected from the gas transmission projects conducted from the employer's departments. The subsequent studies not only increase the number of interviewees but also apply the contractors' participation in the interviews to have more comprehensive results. Given the conditions of volume, temperature, and pressure, oil industry projects are of critical sensitivity and significance. The managers of project-oriented organizations can apply the findings of the present study to promote project quality and success.

The present study is an original one; it is one of the main issues to be studied in investigating the concept of quality in gas transmission projects. This study includes the experimental evidence regarding the positive effect of quality attributes on the performance of such projects. Moreover, the present study attempts to develop the related literature on quality.

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1. Introduction

The global-scale construction sector is the basic industry on which the development of a country depends on. A country development status is generally determined by the quality of its infrastructures and construction projects (Wasiu et al., 2012). However, the construction industry has been criticized over the past decades for its poor performance and efficiency (Loushine et al., 2006). As clients in this industry move forward and seek improvements in service quality, the continuous improvement in the concepts of quality is strongly dependent on group culture and collaboration at internal and external organizational levels. Problems, such as the poor quality of performance, inattentiveness to workplace and manpower, as well as rework costs have led to the creation of a quality management system in the construction industry (Gandolfi et al., 2001). It has also been reported that quality is one of the most effective factors in the success of construction projects (Mane & Pati, 2015). Accordingly, the quality and success of construction projects could be considered as meeting the expectations of project participants so that upon client satisfaction, long-term competitiveness and survival are achieved for commercial companies (Tan & Abdul-Rahman, 2005).

Given the large amount of research done on this topic, it is observed that quality has been developed extensively in repetitive operations, such as goods and services, but it has been left in the study phase in projects. It is clear that some attributes, such as beauty and efficiency must be utilized to describe quality because different people perceive them differently. Therefore, attributes could be defined as the aspects of the product itself or its use, which are based on the comparison of the product alternatives (Grunert, 1989). According to Müller et al. (2007), research shows that projects vary in different industries, and quality attributes are varied (Curkovic et al., 2000). Thus, there is a research gap in the field of gas transmission pipeline projects, where quality is required to be studied. This article is organized to examine the relationship between quality and projects. Initially, project attributes as well as quality attributes in products, services, and projects, in addition to the application of these attributes in construction projects are discussed. Next, the research methodology is explained. Results from the analysis of the findings are presented in the next part. Finally, the key findings of the research as well as opportunities for new studies are provided and summarized concerning the practical implications of the results.

2. Literature Review

2.1. Project Attributes

Although projects vary in size, theme, and nature, they share common attributes. The recognition and awareness of these attributes could be effective in identifying quality attributes in the project environment. Attributes, such as change (Geraldi et al., 2009; Sun and Meng, 2008), ambiguity (De Meyer et al., 2002), uncertainty (Huchzermeier and Loch, 2001; Sun and Meng, 2008), uniqueness (ISO 10006, 2003, Forsberg et al., 2000), temporariness (PMBOK, 2008), integration (Ancona and Caldwell, 1990; Ford and Randolph, 1992), dynamicity (De Meyer et al., 2002), novelty (Turner 1999), complexity (Bailleti et al., 1994; Pich et al., 2002), context-centeredness (Vidal et al., 2011), and intangibility (Pitsis et al., 2003; Winch and Kreiner, 2009) have been introduced as project characteristics emphasized by researchers in this field.

2.2. Quality Attributes in Products and Services

The word quality is often associated with different meanings for different people. Quality is both an objective and a subjective term, for which individuals have their own definitions. It could be examined from a variety

of perspectives (ASQ Glossory, 2008). According to Reeves and Bednar (2004), quality is easy to imagine but difficult to define. However, researchers in the field of quality have provided different definitions for it, with every of whom having considered a particular attribute for it, including fitness for use (Juran, 1998), meeting customer expectations (Kano, 1984), fulfillment of requirements (PMBOK, 2008, ISO, 9000: 2005), competency (Juran, 1974), reliability, usability, price, serviceability, availability, and security (ANSI / ASQC, A3-1987), degree of excellence (Hoyle, 1998), satisfaction (Hoyer & Hoyer, 2001), as well as attributes and design (Curkovic et al., 2005), which have been described in products and services.

2.3. Quality Attributes in Projects

In a research titled 'identifying key success factors in project performance', factors such as competence, communication, effective quality assurance, compliance with standards, as well as positive attitude and durability were introduced (Homthong & Moungnoi, 2004). Likewise, Geraldi et al (2011) introduced the attributes of commitment in quality, empowerment, completeness, clarity, integration, adaptability, meeting requirements, compliance, and the value added aimed at developing the concept of quality in the field of information technology projects. Karna (2004) pointed out to the attributes of competence, abilities, capability, confidence, and loyalty in analyzing customer satisfaction and construction quality.

Hamzah et al (2010) considered professional ethics as an important human factor in improving quality in construction projects. Arazi & Mahmoud (2010), in a research titled 'a framework for contractor qualitative assessment in construction processes', emphasized conformance to quality standards in the fields of materials, labor skills, equipment, and methods in construction projects. El-Mikawi (2002) considered sustainability as a factor effective in the success of construction projects, which is achieved by examining and evaluating different concepts of sustainability in the life cycle of projects. Tai et al (2016), in examining factors affecting the trust between contractors and the owners of construction projects, identified 24 trust attributes, some of which being sharing information, communication, competence, reputation, integrity, and opportunistic behaviors.

2.4. Application of Quality Attributes in Projects

Nowadays, upon the development of the concept of quality in goods and services, its application in projects has been expanded as well. In this regard, Slack et al (2004) believe that a project could be the combination of services and goods. In the following sections, some of the applications of quality attributes in projects will be provided.

Humphreys (2004), Towler and Sinnott (2008), and Dysert (2006) have applied accuracy attribute for describing the cost estimation of different activities of construction projects. Accuracy is a degree showing the deviation from the real price. In terms of the completeness attribute, Yates and Hardcastle (2003) have referred to the perfectness of the contract and project documents. However, Cho and Gibson (2001) have referred to the perfectness of the project definition. According to Ganaway (2006), conformance to quality standards is the capability of creating the requirements in construction industry.

The companies acquire the credibility attribute through a variety of activities including social, technical, commercial, and operational activities (Rehme and Svensson, 2011). According to Jiang et al. (2011), believability and reliability are associated with credibility. They have also indicated that credibility indicates that the parties have managed to fulfill their promises.

Responsiveness attribute is the ability to respond to the changing condition and

interactions with the customer. According to Reis et al. (2004), responsiveness is a main marker in the safety of relationships.

The deliverables are either goods or services that can be tangible or intangible (Kermit Burley, 2013). The tangibles include documents, reports, software products, building, or server updating that can be effective for controlling and ensuring the efficient management of the companies (Cutting and Thomas, 2009).

Another important factor in a given project is timeliness that can affect the success or failure of a project (Hai et al., 2014). According to Michnik and Lo (2009), timeliness refers timely execution of the affairs without any delay. This attribute emphasizes the completion of a contract at the scheduled date. Evans and Lindsay (2005) have defined accessibility and convenience as the ease in conducting contract services.

According to Parasuraman, Zeithaml, and Berry (1985), security can be defined in physical and financial issues and the confidentiality of the project.

3. Material and Methods

3.1. Personal Constructs and George Kelly's Theory

Personal constructs theory was first introduced in the field of psychology by George Kelly in 1950. Kelly (1995) stated that everyone has a set of personal constructs and the constructs indicate our expectations from the events. Therefore, it was attempted to highlight the active nature of the constructible structures (Sokkia, 2007). Kelly (1995) attempted to study individuals and the psychological processes of each person's interpretation from the outside world (Ma and Norwich, 2007). The personal constructs theory discussed by Kelly (1995) is based upon the metaphor "knowledgeable human"; this theory considers a dynamic and active role for human in creating knowledge (Niu and Easterbook, 2007). Each individual's personality consists of an organized system of constructs that are likely to be classified based upon their significance (Jankowicz, 2004). In confirming this theory, Fransella (1972) states that people interpret their physical and social affairs in a specific way and create a pattern in this way. People predict the events, individuals, and themselves based on the patterns and they use such patterns to guide themselves. Thus, it is required to understand people's structural patterns.

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3.2. Repertory Grid

Understanding people's mentality and extracting personal constructs call for special tools. One of these tools is George Kelly's

repertory grid that has been created based on in-depth construct interviews and laddering technique; it is resulted from the interaction made between the interviewer and the interviewee. Repertory grid technique is used in cases where the researcher intends to know how the individuals understand the world and how they apply their own mental constructs to give meaning to the phenomena especially the complicated issues with any possible bias (Partington, 2002). One of the reasons for the popularity of the repertory grid technique is its three major advantages over other quantitative and qualitative techniques, which include the ability to determine the relationship between constructs, ease of use, and the lack of scholar bias. Separate networks allow for providing precise definitions for concepts and the relationship among them (Boyle, 2005).

In this study, 20 managers and executives experienced in gas transmission pipeline projects were interviewed to collect data from the repertory grid using structured partnership-based interviews (Jankowicz, 2004). The interviewees had a bachelor's degree and beyond it, with 80% of them having had more than 20 years of experience.

In the present study, a repertory grid composed of a collaboration-based structured interview was used for collecting the data (Jankowicz, 2004). The process of conducting the interviews and the formation of the repertory grid consists of three main steps: 1. Selecting the title and elements; 2. Extracting the constructs; and 3. Connecting the elements to the constructs (Tan and Hunter, 2002).

3.2.1. First step: Selecting the Title and Elements

A repertory grid is based on what we are trying to understand. Since the present study aims at understanding the quality of projects, the repertory grids are based upon quality in the projects. In repertory grid method, the elements are specific objective examples covering the domain of the research subject (Tan and Hunter, 2002). The elements used in the repertory grid can be anything and it completely depends on the investigated concept. According to Jankowicz (2004) and Anderson (2007), there are 6-12 favorable elements for a repertory grid. In the present study, by using the "role titles method", as many as 6 locations were determined as the elements for describing quality in gas transmission projects. These elements include:

- The highest quality gas transmission projects;
- The lowest quality gas transmission projects;
- The high quality gas transmission projects;
- The low quality gas transmission projects;
- The average quality gas transmission projects;
- The ideal quality gas transmission projects.

3.2.2. Second Step: Extracting the Constructs

After selecting the elements and placing them in the repertory grid, the next step is to extract the constructs belonging to each person through making a systematic comparison of elements with each other. The most important attribute of a construct is its bipolarity (Fransella, 2004). Thus, bipolarization is an essential factor for understanding and extracting the individuals' mental constructs (Marsden and Littler, 2000). Von (2009) introduced dual and triple extraction methods as the main approaches for extracting the constructs. Moreover, during the interviews, upward and downward laddering techniques can be also used for ensuring a better and more accurate understanding of the constructs and their details. According to Tan and Hunter (2002), as many as 15-25 individuals are appropriate for acquiring the required constructs.

For collecting the data, the interviews were conducted on 20 experienced managers and officials involved in gas transmission projects. All of the interviewees had at least undergraduate

degrees and 80% of them had a working experience of 20 years and more.

In the present study, the contrast-based dual method was applied. The two elements were provided and the interviewee was asked "How are these two elements similar or different from each other?" If the interviewee refers to their differences, the differences will indicate two poles of the construct. However, if interviewee refers to the similarities, the interviewee is asked to point out the opposite of that similarity. The interview was conducted to the saturation point i.e. the interviewee failed to provide a new construct.

3.2.3. Third step: Connecting the Elements to the Constructs

In this step, each of the elements are analyzed and evaluated based on each bipolar construct; it will be clear how individuals describe each element based on a given construct and differentiate the elements (Rogers and Ryals, 2007). Thus, after selecting the elements and extracting the personal constructs, it is essential to connect the elements to the constructs. For making a more accurate distinction between the elements (based on the construct) and providing an opportunity for reflecting the participants' impartial views, a grading method is applied for evaluating the elements. Five-point or seven-point scales are the most common scales used in most of the studies (Von, 2009). In evaluating the elements of the present study, the five-point Likert scale was used for reflecting the participants' impartial views.

The reliability of the repertory grid has made it attractive not only for repeating the same results but also for showing change or stability and whatever they imply (Fransella et al., 2004). Fransella and Bannister (1977), in reviewing some studies on the repertory grid, expressed that high or low reliability was not important; according to them, what mattered was that if individuals maintained or changed their interpretations of events, the network would be capable of representing them. In the repertory grid, network validity is determined by its ability to make individuals know how to describe their own interpretations (Petersen, 2004). From this perspective, a network able to reflect a more accurate description of people's interpretations will have higher validity (Fransella et al., 2004).

Similar to the study conducted by (DanaeeFard et al., 2014), the following measures were adopted to ensure the reliability and validity of the findings in this study:

- Using the role title or role description method at the element selection stage
- Using the ladder complementary method at the construct extraction stage
- Matching the extracted constructs using the participants' viewpoints at the extraction stage
- Using a 5-point Likert scale at the stage of connecting the elements to the constructs
- Performing a content analysis by the researcher as well as two project management experts

4. Results

By conducting 20 independent interviews, as many as 20 unique repertory grids were formed and 284 personal constructs were extracted. Since the number of the constructs obtained was too many to be analyzed, the constructs were added up and combined by using content analysis technique. Similar constructs were categorized in 40 groups forming the secondary constructs (See Table 1).of small foot print in skid design, the SMR process with one phase separator (by 43% sharing in SMR processes) has been selected in this paper. The commercialized liquefaction units by companies such as Linde, Black & Veatch, Air Products and so on, also contains only the 0-phase, 1-phase and 2-phase separators in their refrigeration cycles.

Table 1. Secondary Constructs Obtained from the Content Analysis

ID	Secondary Constructs	Frequency Initial Constructs	Description of the Positive Pole of the Secondary Construct
1	Compliance with the standards-nonconformity with the standards	13	Adhering to the basic requirements defined for the products in terms of quality, health protection, consumer's safety, and environment
2	Competence-incompetence	18	Having the required expertise, experience, and financial ability
3	Appropriate design and engineering-inappropriate design and engineering	12	Having the designing capability as well as basic and detailed conceptual engineering
4	Effective supervision - ineffective supervision	18	Enjoying a systematic procedure for ensuring the execution of plans, correct use of resources, and achievement of goals
5	clarity- ambiguity	7	Enjoying a management based on clarity of goals by justifying the human resources about their duties and responsibilities
6	flexibility- stiffness	11	Enjoying the organizational capabilities for managing the required changes in designing and engineering, structure, human resources, and merging/combining processes and working methods
7	Commitment- indifference	6	Commitment to a project and the duty or warranty existing for a project
8	Sound execution- unsound execution	6	Adherence to the initial studies and the feasibility report of the project, selecting competent contractor and consultant, and clarity of the deliverables in engineering documents
9	Specialization-generalism	13	The presence of well-informed expert staff in an organization regarding the subject of the project and their own responsibilities, accurate classification of essential duties and principles by the individual
10	Technology oriented- traditionalism	10	Applying technology and new construction method for speeding up the construction process, reducing the execution time, and promoting the intended quality
11	Desirability- undesirability	6	The set of product attributes in terms of quality and quantity that brings about an admired product
12	Convergence-divergence	17	Enjoying the cooperation between different units or parallel activities for common goals
13	Accountability- unaccountability	11	Responsibility, accountability, and acceptance of a project requested from an individual

14	Continuity-Discontinuity	18	Continuity is a fact of something continuing of existence or operation for a long period of time without being changed or stopped (continuity of developers' key resources on their project)
15	Duplication- induplication	6	Adherence to the principles of project execution for reducing the unwanted duplication within a system
16	Satisfaction- dissatisfaction	5	The project employer's feeling or attitude toward the project or project services after its operation
17	Underuse- overuse	2	The highest efficiency is achieved by using the least energy possible
18	Supplying the requirements- failure to supply the requirements	6	The needs and expectations of the employer or the beneficiaries are fulfilled
19	Integration- separation	13	Enjoying a sound background for registering and recording the uniform and compatible information for using in the systems or fulfilling the needs
20	Empowerment- weakening	6	Enjoying a process in which the individuals are able to control themselves and take up new responsibilities
21	Objectivism- subjectivism	4	Enjoying an objectivism independent of beliefs and attitudes
22	Effective communications- ineffective communications	8	Supplying an appropriate network and required data for all of the key factors needed for the execution of a project
23	Foresight - presentism	2	Understanding the possible future opportunities and selecting them for directing the present measures
24	Participation - isolation	4	The individuals' mental and emotional involvement for achieving the intended goals
25	Safety- risk	5	Adherence to principles that reduce the rate or degree of risk
26	Reliability- unreliability	4	Enjoying the likelihood of an accurate function for a definite time (based on the existing and predetermined condition)
27	Efficiency- waste	4	The capability of achieving the defined goals
28	Time management- time mismanagement	3	Enjoying the processes required for the management of project's timely completion
29	Stability - instability	6	Enjoying a series of status that are required to continue over time
30	Cost retrenchment - cost overshoot	3	Continuous improvement of value-adding activities and reducing or excluding non-value-adding activities

31	Team oriented- individualism	7	A group of individuals that bring about synergy for achieving a definite goal by having complementary kills
32	Risk management- risk mismanagement	2	A systematic method for excluding uncertainties so that the system increases the likelihood of achieving the goals
33	Good documentation- bad documentation	3	The project's deliverable documents are complete, adequate, and accurate
34	The architectural beauty of facilities (nice) - the architectural ugliness of facilities (unlikable)	3	The harmony and coordination of equipment and facilities with the arrangement of spaces and environment
35	productivity- idleness	3	The execution of activities with the least resource waste
36	added Value - added loss	2	Enjoying a profit beyond the initial expectations of the investor in a specific field
37	Creativity and innovation - inability	4	Enjoying mental capabilities for creating a new idea or concept
38	Dynamism- staticity	3	The organization's alignment with environmental changes and creating the possibility for predicting results and effects of managerial decisions
39	Accessibility- inaccessibility	5	Ease of operating, repairing, checking, and supervising the equipment and having access to the equipment
40	sustainability- unsustainability	5	Giving due attention to effective environmental factors in places people live

When the content analysis was conducted and the constructs were classified in 40 categories, the repertory grid was formed. This grid is a rectangular matrix in which the element grading was conducted for 40 secondary constructs; the positive and negative poles of this matrix are located on both sides of this matrix (See Table 2). As it can be seen in the matrix, the attributes of projects with a higher quality are at the positive pole. They include compliance with the standard, competence, and appropriate design and engineering. Nonconformity with the standards, incompetence, and poor and inappropriate design and engineering are all at the negative pole. According to the interviewees, ideal quality projects are the best ones, and constructs including compliance with the standards and competence have been evaluated at a very high level.

4.1. The Compliance of the Constructs

In investigating the compliance of the constructs with quality using *t*-test, it was concluded that all secondary constructs and grid elements could affect the quality of gas transmission projects. Once more,

the constructs were analyzed and investigated by the experts. The results of the binominal test indicated that according to the interviewees, most of the constructs are compliant with the measurement of the hidden attribute (the quality of gas transmission projects). However, in the re-interview, the compliance of one of the constructs was mentioned by few interviewees. Moreover, in some of the constructs, there is no reason indicating the rejection of the assumption that the number of pros and cons is equal.

Table 2. Cumulative Repertory Grid

ID	Secondary Constructs	Grading						Construct (Negative pole)
1	Compliance	5	1	4	2	3	5	Nonconformity
2	Competence	4	1	4	2	3	5	Incompetence
3	Appropriateness	5	1	5	2	3	5	Inappropriateness
4	Effective supervision	4	2	4	2	3	5	Ineffective supervision
5	Clarity	5	1	4	2	2	5	Ambiguity
6	Flexibility	4	2	4	2	3	5	Stiffness
7	Commitment	4	2	4	2	3	5	Indifference
8	Sound execution	4	2	4	2	3	5	Unsound execution
9	Specialism	4	1	4	2	3	5	Generalism
10	Technology oriented	4	2	4	2	3	5	Traditionalism
11	Desirability	4	2	4	2	2	5	Undisirability
12	Convergence	4	1	4	2	3	5	Divergence
13	Accountability	4	2	4	2	3	5	Unaccountability
14	Continuity	4	2	4	2	3	5	Discontinuity
15	Induplication	4	2	4	2	3	5	Duplication
16	Satisfaction	5	1	4	2	3	5	Dissatisfaction
17	Underuse (Consumption energy)	4	2	4	3	3	5	Overuse (Consumption energy)
18	Supplying the Requirement	5	1	5	1	3	5	Failure to supply the Requirement
19	Integration	5	1	4	2	3	5	Separation
20	Empowerment	4	2	4	2	2	5	Weakening
21	Objectivism	5	1	5	1	3	5	Subjectivism
22	Effective communications	4	2	4	2	2	5	Ineffective communications
23	Foresight	4	2	3	2	2	5	presentism
24	Participation	4	1	4	2	3	5	Isolation
25	Safety	4	2	4	2	2	5	Risk
26	Reliability	5	1	4	1	3	5	Unreliability
27	Efficiency	5	1	5	2	3	5	Waste
28	Time management	4	2	4	2	3	5	Time mismanagement
29	Stability	5	1	5	1	3	5	Instability
30	Cost retrenchment	4	2	4	2	2	5	Cost overshoot
31	Team oriented	5	1	4	1	2	5	Individualism
32	Risk management	4	2	4	2	3	5	Risk mismanagement
33	Good documentation	4	2	4	2	3	5	Bad documentation
34	Nice	4	1	3	1	2	5	Unlikable
35	Productivity	4	1	4	2	3	5	Idleness
36	Added value	4	2	3	2	3	5	Added loss
37	Creativity	4	2	4	2	3	5	Inability
38	Dynamism	4	1	4	1	3	5	Staticity
39	Accessibility	4	2	4	2	3	5	Inaccessibility
40	Sustainability (Environmental)	4	2	4	2	2	5	unsustainability (Environmental)
		The highest quality projects	The lowest quality projects	Project with high quality	Project with low quality	Project with average quality	Project with ideal quality	

4.2. Clustering the Constructs of the Repertory Grid

The hierarchical cluster analysis was applied for clustering the constructs. The hierarchical compact method starts with single constructs. Thus, similar constructs are placed in clusters, the members of which have the highest similarity to the created clusters. The average linkage dendrogram indicates the clustering of the constructs. In the second phase, the constructs consist of 7 clusters. Figure 1 shows the dendrogram diagram.

In investigating cluster number 1, it can be seen that desirability, empowerment, effective communications, safety, costs retrenchment and sustainability constructs fall into this cluster and the combination of this cluster with foresight construct has created a new cluster. Moreover, in cluster 3, it can be seen that competence, specialism, convergence, participation, and productivity constructs fall into one cluster for their adaptability and similarity, and the combination of this cluster with dynamicity construct has created a new cluster. On the other hand, by investigating the cluster and elements, it can be observed that projects having attributes including desirability and due attention to safety and environment are regarded as projects that enjoy a high quality in terms of their evaluation from the elements. Other cluster can be investigated just like cluster 1.

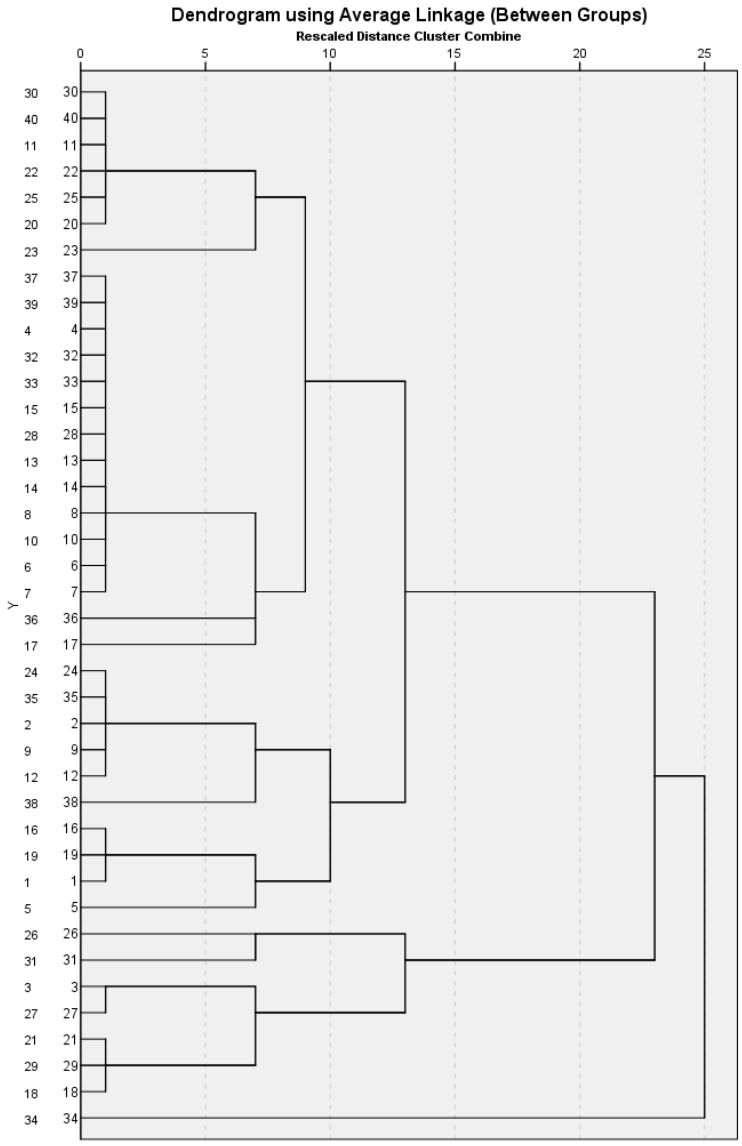

Figure 1. Dendrogram Diagram

To further evaluate appropriateness of the constructs with the related clusters, as many as 15 experts were surveyed using a questionnaire. The data were then analyzed using binominal test. After conducting the survey, most of the constructs were replaced in the suggested clusters. Considering the significance of each cluster, cluster number 7 was excluded. This cluster consisted of only one construct, i.e. the architectural beauty of the facilities. The final clustering is provided in Table 3.

Table 3. Clustering of Constructs

Cluster	Title of Construct	Cluster	Title of Construct
1	Desirability - Undesirability Foresight - Presentism Cost retrenchment - Cost overshoot Sustainability(Environmental)-Unsustainability(Environmental) Participation- IsolationIn duplication - Duplication	4	Compliance - Non-compliance Integration - Separation Creativity - Inability Good documentation - Bad documentation
2	Effective supervision - Ineffective supervision Commitment - Indifference Technology oriented - Traditionalism Accountability - Unaccountability Continuity - Discontinuity (Consumption energy) Normally - Intensity (Consumption energy) Time Management - Time mismanagement Risk management - Risk mismanagement Added value - Added loss Effective communication - Ineffective communication Team oriented - Individualism Empowerment - Weakening	5	Reliability - Unreliability Sound execution - Unsound Execution Stability - Instability Accessibility - Inaccessibility Safety - Risk
3	Competence - Nonconformity Specialism - Generalism Convergence - Divergence Efficiency - Waste Dynamism - Staticity Productivity - Idleness Satisfaction - Dissatisfaction	6	Appropriateness - Inappropriateness supplying the Requirement - Failure to supply the Requirement Objectivism - Subjectivism Clarity - Ambiguity Flexibility - Stiffness

4.2. Identifying the Main Constructsd

Pareto chart was used to identify the main constructs affecting the project quality. In the first phase, inter-cluster Pareto chart was applied to identify the cluster having the most effects on the project quality. Moreover, in the second phase, intra-cluster Pareto chart was used to identify the most important construct of each cluster using significance level of 0.05. In the first phase, the Pareto chart counter indicated the number of intra-cluster constructs. In the second phase, the Pareto chart counter identified the number of initial constructs related to each construct. They were all determined based on the research documents.

As it can be seen from Figure 2, the x-axis indicates each of the six clusters and the y-axis shows their frequency. It can be observed that the second cluster accounts for 12 constructs out of 40 secondary constructs; it accounts for the highest percentage (30%) of the main factors. The cumulative line in Pareto chart indicates the total portion of the causes. Cluster frequency indicates that the second point of the cumulative line is higher than its previous point. Experience has shown that reducing the long bar to half is much easier than reducing the short bar to zero. Thus, if the positive pole

of the existing constructs in the second cluster improves, ignoring the other clusters will solve most of the problems related to the quality of gas transmission projects, and the quality of the entire project will improve. These factors include ineffective supervision and control, indifference, traditionalism, unaccountability, separation, underuse, lack of empowerment, isolation, lack of time management, individualism, lack of risk management, and added loss.

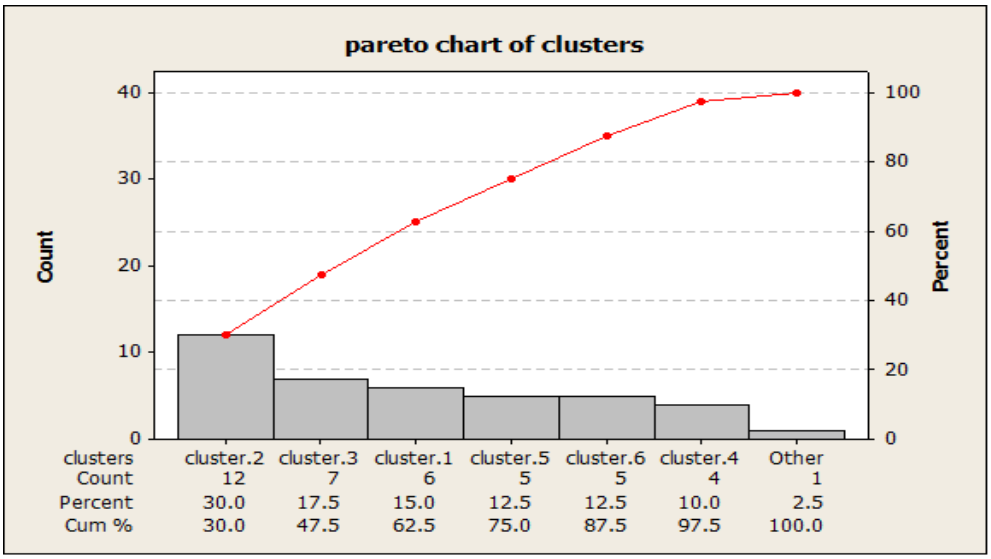

Figure 2. Pareto Diagram Between Clusters

Moreover, in Table 4 for intra-cluster Pareto chart, it can be seen that improved insignificant constructs will result in the increased quality of the project. These insignificant constructs include ineffective supervision and control, unaccountability, divergence, incompetence, nonconformity with the standards, separation, unsound execution, and inappropriate design and engineering.

The results of the first phase of Pareto analysis indicates that in comparison to the other cluster, the second cluster accounts for the highest number of constructs with 12 constructs. Moreover, the results of the second phase indicated that constructs 4 and 13 have the highest number of initial constructs among the constructs of this cluster. The results of the second phase determined the constructs having the highest number of initial constructs in each cluster. Thus, the negative poles of the following nine constructs were identified as the main factors affecting the reduced quality of gas transmission projects.

Table 4. Pareto charts to determine the constructs of clusters within each cluster

The Title of the Negative Pole of Effective Constructs	Frequency of Construct in Primary Constructs	Num. of Cluster Constructs	Cluster Num.	Cluster
Undesirability	6	6	11	1
Ineffective-supervision	18	12	4	2
Unaccountability	11	12	13	2
Divergence	17	7	12	3
Incompetence	18	16	2	3
Nonconformity	13	4	1	4
Separation	13	12	19	4
Unsound Execution	6	5	8	5
Inappropriateness	12	5	3	6

These nine constructs account for 40% of the total 284 initial constructs. If the negative poles of these constructs are improved, most of the problems related to the quality of gas transmission projects will be solved. These attributes include:

nclude:

- Compliance with the standards-nonconformity with the standards;
- Competence- incompetence;
- Appropriate design and engineering-inappropriate design and engineering;
- Effective supervisionIneffective supervision;
- Sound execution- unsound execution;
- Desirability- Undesirability;
- Convergence- divergence;
- Accountability- unaccountability; and
- Integration- separation.

5. Discussion

In this section, discussion is provided based on the findings of this study and considering theoretical foundations and findings in past research aimed at investigating the degree of possible convergences and divergences.

5.1. Compliance

Technical compliance is an important attribute required for the proper performance of construction projects. According to findings (Jha, 2004), quality compliance is one of the five criteria of project performance. In the same vein, Ganaway (2006) argues that the construction industry should emphasize the need for standard-based compliance in contracting as well as in product specification, processes, and services, with everybody being required to understand it.

Therefore, the necessity of considering this attribute is consistent with the findings of other researchers in the field of construction projects.

5.2. Competence

This attribute implies project managers' qualification indicators. According to Liikamaa (2015), the literature on project management often offers various descriptive requirements, skills, attributes, and roles, with their competence being affected by personal and social attributes as well as individuals' skills. Competence has been defined as the mastering of skills and knowledge needed by all employees (Parasuraman, 1985).

Turner et al (2003) believes that competence is essential for project success but cannot guarantee project success. In contrast to Turner and Muller, Nagrecha (2002) believes that competence is an important attribute of project managers, which does not affect their leadership style and competence in project success. According to Liikamaa (2006), many competencies are shared among professional groups, but each group has also specific attributes that need to be identified according to the requirements of each organizational task. As mentioned in the present research, high-quality projects have qualified managers or contractors, with this fact being consistent with the results of other researchers.

5.3. Appropriateness

The design and engineering phase is one of the major project phases, which has been given the highest rating in the study by Sha'ar et al (2017). Babalola et al (2018) considered the purpose of the design phase to reduce losses in the construction industry in terms of time, costs, and quality. In this respect, Tang et al (2003) considers design quality as a key evaluation factor from customers' point of view, which is consistent with the findings of this study.

5.4. Effective Supervision

According to Hazir (2014), supervision involves a set of policies, methods, and tools that guarantee the achievement of project goals. In this context, Jack et al (2016) believe that the project supervision and control

process is meant to ensure that everything goes according to plans. In other words, supervision results in identifying disputes and changing management; it also updates the plans gradually according to the feedback. Hence, this attribute is in line with the results reported by researchers in this field.

5.5. Sound Execution

This attribute highlights the importance of applying the principles of project management standards as stated by the interviewees. In this regard, Chatfield (2007) describes project management as a field of planning, organizing, and managing resources to successfully achieve the project's specific goals and objectives. According to Kerzner (2005) as well as Pennypacker and Grand (2003), many studies have highlighted the benefits of using project management, for its processes could be applied in a variety of industries by providing a structured approach to successful project completion. Therefore, standard project management could be used to execute projects soundly, which is consistent with the concept of this attribute.

5.6. Desirability

This attribute represents one of the important project activities, which is the process of purchasing goods and materials as well as planning for them. As mentioned previously in this study, material management needs to be executed properly to increase project quality. According to Dakhlim and Lafhaj (2018), material management is done to ensure that the required products are provided and delivered properly and accurately at the right time and place, with the highest quality and at a reasonable price. In their findings, Khyomesh and Chetna (2011) recommended that the goods manufactured be inspected before being delivered to the site and that the requirements specified in the order be well considered. In addition, according to them, in the effective planning for purchasing, transporting, and storing materials, the quality assurance and proper selection of manufacturers and suppliers are required.

5.7. Convergence

Convergence, in industry, is a strategic goal and a business challenge. Convergence concepts serve different purposes and functions. In addition, the convergence of human systems and technologies increases communication between people at all times and places. Alderman N. and Ivory C. (2011), in their research tilted 'Translating Convergence in a Project', believe that it is necessary to examine the relationship between project convergence and divergence to determine the causes of project success and failure. In the same vein, Law and Callon (1992) stated that convergence or divergence is one of the special attributes of the actor-network relationship. Ejohwomu et al (2016) stated that conflict causes non-convergence in projects. Likewise, Acharya et al (2006) and Adnan et al (2012) stated that the lack of convergence leads to conflicts in projects, thereby making them fail. Therefore, this attribute is consistent with the descriptions presented by other studies on project failure or success.

5.8. Accountability

This attribute consists of the reliability and acceptability of responsibilities, as mentioned by the interviewees in the research process. In this study, attentiveness to trust is in line with the findings of Samuel (2001) who defined accountability as employee confidence in meeting performance commitments. It is also in line with the findings of Browning (2012) who believed that a team accepts responsibilities for the results of its actions. Accountability leads to a rapid improvement in the project process, with this being in line with the findings of McGrath and McGrath (2018). In contrast to the definitions of accountability, they considered legislative, organizational, contractual, and informal sources for accountability, which ensure a satisfactory performance.

5.9.Integration

By project integration it is meant to establish a type of interdependency among the components of an organization to achieve project goals. Since the concept of component solidarity is implied by the attribute of integration, it ensures that different elements of a project be in harmony with each other. Thus, this study is in line with the study by Baiden et al (2006) who defined integration as 'practices, methods, and behaviors, which create an effective culture of effective collaboration among individuals, organizations, and departments.' It is also consistent with the perspectives of Ibrahim et al (2011) who defined integration as the exchange of information, communication, practices, tools, and orders, which facilitates communication and interaction among team members.

6. Conclusions

Today, no one can deny the fact that project management has become quality oriented. Everyone prefers not only project delivery but quality project delivery. Therefore, quality management must be in place from the beginning of the project to the end.

In a project, quality attributes are defined by stakeholders, and a quality attribute is used to indicate how well the system meets the needs of its stakeholders. Therefore, by applying quality attributes, we can determine whether the system meets the quality requirements as well as the needs of the stakeholders.

In this study, 20 experienced managers and executives involved in gas transmission pipeline projects were interviewed using the repertory grid technique, with a total of 284 primary personal constructs of quality extracted. Next, using a content analysis, 284 primary constructs were reduced to 40, which formed a cumulative repertory grid. At the next stage, the constructs of the cumulative repertory grid were categorized into six separate clusters based on statistical similarities and using a hierarchical cluster analysis.

In addition, by employing Pareto statistical analysis in two stages within each cluster and among the clusters, cluster representatives, including the constructs of compliance, competence, appropriateness, effective supervision, sound execution, desirability, convergence, accountability, and integration were identified and selected.

As already noted in this research, these attributes reflect the multidimensionality of quality concepts in construction projects and exhibit their different effects on quality enhancement in these projects. The study of quality in projects indicates an approach to the concept of quality in companies facing various challenges in today interactions, similar to the ones discussed here. Given these findings, continuous improvements in these attributes could be considered as important factors in meeting quality requirements in construction projects. The results of this study could be used by managers and experts in the field of gas transmission pipeline projects to improve quality management in projects by drawing upon the knowledge of important quality attributes in the studied field.

The scope of this study is limited to gas transmission pipeline projects in Iran. Methodologically, this study has limitations similar to those in empirical research. In addition, perceptual and individual bias could influence the research process in any organizations. One of the limitations of this study is the review of projects at specific times. In this study, six large gas transmission pipeline projects were studied. Bureaucracy created problems in finding project agents and conducting interviews. The interviews were long and exceeded an hour; in addition, there was always the possibility that the interviewees would get bored and not have enough accuracy in answering the questions. In addition, research should be conducted when people are emotionally prepared so as not to provide inappropriate responses under disturbing factors, such as job-related problems.

In terms of the contribution of innovation in this research, one could refer to the large number of qualitative constructs according to managers' understanding in gas transmission pipeline projects. By offering validation suggestions, this research enriches the literature on project quality; in addition, the use of these constructs by project-oriented organizations enhances the insights of managers and stakeholders. In addition, the repertory grid technique, which is based on interpretive theories, has not already been used in oil and gas projects, so it could be considered an innovation in this respect.

In this study, the quality attributes of gas transmission pipeline projects were identified by the participants. Testing and refining these attributes by further research in this field could enrich the treasury and help create new definitions for project quality. It is suggested to investigate interactions and relationships among the attributes identified in future research.

References

Acharya, N. K. Lee, Y. D. and Im, H. M., 2006. Conflicting factors in construction projects: Korean perspective, Construction and Architectural Management, 13, pp. 543-566.

Adnan, H., Shamsuddin, S. M. Supardi, A. and Ahmad, N., 2012. Conflict Prevention in Partnering Projects, Procedia - Social and Behavioral Sciences, 35, pp. 772-781.

Alderman N. and Ivory C., 2011. Project Management Journal, 42(5), 17-30 © 2011 by the Project Management Institute Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/pmj.20261

American Society for Quality., 2008. http://www.asq.org/glossary/q.html.

Ancona, D.G., Caldwell, D., 1990. Beyond boundary spanning: managing external dependence in product development teams, Journal of High Technology Management, 1, pp.119-135.

Anderson, N. R., 2007. Repertory grid technique in employee selection, Personnel Review, 19(3), pp.9-15.

ANSI/ASQC, A3-1987, 1987. Quality System Terminology (Milwaukee, WI: American Society for Quality Control).

Babalola, O.; Ibem, E.O.; Ezema, I.C., 2018. Implementation of lean practices in the construction industry: A systematic review. Build. Environ., 148, pp. 34-43.

Baiden, B.K., Price, A. D.F. and Dainty, A.R.J., 2006. The extent of team integration within construction projects, International Journal of Project Management, 24(2), pp. 13-23.

Bailleti AJ, Callahan JR, DiPietro P., 1994. A coordination structure approach to the management of projects, IEEE.

Boyle, T. A., 2005. Improving Team Performance Using Repertory Grids, Team Performance Management, 11(5/6), pp. 179.

Browning, H., 2012. Accountability: Taking Ownership of Your Responsibility. Pfeiffer, Greensboro.

Khyomesh,V. Patel, Chetna M. Vyas, 2011. Construction Materials Management on Project Sites, National Conference on Recent Trends in Engineering & Technology, 13-14 May 2011, B.V.M. Engineering College, V.V.Nagar,Gujarat,India.

Chatfield, C., 2007. A Short Course in Project Management, Microsoft Office Project 2007 Step by Step. Retrieved from http://www.office.microsoft.com.

Cho, C. S., & Gibson, E., 2001. Building project scope definition using project definition rating index, Journal of architectural engineering, 7(4), pp.115-125.

Cutting, T., 2009. Deliverable-based Project Schedules: Part 1. PMHut.com (Last accessed 8

November 2009).

Curkovic, s., Vickery,s.K. and Droge, C., 2005. An empirical analysis of the competitive dimension of quality performance in in the automotivesupply,industy.InternationalJurnal of Operations & production Management, 0, pp.386-403.

Curkovic, S., Vickery, S. K., & Droge, C., 2000. An empirical analysis of the competitive dimensions of qu ality performance in the automotive supply industry, International Journal of Operations & Production Management, 20(3), pp. 386-403.

Dakhlim, Z. and Lafhaj, Z., 2018. Considering Materials Management in Construction: An Exploratory Study, doi:10.3390/ logistics2010007.

Danaeefard, H., Mortazavi, l., Fani, A. A., Azar, A., 2014, Managerial Effectiveness Structuring: Applying the Repertory Grid Research Method to Practice,Saffar Publishing,Iran.

De Meyer, A., Loch, C.H. and Pich, M.T., 2002. Managing project uncertainty: from variation to chaos, Engineering Management Review, IEEE, 30(3), pp.91-91.

Dysert, L. R., 2006. Is Estimate Accuracy an Oxymoron? AACE International Transactions, pp.1-5.

El.Mikawi, M. A., 2002. Sustainable Development In Construction, journal on Construction, Management, Quality, Sustainablity.

Ejohwomu, O. A., Oshodi, O. S. and Onifade, M. K., 2016. Causes of Conflicts in Construction Projects in Nigeria: Consultant's and Contractor's Perspective, Nigerian Journal of Technology (NIJOTECH), 35(2), pp. 270-277.

Evans, J.R. and Lindsay, W.M., 2005. The Management and Control of Quality, 6th Edn. South-Western, Thompson Corporation.

Ford, R. and Randolph, A. W., 1992. Cross Functional Structures: A Review and Integration of Matrix Organization and Project Management, Journal of Management, 18(2), pp.267-294.

Forsberg, Kevin et al., 2000. Visualizing Project Management, 2nd ed., John Wiley & Sons. Transactions on Engineering Management. USA, 41(4), pp.394-403.

Fransella, F., 1972. Personal Change and Reconstruction: Research on a Treatment of Stuttering, Academic Press London and New York.

Fransell, F., Bell, R. and Bannister, D., 2004. A manual for repertory grid technique, John Wiley & Sons Inc., New York.

Fransella, F. and Bannister, D., 1977. A Manual For Repertory Grid Technique,Academic Press, New York.

Petersen, s., 2004. A Repertory Grid evaluation of a multidimentional theory of courage. Doctoral dissertation. University of Kansas.

Ganaway, N. B., 2006. Construction Business Management: A Guide to Contracting for Business Success, Butterworth Heinemann, London, UK.

Geraldi, J.G., Lee-Kelley, L. and Kutsch, E., 2009. The Titanic sunk, so what? Project manager response to unexpected events, International Journal of Project Management.

Gandolfi, K., Mourtel, C. and Olivier, F., 2001. Electromagnetic analysis: Concrete results, in Cryptographic Hardware and Embedded Systems - CHES 2001, pp. 251-261.

Geraldi J.G., Kutsch E.and Turner N., 2011. Towards a conceptualisation of quality in information technology projects, International Journal of Project Management, 29(5), pp.557-567.

Grunert, K. G., 1989. Attributes, attribute values and their characteristics: A unifying approach and an example involving a complex household investment, Journal of Economic

Psychology, 10, 229-251.

Hai, N.L., Watanabe, T., 2014. The status quo and perspective for improvement of public works procurement performance in Vietnam, J. Adv. Perform. Inf, 6, pp.22-39.

Hamzah Abdul-Rahman, H. Wang C and Xiang WY, 2010. How professional ethics impact construction quality: Perception andevidence in a fast developing economy, Sci. Res. Essays, 5, pp. 3742-3749.

Hazir, O., 2014. A review of analytical models, approaches and decision support tools in project monitoring and control, International Journal of Project Management, 33(4), pp. 808-815.

Homthong S., Moungnoi W., 2016. Critical Success Factors Influencing Construction Project Performance for Different Objectives: Operation and Maintenance Phase, International Journal of Advances in Mechanical and Civil Engineering, 3(3) ,pp. 84-95.

Huchzermeier, A. and Loch, C.H., 2001. Project Management Under Risk: Using the Real Options Approach to Evaluate Flexibility in R&D. Management Science, 47(1), pp.85-101.

Humphreys, K.K., 2004. Project and Cost Engineers' Handbook, Marcel Dekker, New York.

Hoyer, R. W. and Hoyer, B. Y. B., 2001. What is quality? Quality Progress, 34(7), pp.53-62.

Hoyle, D., 1998. Quality systems - a new perspective, Quality World, 22(10), pp.710-3.

ISO 10006:2003, 2003. Quality Management Systems-Guidline for quality management in project.

ISO, E. N. 9000: 2005, 2005. Quality management Systems-Fundamentals and vocabulary.

Ibrahim, C.K.C., Costello, S.B. and Wilkinson, S., 2011. Key practice indicators of team integration in construction projects: a review. Proceedings for the 2nd International Conference on Construction and Project Management. Singapore.

Idrus, B.A., Sodangi, M., 2010. Framework for Evaluating Quality Performance of Contractors in Nigeria, International Journal of Civil & Environmental Engineering IJCEE-IJENS, 10(1), pp. 31-36.

Jack, L., Okeke, O.C., Okechukwu, S.I. and Akinola, A.O., 2016. Project management: A system approach to planning, implementation, monitoring and evaluation, International Journal of Advanced Academic Research, 2(11), pp. 65-79.

Jankowicz D., 2004. The easy guide to repertory grids, John London: wily & sons.

Jiang, Z., Henneberg, S. C. and Naude, P., 2011. Supplier relationship management in the construction industry: the effects of trust and dependence, Journal of Business & Industrial Marketing, 27(1), pp.3-15

Jha, K. N., 2004. Factors for the success of a construction project: an empirical study. Doctoral thesis, Indian Institute of Technology, Delhi, India.

Juran, J., 1974. Quality Control Handbook, 3rd ed., McGraw Hill, New York.

Juran, J., 1998. Juran's Quality Control Handbook, 5th edn, McGraw-Hill.

Kano, N., Seraku, N., Takahashi, F. and Tsuji, S., 1984. Attractive Quality and Must-be Quality, Hinshitsu. The Journal of the Japanese Society for Quality Control, pp.39-48

Kärnä, s., 2004. Analysing customer satisfaction and quality in construction - the case of public and private customers, Nordic Journal of Surveying and Real Estate Research - Special Series, 2.

Kelly, G.A., 1955. The Psychology of Personal Constructs, W.W.Norton, New York.

Kermit, B., 2013. What Is a Deliverable in Project

Management?, Houston Chronicle. Small Business section. Hearst Corporation, 2013. ^ "Goal: Define project deliverables". Microsoft Office website. Accessed December 9.

Kerzner, H., 2005. Using the project management maturity model: strategic planning for project management, (2nd ed.). Hoboken, NJ: John Wiley & Sons

Law, J. and Callon, M., 1992. The life and death of an aircraft: A network analysis of technical changes, In W. Bijker & J. Law (Eds.), Shaping technology/ building society: Studies in sociotechnical change. MA: MIT Press. Cambridge, pp. 21-52.

Liikamaa K., 2006. Tacit Knowledge and Project Manager's Competences, PhD Thesis, Tampere University of Technology, Publication 628.

Liikamaa, K., 2015. Developing a project manager's competencies: A collective view of the most important competencies, 6th International Conference on Applied Human Factors and Ergonomics (AHFE2015) and the Affiliated Conferences, Procedia Manufacturing, 3, pp. 681-687.

Loushine, T.W., Hoonakker, P.L.T., Carayon, P., Smith, M.J., 2006. Quality and Safety Management in Construction, Total Quality Management and Business Excellence, 17(9), pp. 1171-1212.

Mane, P.P., 2015. Quality Management System at Construction Project: A Questionnaire Survey, Int. Journal of Engineering Research and Applications, 5(3), pp.126-130.

Ma, A., Norwich, B., 2007. Triangulation and Theoretical Understanding". Social Research Methodology, 10(3), pp.211-226.

McGrath, S. and Whitty, S., 2018. Accountability and responsibility defined, International Journal of Managing Projects in Business, 11(3), pp. 687-707. https://doi.org/10.1108/IJMPB-06-2017-0058.

Michnik, J. and Lo, M. C., 2009. The assessment of the information quality with the aid of multiple criteria analysis. European Journal of Operational Research, 195(3), pp.850-856, doi: 10.1016/j.ejor.2007.11.017.

Marsden, D. and Littler, D., 2000. Exploring consumer product construct systems with the repertory grid technique, Qualitative Market Research: An International Journal, 3(3), pp.127-144.

Müller, R., Geraldi, J. G., and Turner, R., 2007. Linking Complexity and Leadership Competences of Project Managers. VII I IRNOP: Projects in Projects, in Innovations, Innovations Vol. 19th to 21st of September, Brighton No.

Nagrecha, S., 2002. An introduction to earned value analysis. Earned value analysis 2. [Online]. Available: http://www.pmiglc.org/COMM/Articles/0410_nagrecha_eva-3.pdf.

Parasuraman, A., Zeithamlz, V. and Berry, L., 1985. Aconceptual model of service quality and itsimplications for future research, Journal ofMarketing, 49, pp.41-50.

Niu, N. Easterbbook, S., 2007. So you think you know others goals? A Repertory grid study, IEEE Software Journal. 24(2), pp.53-61.

Partington D., 2002. Essential skills for management Research, London: SAGE Publications.

PMI, 2008. A guide to the project management body of knowledge: PMBOK Guide (4th Ed.). Newtown Square, PA: Project Management Institute.

Penny packer, J. S. and Grand, K. P., 2003. Project management maturity: an industry benchmark. Proj Manage J, 34, pp. 4-11.

Pich MT, Loch CH and De Meyer A., 2002. on uncertainty, ambiguity, and complexity in project management, Management Science, 48(8), pp.1008-1023.

Pitsis, T., Clegg, S., Marosszeky, M. and Rura-Polley, T., 2003. Constructing theolympic

dream: a future perfect strategy of project management.

Rogers, B., Ryals, L., 2007. Repertory Grid to access the underlying realities in key account relationships. International Journal of Market Research, 49(5), pp.595-612.

Reeves, C. and Bednar, D., 1994. Defining quality: alternatives and implications. Acad. Manage. Rev., pp.419-445.

Rehme, J. and Svensson, P., 2011. Credibility-driven entrepreneurship. Entrepreneurship and Innovation, 12(1), pp.5-15.

Reis, H. T., Clark, M. S. and Holmes, J. G., 2004. Perceived partner responsiveness as an organizing construct in the study of intimacy and closeness, In D. Mashek & A. Aron (Eds.), Handbook of closeness and intimacy, pp. 201-225.

Turner, R., 2002. Managing Quality, Chapter 16 Rodney Turner, Stephen Simister (Eds.), Gower Handbook of Project management, Gower Publishing.

Sha'ar, K., Assaf, S., Bambang, T., Babsail, M. and Fattah, A.A.E., 2017. Design-construction interface problems in large building construction projects. Int. J. Construct. Manag., 17, pp. 238-250.

Samuel, M., 2001. The Accountability Revolution: Achieve Breakthrough Results in Half the Time. 2nd Edition, Facts on Demand Press, Tempe.

Slack, N., Chambers, S. and Johnston, R., 2004. Operations Management. 4th Edition, Pearson Education, Harlow.

Sokkia Weingarten, M., 2007. Trio/Upward Bound Students' Constructions of Vocations Using George Kelly's Rep-Test Method, (A dissertation) faculty of Brigham Young University, Doctor of Philosophy, Department of Counseling Psychology and Special Education.

Sun, M. and Meng, X., 2008. Taxonomy for change causes and effects in construction projects. International Journal of Project Management, 27(6), pp.560-572.

Tai, S., Sun, C. and Zhang, S., 2016. Exploring factors affecting owners' trust of contractors in construction projects: a case of China, SpringerPlus, 5(1783). doi: 10.1186/s40064-016-3393-9.

Tan, C. K. and Abdul-Rahman, H., 2005. Preliminary research into overcoming implementation problems in construction projects, Proceeding of the 4th Micra Conference. Faculty of the Built Environment, University Malaya, 08.15-08.28.

Tan, F.B, and Hunter, M.G., 2002. The Repertory Grid Technique: A Method for the study of Cognitive in Information Systems, MIS Quaterly. 26(1), pp.39-57.

Tang, S., Lu, M., & Chan, Y., 2003. Achieving Client Satisfaction for Engineering Consulting Firms, Journal of Management and Engineering, 19(4), pp. 166-172.

Towler, G. and Sinnott, R., 2008. Chemical Engineering Design Principles, Practice and Economics of Plant and Process Design, Amsterdam, Elsevier.

Turner, J. R., 1999. The Handbook of Project-based Management, McGraw- Hill, UK.

Turner, J. R. and Muller, R., 2003. On the nature of a project as a temporary organization, International Journal of Project Management, 21(1), pp. 1-8.

Vidal, L-A., Marle, F. and Bocquet J-C., 2011. Measuring project complexity using the Analytic Hierarchy Process, International Journal of Project Management, 29, pp.718-727.

Von, V., 2009, An integrated method to assess consumer motivation in difficult market Niches: A case of the premium car segment Russia, Master of Science in Economics. MarinaShcheglova, Berlin University.

Wasiu, A. B., Aliu, A. and Modupe, A., 2012. An Assessment of Implementation of Quality Culture in Construction. Department of Building, University of Lagos.

Winch, G. and Kreiner, K., 2009. Future Perfect Strategising on Major Projects, Proceedings of the 9th EURAM, 11th to 14th May, Liverpool, UK.

Yates, D.J. and Hardcastle, C., 2003. The Causes of Conflict and Disputes in the Hong Kong Construction Industry. A Transaction Cost Economics Perspective.' RICS Foundation Research Papers, 4(22), pp.1-50.

شناسایی ویژگی‌های کلیدی کیفیت در پروژه‌های خطوط انتقال گاز با استفاده از روش شبکه خزانه

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چکیـــــــده

هدف اصلی این تحقیق، فهم‌شناسی ویژگی‌های کلیدی کیفیت در پروژه‌های انتقال گاز است. با به‌کارگیری نظریه سازه‌های شخصی کلی و روش شبکه خزانه و همچنین انجام مصاحبه با ۲۰ مدیر و متخصص پروژه‌های انتقال گاز، ۲۸۴ سازه کیفی شناسایی‌شده است. این سازه‌ها با استفاده از تحلیل محتوا در ۴۰ دسته طبقه‌بندی و سپس با روش‌های آماری مورد تجزیه‌وتحلیل قرار گرفتند. با استفاده از تجزیه‌وتحلیل آماری ۹ ویژگی کیفی شامل، انطباق با استانداردها، شایستگی، تناسب در طراحی و مهندسی، نظارت مؤثر، اجرای صحیح، مطلوبیت، همگرایی، پاسخگویی و یکپارچگی شناسایی شد. این سازه‌ها به‌عنوان عوامل اصلی مؤثر بر کیفیت پروژه‌های انتقال گاز می‌باشند.

در این مطالعه داده‌ها از پروژه‌های انتقال گاز انجام‌شده از ادارات کارفرما جمع‌آوری‌شده است. مطالعات بعدی نه‌تنها تعداد مصاحبه شوندگان را افزایش می‌دهد، بلکه مشارکت پیمانکاران در مصاحبه‌ها را برای دستیابی به نتایج جامع‌تری اعمال می‌کند. با توجه به شرایط حجم، دما و فشار، پروژه‌های صنعت نفت از حساسیت و اهمیت حیاتی برخوردار هستند. مدیران سازمان‌های پروژه محور می‌توانند از یافته‌های پژوهش حاضر برای ارتقای کیفیت و موفقیت پروژه استفاده کنند.

مطالعه حاضر جدید بوده و یکی از اولین موارد بررسی مفهوم کیفیت در پروژه‌های انتقال گاز است. این مقاله شواهد تجربی از تأثیر مثبت ویژگی‌های کیفیت بر عملکرد این‌گونه پروژه‌ها است و ادبیات مربوط به کیفیت را توسعه می‌دهد.

واژگان کلیدی: ویژگی‌های کیفیت، سازه، شبکه خزانه، خوشه، انتقال گاز