

# Relationship Embeddedness as a Predictor of Relationship Quality Levels in Construction Teams

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**Abstract:-** Researchers who advocate for social networks as a form of project organizing in construction contend that construction projects executed under this arrangement carry a relational element and therefore, the quality of relationships which can determine contract appropriateness and application. However, there are no uniform or extant guidelines in the industry that assist in the analysis, measurement, and management of relationship quality levels in construction teams. The aim of this paper was to map project team relationships into relationship quality levels based on current industry practices and extant literature. First, the study conducted an intensive, systematic literature review and second, a multiple case study design was used to establish relationship quality levels within a construction team. Findings reveal four levels of relationship quality: price, quality, partnering, and strategic partnering/strategic alliance. The findings advance a relationship quality levels model as a tool that may be used to analyze, measure, and ultimately manage relationships in construction teams. The implication of this research is to provide a tool that advances the concept of network embeddedness in construction team relationship quality levels. Furthermore, a framework for managing interpersonal relationships in construction teams is proposed.

**Key words:** Relationship, relationship quality, network, relational behavior, social behavior

## I. INTRODUCTION

Researchers who advocate social networks and relationship embeddedness as a form of project organizing in construction (1; 2; 3; 4; 5) contend that construction projects executed under this arrangement carry a relational element and therefore, the quality of relationships can determine contract appropriateness and application [6]. In an attempt to understand the connection between relationship embeddedness in social networks and construction team relationships, [7] investigated the association of social and relational behaviors of individual team members. He further modeled relationship embeddedness based on the association between social and relational behaviors of individual construction team members. [7] concluded that relationship embeddedness can be used to model the level of relationship quality of a construction team.

Furthermore, findings based on network embeddedness in construction teams indicate that positive relations in a construction project team are a result of positive interactions between team members, based on individual social and relational behaviors which carry with it some level of relationship quality [7]. However, to this end, there are no

uniform or extant guidelines in the industry that assist in the analysis, measurement, and management of relationship quality in construction teams based on team member behaviors. Attempts in modeling relationship quality levels have majorly focused on the relational behaviors while ignoring the social behaviors [e.g., 8; 9; 10].

The aim of this paper is to predict relationship quality levels using relationship embeddedness and current industry practices and extant literature. In order to achieve this, the study conducted an intensive, systematic literature review and a multiple case study design was used to establish relationship quality levels within a construction team. The contribution of this research advances relationship quality levels and a relationship quality framework that may be used to analyze, measure, and ultimately manage relationships in construction teams. The implication of this research is to provide a tool that advances the concept of network embeddedness in construction team relationship quality levels which could be useful to construction managers in their quest for managing interpersonal relationships in construction teams.

## II. RELATIONSHIP QUALITY

Relationships have been defined as “team member interconnections established by either by a contract or as a result of continuing and often committed association between two or more team members” [11]. From the definition, it is implied that relationships can be as a result of legally binding agreements or other informal arrangements. Contracts establish the basic formal structure of relationships between project parties [12; 13]. However, individuals drawn from the various project parties, interact informally with others outside their organizations leading to a network of relationships [14] and since they are specific to a given project, they are thus referred to as project networks. [15] explained these project network relationships through interconnections between team members based on their continuing and often committed association (i.e., relational behaviors) and the social behaviors that drive team relationships. A concept further advanced by [1] who looked at the role of social and relational behaviors in relationship embeddedness. They concluded that, relationship embeddedness is a function social and relational behaviors and that as project team members interact based on their social and relational behavior they carry some level of relationship quality.

Relationship development in construction teams ranges from arm's length kind of relationship to embedded relationships. Arm's length relationships are purely based on contractual agreements where project parties are selected through a competitive bidding process, to provide pre-specified goods and services at a predetermined price [16]. In such cases, relationships are not based on any previous history or any personal relationship considerations [17]. On the other hand, team members develop embedded relationships when they work together over a period of time, and exchange information with one another [18]. [19] defined relationship embeddedness as the personal relationships that people develop with one another through interactions. On his part, [20] interpreted relationship embeddedness as RQ between members with a feeling of common identity and mutual support. Embedded relationships often offer a platform for team member behaviors to develop as well as the quality of relationships which are characteristic of trust, information transfer and conflict resolution [20].

Relationship embeddedness as used in this paper is viewed as a dimension of team member behavior which include both the relational and the social behaviors [7]. These two behaviors exist simultaneously which means that these behaviors are not isolated and that one has an effect on the other. A further explanation of relationship embeddedness based on team member behavior is that team member's relational behaviors are dependent on the social behavior of the other [7]. Therefore, a strong interdependence between the relational and social behaviors means a high degree of embeddedness. As explained by [20], this relationship embeddedness variations relates to a varying degree of relationship quality. Therefore, it is a consistent hypothesis based on these authors to say that the interdependencies between team members' relational and social behaviors can be used to predict the level of relationship quality in a team.

Relational behaviors in construction teams is a well-researched topic. The relational behaviors in construction teams stem from the Macneil's relational contract theory [21]. According to [21], the most commonly expressed relational behaviors in construction teams include harmonization of conflict  $R_1$ , propriety of means  $R_2$ , restraint of power  $R_3$ , reliance and expectation  $R_4$ , contractual solidarity  $R_5$ , flexibility  $R_6$ , and reciprocity  $R_7$ . The social behaviors exhibited by construction team members include past experience  $S_1$ , benevolence  $S_2$ , and integrity  $S_3$  [21].

### III. Methodology

The methodology used in this research was twofold. First, the study conducted an intensive, systematic literature review. For the literature review, the researcher launched a comprehensive search in the areas of construction, business, and psychology to investigate previous articles pertaining to network embeddedness of construction teams. The keywords such as "relationship quality," "network embeddedness," "construction team relationships," and "interpersonal relationships" were used to conduct the search.

Secondly, the research sought data using a multiple case design in line with the case study best practices published by [22]. This paper collected data from three highway transportation construction projects and one wastewater construction project. The researcher played the role of a neutral observer and investigator in all cases during data collection.

To find the case studies for this research, public agencies were contacted about participating in the study and if they have a current project under construction that could be used as case studies. The agencies that expressed interest in providing projects for case use in this study also provided contact information for project engineers. The engineers were then contacted through email and by phone to explain the aim and scope of the research. An introduction of the researcher by the project engineers to the other project team members ensued. In addition, the researcher requested permission to visit the project site to observe working relationships and to attend site meetings. The owner, contractor, subcontractors, and consultants involved in the selected projects were then contacted through email and followed by phone calls asking for their willingness and availability to participate in the research. Those that agreed to participate were then asked to complete the survey online.

Web-based survey were approximated to take 15-20 minutes, and utilized a set of structured, closed-ended questions. The survey was conducted at the project site when the researcher visited, or those who were available in the office within driving distance from the site. Also, the researcher contacted those who were not at the site at the time and sent them the survey link so that they could complete the survey.

#### A. Ordered multinomial logistic regression

Multinomial logistic regression was used to model probabilities of a construction project team being in a specific relationship quality level. This statistical analysis technique was used to model relationship quality based on relationship embeddedness of a construction team. Ordered multinomial logistic regression is an extension of logistic models and is used when modeling ordered categorical variables. Multinomial logistic regression as used to model relationship quality levels based on construction team embeddedness, is given as;

$$\ln \left[ \left\{ \frac{P(RQL \geq j)}{1-P(RQL \geq j)} \right\}_m \right] = \alpha_j + \sum_{n=1}^3 \beta_n R_m S_n \text{ for } j = 0..j-2 \quad (1)$$

Taking  $J^{\text{th}}$  category as the reference, yields  $J-1$  equations with unique intercepts ( $\alpha_j$ ) and common slopes ( $\beta_1, \beta_2, \beta_3$ ),  $RQL$  is the expected relationship quality level, and  $S_n$  (three in this case - past experience,  $S_1$ , benevolence,  $S_2$ , and integrity,  $S_3$ ) are the explanatory variables.

To interpret the influence of the binary relationship embeddedness variables on relationship quality levels, the odds ratio (OR) for two levels of  $R_m S_n$  (i.e.,  $R_m S_n = 0, R_m S_n = 1$ ) is calculated as;

$$OR_{(0,1)} = \exp(\beta_n) \quad (2)$$

$OR_{(0,1)}$  describes the numerical odds of a construction team being in a higher relationship quality level rather than a lower relationship quality level when team members exhibit social behaviors ( $S_n = 1$ ) rather than not exhibiting social behaviors ( $S_n = 0$ ), holding the other variables constant.

#### B. Description of data

Relationship embeddedness was used to model relationship quality levels using the multinomial logistic regression. The relationship embeddedness used in this paper is borrowed from the concept advanced by [7] on the role of social and relational behaviors in relationship embeddedness. The expected Relationship Embeddedness (REM) of a team based on a relational behavior,  $R_m$  represents the probability of a construction team member being in a specific relational state and is a function of the social behaviors exhibited, i.e.,

$$REM = f(s) \quad (3)$$

Where,  $s$  represents the social behaviors of past experience, benevolence and integrity and is calculated as a product of relational and social behaviors exhibited by the construction team members (i.e.,  $R_m * S_n$ ).

Since the scores for both relational and social behaviors are binary (0 and 1), the resulting REMs are also binary and represent the following:

0 is a state where team members exhibit no social behavior

1 is a state where team members exhibit a social behavior

In modeling relationship quality,  $RQL$ , four relationship quality levels from [10] maturity model and further investigated by [9] were revisited and given discrete numbers representing the sum of possible combinations (Table 1) for the construction team members to exhibit/not exhibit relational behaviors ( $R_m$ ) under each of the three social behaviors ( $S_1, S_2 & S_3$ ), i.e.;

$$RQL = R_m S_1 + R_m S_2 + R_m S_3 \quad (4)$$

Table 1. Computation of relationship quality levels

$(R_m S_n)$			$RQL$	Coding
0	0	0	0	Price relationship quality level
1	0	0		
0	1	0	1	Quality relationship quality level
0	0	1		
0	1	1		
1	0	1	2	Partnering relationship quality level
1	1	0		
1	1	1	3	Strategic partnering/Strategic alliance relationship quality level

## VI. FINDINGS AND RESULTS

The data used to model relationship quality was from surveys completed by participants working in the projects used as case studies. In modeling relationship quality, the completed survey data from the four case studies were summed together. In total there were 48 responses and at least one fell in either one of the four relationship quality levels.

The four RQLs were fitted using the REM scores calculated in equation 3. The model fitting shows the probability of a team being in one relationship quality level

or another given the REM of a team. In running the analysis, the 4<sup>th</sup> level of relationship quality (coded as Strategic partnering/Strategic alliance) was used as the reference category. This resulted to a total of 63 models. Due to the perfect fit of the models based on the overall model, there was need for further investigation on this association. Therefore, a further comparison was conducted to ascertain the best model. This was achieved using backward stepwise selection, a function available in SPSS software. After conducting the backward stepwise model selection, 10 models were selected as shown in Table 2.

Table 2. Model fitting information

	Odds	Effect	Parameters	Estimates	SE	Wald	P value	OR
Harmonization of conflict	$P(RQL = 3)$	Intercept	$\alpha_4$	0.290	.202	2.055	.152	
	$P(RQL = 0)$	Past experience	$\beta_1$	0.974	.423	5.298	.021*	2.649
	$P(RQL = 2)$	Intercept	$\alpha_4$	-0.874	.278	9.902	.002*	
	$P(RQL = 0)$	Integrity	$\beta_3$	19.753	.342	3329.043	< .001*	3.789E8
Propriety of means		Intercept	$\alpha_4$	-0.582	.143	16.693	< .001*	

	$P(RQL = 2)$	Past experience	$\beta_1$	-0.962	.364	6.984	.008*	.382
	$P(RQL = 0)$	Integrity	$\beta_3$	-2.434	.742	10.762	.001*	.088
Restraint of power	$P(RQL = 2)$	Intercept	$\alpha_4$	0.815	.231	12.433	< .001*	
	$P(RQL = 0)$	Past experience	$\beta_1$	2.443	.757	10.422	< .001*	11.508
	$P(RQL = 1)$	Intercept	$\alpha_4$	-0.968	.175	30.575	< .001*	
Reliance and expectation	$P(RQL = 0)$	Past experience	$\beta_1$	-1.189	.556	4.582	.032*	.304
	$P(RQL = 2)$	Intercept	$\alpha_4$	-0.638	.155	16.922	.001*	
	$P(RQL = 0)$	Integrity	$\beta_3$	-2.082	.625	11.081	.001*	.125
Contractual solidarity	$P(RQL = 1)$	Intercept	$\alpha_4$	-0.653	.141	21.624	< .001*	
	$P(RQL = 0)$	Benevolence	$\beta_2$	-1.957	.484	16.330	< .001*	.141
		Intercept	$\alpha_4$	-0.675	.153	50.349	< .001*	
Reciprocity	$P(RQL = 3)$	Past experience	$\beta_1$	-2.893	1.028	7.921	.005*	.055
	$P(RQL = 0)$	Integrity	$\beta_3$	-1.108	.358	9.575	.002*	.330

#### A. Interpreting the logistic regression models

In predicting relationship quality levels in a construction team, results show that:

- Relationship quality level, RQL is 2.649 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who have worked together before resolve conflicts informally, flexibly, and internally.
- Relationship quality level, RQL is 3.789E8 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who show integrity resolve conflicts informally, flexibly, and internally.
- Relationship quality level, RQL is 0.382 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who have worked together before, adhere to the principles of division of responsibilities together with the terms and conditions set out in the contract.
- Relationship quality level, RQL is 0.088 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who show integrity adhere to the principles of division of responsibilities together with the terms and conditions set out in the contract.
- Relationship quality level, RQL is 11.508 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who have worked together before will avoid applying their authority against any other team member's interest.
- Relationship quality level, RQL is 0.304 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who have worked together before rely on others to fulfill their part of the bargain.
- Relationship quality level, RQL is 0.125 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who show integrity rely on others to fulfill their part of the bargain.
- Relationship quality level, RQL is 0.141 times more likely to be in a higher relationship quality level rather

than a lower relationship quality level when team members who are benevolent work peacefully and harmoniously to preserve a relationship.

- Relationship quality level, RQL is 0.055 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who have worked together before, treat one another as equals.
- Relationship quality level, RQL is 0.33 times more likely to be in a higher relationship quality level rather than a lower relationship quality level when team members who show integrity treat one another as equals.

## IV. DISCUSSION

#### A. Relationship quality level prediction

The paper found that relationship embeddedness of a team can be used to predict the relationship quality level of a team. Research findings show that of the seven relational behaviors associated with relationship embeddedness, only one (flexibility behavior) was not associated to relationship quality levels. Team members who express both relational and social behaviors are more likely to be in a higher relationship quality level when compared to the lowest relationship quality level.

For the social behaviors, the effect of past experience on five of the seven relational behaviors predict relationship quality levels in construction teams. For example, team members who have worked together before, resolve issues informally and at the lowest level without involving the upper management (harmonization of conflict). These results are consistent with the findings by [23] who asserted that past experiences builds one's reputation whether good or bad which can build or break future relationships.

The effect of integrity behavior on four out of the seven relational behaviors predict relationship quality levels in construction teams. What these findings mean therefore, is that the interdependencies between the integrity behavior and the four relational behaviors predict the relationship quality level in a team. For example, when a team member is trustworthy, others are willing to exchange things with

them for a mutual benefit (reciprocity). The effect of benevolence on only one of the seven relational behaviors predict relationship quality levels in construction teams.

#### B. State of the art practice

To proactively initiate, improve, and manage relationships in construction projects, the researcher suggests adjustments be made to the project management in

the case studies, and proposes an interpersonal relationship management framework, shown in Fig. 1. The different stages of the framework are explained in Table 3. The sources of information for the different stages of the proposed interpersonal relationship management framework was solicited from the literature review, survey, and case studies.

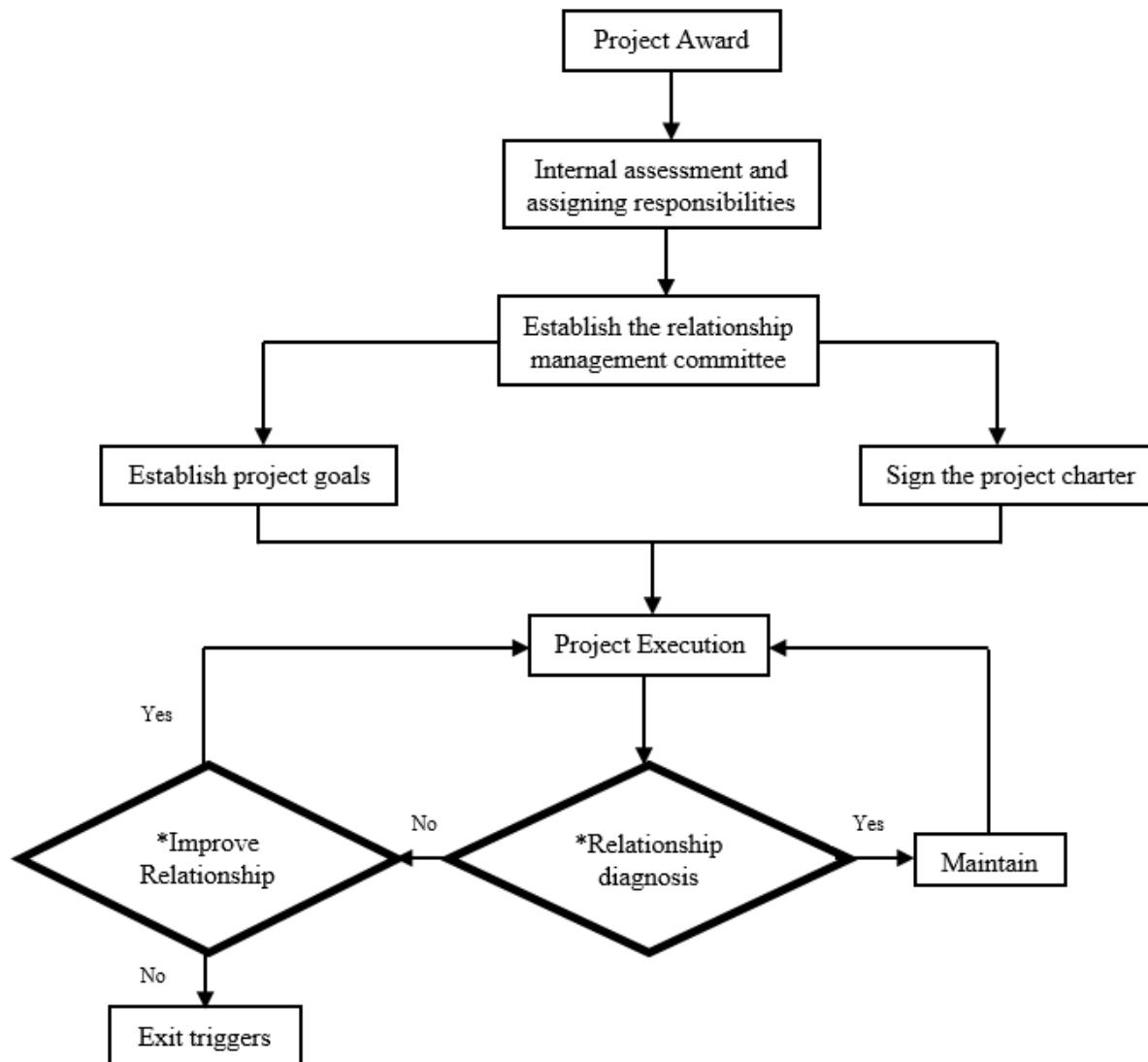


Fig. 1. Proposed interpersonal relationship management framework

The relationship quality level models presented as prediction models, can be used as a relationship diagnosis, together with feedback from team members to assess the relationship quality levels presented in Fig. 2. The computed relationship embeddedness, may be used in predicting the relationship quality levels in a construction project.

Table 3. Description of relationship management strategies for each case study project

	Case I: Highway Interchange Construction Project	Case II: Highway Widening Project	Case III: Gravity Sewer Replacement Project	Case IV: Highway Construction Project
Project delivery method	DBB (A+B)	DBB	Agency CM/DBB	DBB
Description	After the award of the contract, there was an initial partnering session, and the parties agreed to the project objectives and signed a project charter. However, partnering efforts were abandoned during project execution with strained relationships reported in the project.	The process of initiating relationships and management started after the project award for this DBB project. Partnering clauses were contained only in the contract with no partnering sessions.	Project managed by a consulting program manager. This DBB procured project had no formal relationship management forming sessions.	Traditionally procured, the process of establishing relationships started immediately after the project award with an initial partnering session with all members of the project team represented.
Relationship management strategy used	Formal Partnering	Informal Partnering	None	Formal Partnering
Relationship management actions	Signed a project charter, initial partnering session, no follow-up partnering meetings, long decision-making processes, agreed upon project goals in the signed charter not followed up, no incentives, no team building activities, or personnel changes	Informal partnering, partnering clause in contract, no team building activities, formal communication, most of the working relationship conditions contained in the contract, project charter not signed	No formal or informal partnering was involved in this project. However, parties held weekly meetings to discuss any issues arising, project goals, roles and responsibilities contained in the contract.	Signed a project charter, listed project performance indicators initial partnering session, team building activities, external partnering facilitator, regular partnering sessions, problem-solving strategies, continuous training plus appropriate incentives, empowerment of parties in decision making, fair dealing between parties, and clarity in the description of roles.

Table 4. Description of relationship management stages

Relationship management stage	Description
Internal assessment and assigning of responsibilities	<ul style="list-style-type: none"> <li>Identify the internal strengths and weaknesses of the project team in terms of relationship building which includes individuals' social and relational behaviors</li> <li>Assess project complexity, staff competencies, and recruit staff as needed</li> <li>Establish criteria for procuring of subcontractors, external suppliers, and consultants, based on the relationship attributes set out in the conceptual model</li> <li>Incorporate social and relational behaviors in the selection of other members into the project team.</li> </ul>
Establish relationship management committee	<p>The relationship management committee is comprised of senior project managers, superintendents, and foremen as well as other team leaders working out in the field from the different organizations involved in the project. The main role of this committee is to</p> <ul style="list-style-type: none"> <li>Harmonize the individual goals of the different organizations into those of the project</li> <li>Monitor and assess relationship performance</li> <li>Encourage collaboration and integration, and</li> <li>Give continuous feedback for performance improvement.</li> </ul> <p>The committee will also be open to receive reviews and assessments from project team members</p>
Establish project goals	Project goals are established by the relationship management committee, where each party to the construction contract is represented by one project participant. This is done before the start of the execution of the project.
Sign the charter	Once the project objectives are set, the different parties in the team sign a project charter as a sign of their commitment to deliver them. The project charter will essentially reflect best practices in relationship management through open communication, transparency, and encouraging collaboration. The project charter will include among other things: <ul style="list-style-type: none"> <li>Key performance indicators of the project or relationship quality attributes</li> <li>Project objectives</li> <li>Code of Ethics regarding interpersonal relationships</li> <li>Succession plan in case of personnel changes</li> </ul>
Relationship diagnosis	<ul style="list-style-type: none"> <li>Include measures to monitor and maintain team member behaviors with relationship quality attributes presented in the conceptual model of network embeddedness (Figure 5.1) being recommended.</li> <li>Hold periodic relationship management meetings to discuss and resolve any arising relationship matters</li> <li>Periodic measures of relationship performance based on the relationship quality measures established in this research</li> <li>Invite and assess team member reviews and surveys to determine the levels of relationship quality.</li> <li>Include an established procedure for dispute resolution.</li> </ul>
Improve relationship	<ul style="list-style-type: none"> <li>Execute both internal and external (use of an external facilitator) team building activities</li> <li>Continuous improvement to formal and informal open communication</li> <li>Evaluate impacts of personnel changes in the project</li> <li>Identify potential triggers to deteriorating relationships</li> </ul>

The decision to improve relationships is critical if parties want to deliver the project based on set project goals. The main area in which to start this stage is to identify the potential triggers that lead to deteriorating relationships. Triggers in this case are defined as any events or critical occurrences that can directly or indirectly initiate the process of deteriorating relationships between construction team members [24]. Triggers in construction team relationships can include things such as; field level events (e.g. errors, mistakes and poor quality; absenteeism; idling, slow pace and continuous/long breaks [25], relationship level events (e.g. lack of integrity, lack of trust, or pre-existing factors such as two team members who have never liked each other possibly due to their past experiences (social behaviors), or network level events (e.g. sudden change in available technology or a gradual change in the demographics of the team as some members exit and new ones join the team as the project progresses) [2]. Once identified, strategies to improve and possibly to eliminate such triggers are initiated. If the relationships are at a point where nothing possibly could be done to improve the relationships and return back on track with the project execution, strategies to deal with some members disengaging or exiting the project must be formulated.

#### C. Relationship Quality Levels

Relationship quality can be used to show the condition of interpersonal relationships in construction teams in terms of strength and effectiveness. Relationships in construction teams can vary over the construction duration of a project. As noted by respondents in the case studies, different views exist from project participants working on the same project regarding the project atmosphere.

Social relationships develop with time, starting with an arms-length kind of relationship. Members of the team attach to one another with time, depending on their behaviors and interactions with one another and in return, they bridge the social gaps between them. In line with the findings of this research, this paper presents four fundamental levels of relationship quality in construction teams (fig. 2). The relationship quality levels are based on working arrangements, through the different strategies, actions, and attributes found throughout the literature and supported by findings from the case studies. Further, the relationship management strategies from the case studies presented in Table 4 demonstrate a practical application of different strategies aimed at integrating the project team, and are used to explain the different levels of relationship quality.

The lowest level of the relationship quality model is defined as the price level. At this level, no relational element is involved; relationships are purely defined and governed by the contractual provisions. Most of these relationships are transaction based, one-off, and short-lived. Examples of these relationships in construction teams include purchasing arrangements with material suppliers in a construction project [26].

The second level of relationship quality is the quality level, where relational engagements do not depend on any formal methods or actions. Under the social network theory, acquaintances are unknown individuals, and these are met by chance. Once an individual establishes positive relations with another, then their relationship begins to move towards the acquaintance level of relationship quality [23]. At the quality level, team members socialize, forming networks of relationships, and are attracted to other team members, for example, those with whom they have something in common, or due to their resource base. This level also includes relationships at the personal level and not necessarily working relationships. This level can be considered critical in establishing and sustaining quality relationships. Contract adequacy at this level is also high, but lower than that at the price relationship quality level. From the case studies conducted, Case III depicts an example of the quality level of relationship quality, based solely on contracts with no formal relationship management strategies.

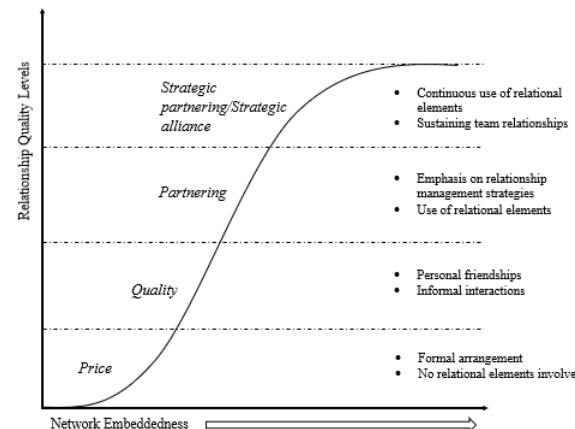


Fig. 2. Relationship quality levels

The partnering level represents the third level of construction team relationship quality. At this level, different efforts in terms of relationship management strategies are used to enhance and manage relationships. Should contract adequacy be reduced, much emphasis is placed on more relational elements, such as a focus on project goals [26]. For example, if parties commit to open lines of communication in the project charter, then strategies at this level will be geared toward increasing open lines of communication, both formally and informally, in order to correspond to the signed commitment [2]. Case I failed at this level, where the commitments in the project charter by the parties were not followed up, and corresponding actions further strained relationships in the project team. Furthermore, at this level, relationships go beyond formalities contained in the charter, together with other relationship management strategies, such as workshops and team building activities. More effort is placed in attempting to achieve high levels of trust, performance satisfaction, and commitment, than delivering on the project goals [2]. For example in Case IV, a team effort from all parties was required to ensure that the partnering agreement is achieved. The participants of Case IV agreed that goodwill from team members empowered others to achieve the project goals as

open lines of communication and regular partnering sessions had become the norm.

The fourth level is the strategic partnering/strategic alliance level, where all relationship quality attributes are pursued. This level depicts a situation where relationship embeddedness was achieved, based on the social and relational behaviors of the project team members. The result is trust, knowledge transfer, and conflict resolution are enhanced [2, 20]. Features of an integrated team are realized through this means, including sharing of cost information, privileged access to resources, faster processing of information, learning and performance feedback, and the invention of new ideas [2]. At this level, the team is encouraged to assess their performance periodically, to ensure that they stay on track and avoid descending to a lower level.

## V. CONCLUSION

The objective of this paper was to predict relationship quality levels using relationship embeddedness of construction teams based on data drawn from the literature review and case studies. The aim was to map project team relationships with current industry practices and extant literature and ultimately develop a proposed implementation framework and construction team relationship quality levels.

Overall, the findings of this paper show 10 valid relationship quality level prediction models. What these findings mean, therefore, is that relationship quality levels, can be predicted by relationship embeddedness. The findings confirm the prediction models as a tool that may be used to analyze, measure, and ultimately manage relationships in construction teams. Furthermore, a framework for managing interpersonal relationships in construction teams, and ultimately managing relationship quality, is proposed.

Finally, the proposed model of relationship quality suggests four levels of relationship quality: contractual, acquaintance, effort, and integration. These levels are enhanced by means of different strategies used in different construction projects. The strategies are proposed in the framework and based on the strategies extracted from the literature review and the case studies. The relationship quality level model shows that as relationship quality increases, the effort to achieve project success also increases, answered by a corresponding increase in relationship embeddedness.

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