RELATIONAL CONTRACTING APPROACH FOR IMPROVING PERFORMANCE OF INFRASTRUCTURE DEVELOPMENT PROJECTS

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ABSTRACT

Relational Contracting (RC) is a flexible procurement approach directed at optimising project performance through applying its principles; aiming at the relational integration of all stakeholders of a project, by engaging them in "cross linked value networks". Partnering, alliance, private-public partnerships and joint ventures are the common procurement types of such nature. Although RC have proven benefits especially for complex and uncertain infrastructure development projects, these are not well established in most developing countries including Sri Lanka. Therefore, understanding of industry practitioners on how RC systems bring in performance improvements to construction projects will definitely promote RC. In view of that, the research aims to provide related knowledge by identifying and subsequently assessing the impact of key parameters of RC on major performance areas of infrastructure development projects. A questionnaire survey was conducted based on the knowledge gained through literature and was followed by an interview survey to validate the questionnaire survey findings derived through statistical t-tests. Questionnaire findings identified nineteen significantly existent characteristics in RC types and were recognised as highly important for 'Time', 'Cost' and 'Quality' performance of infrastructure development projects. Thus, adopting of RC should be promoted to achieve better project outcome.

Keywords: *Construction Performance; Infrastructure Development Projects; Procurement Methods; Relational Contracting.*

1. INTRODUCTION

The construction industry is one of the key activities in any country's economy while physical infrastructure is a major construction industry segment. Hence, enhanced performance of infrastructure projects is of paramount important for a country to achieve national development.

Performance of construction projects is considerably affected by procurement practices as well as contracting structures and styles (Palaneeswaran *et al*., 2003). For instance, poor performance is more evident in traditional adversarial type of contracts (Enshassi *et al.*, 2009); conversely, construction project performance in whole range of criteria can be dramatically improved if collaborative working practices are incorporated in to the project environment (Bennett and Jayes 1995 cited Bresnen and Marshall 2000b p. 229). Relational Contracting (RC) is one of the approaches capable of inducing such changes (Rahman *et al.*, 2007).

Relational Contracting (RC) is a set of principles or a philosophy of contracting when its elements are incorporated into a contract, referred as a relational contract (Mclennan, 2000; Yeung *et al.*, 2012). Further, RC replaces legal provisions with informal agreements (Rahman and Kumaraswamy, 2002) and considers contracts to be ongoing dynamic (flexible) and long term 'relationships' between parties (Macneil 1980 cited Chang *et al*., 2010 p.04). RC gives rise to a spectrum of project delivery systems with different combinations of relational elements at different degrees. Among them, partnering, joint venture, alliancing and public private partnership are commonly used RC systems.

Partnering is of two types namely project partnering and strategic partnering where project partnering refers to one off scheme and strategic partnering refers to on-going schemes over a series of development (Bennett and Jayes, 1995). Alliancing too has two categories namely strategic alliancing and project alliancing (Rowlinson and Cheung, 2002). The key difference between project partnering and project alliance is that partnering do not has a contractual enforceability itself and merely based on relational aspects whereas

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alliances have (Manley, 2002). Joint Venture (JV) is a relational strategy used by companies to temporarily combine finance, skills and knowledge and other resources (Walker and Johannes, 2003). Public Private Partnership (PPP) is a long-term contractual agreement between a public sector body and a private sector entity, where private sector entity is entitled to construct or manage a public sector infrastructure facility or provide services to the public using that facility on behalf of the public sector (Grimsey and Lewis, 2002). Among them JV is the widespread RC system in Sri Lankan industry. However, these systems are not perfectly established in Sri Lanka, instead they only incorporate the RC attributes to a limited level.

The primary objective of this paper is to affirm on value of RC approach, by exploring how RC systems contribute to improve performance of infrastructure construction projects. For that purpose, this research identifies the key parameters in RC systems for enhancing construction performance and subsequently assesses the impact of them to improve the performance of infrastructure development projects.

2. RESEARCH METHODOLOGY

2.1. INITIAL SURVEY

Key characteristics of RC systems, which have capacity to enhance performance of construction projects, were identified through an extensive literature survey. Having prepared the draft questionnaire based on the literature findings, a pilot survey was conducted by interviewing an academic expert and an industry expert to elicit their knowledge with view to identify any further characteristics which is more or less unique to the local industry practices. No new characteristic of RC were found through this expert survey however the questionnaire was improved with their comments. As the next step, industry-wide questionnaire survey was carried out to identify significant characteristics contributing to infrastructure development project performance in the practical scenario in Sri Lankan construction industry.

2.2. QUESTIONNAIRE SURVEY

Sample Selection: Main stakeholder such as clients, consultants, contractors and suppliers in the supply chain of infrastructure projects were considered in the sample population. Contact information of such stakeholders who are involved in large-scale infrastructure development projects was collected to establish the sample framework. It was believed that persons who have more than 10 years of total experience in construction industry and who have been involved both in RC systems and in infrastructure development projects as experts to the research. The contacts were collected from Institute of Construction Training and Development (ICTAD), leading organisations of the sector and from the telephone directory. A sample of 32 number of such persons was selected through Random sampling technique. Among them, 7 persons were from client organisations, 8 from consultants, 10 from contractors and 7 from supplier organisations.

Questionnaire Design: The questionnaire consists of three sections. In the first section, demographic characteristics of the respondents were asked to confirm that the respondents have achieved the criteria concerned in refining experts related to this research. Section two aims at identifying the level at which the RC characteristics exist in RC systems in the Sri Lankan construction industry. This section comprise of single question with twenty-one RC characteristics identified from the initial survey, for the respondents to rate in a seven-point Likert scale (1=Not exist at all, 2= Very weekly exist, 3=weekly exist, 4= Moderately exist, 5=Exist, 6=Strongly exist, 7=Very Strongly exist). The third section aims to identify the respondents' opinion on the importance of the same RC characteristics on improving performance of infrastructure development projects with related to five performance indicators namely, *time, cost, quality, health and safety and environment*. The respondents were asked to rate using a similar seven-point Likert scale (1=Not important at all, 2=Very weekly important, 3=Weekly important, 4=Moderately important, 5= Important, 6= Strongly important, 7=Extremely important).

Survey and analysis: Final questionnaire was delivered by hand as well as through electronic mail after confirming the respondents' accomplishment of the criteria established to identify experts to the research. One sample t-test was adopted to identify RC characteristics that significantly exist in RC systems and to identify RC characteristics, which are significantly important for five performance areas considered separately. Accordingly, null hypothesis was defined as 'H_0: $\mu = \mu_0$' and alternative hypothesis as 'H_1: $\mu \neq \mu_0$', where μ is population mean and μ_0 is the hypothesised value of population mean. In the analysis, μ_0

was positioned at '4' which is the moderate level of existence/importance. T-tests were conducted using 'statistical Package for Social Science (SPSS)' software. The characteristics which had 'significance' less than 0.05 (level of significant used for the test) and positive t value, were considered as significantly existing/ highly important above the moderate level. Following the analysis of questionnaires, four number of unstructured interviews were conducted to extract further expert views with regards to questionnaire survey results.

3. DISCUSSION

3.1. RC CHARACTERISTICS

Among the 21 characteristics tested, 19 were established through t test results as significantly existent in Sri Lankan RC systems. Table 1 shows these significant characteristics.

Table 1: Significant Characteristics in RC Systems

No	Characteristic	Sig	t-value	Rank
C17	Resource sharing	0.000	12.785	01
C08	Continuous effort on performance improvement	0.000	11.633	02
C18	Enthusiasm	0.000	10.001	03
C05	Common/mutual project goals	0.000	09.423	04
C15	Mutual understanding	0.000	08.575	05
C01	Commitment	0.000	08.358	06
C07	Immediate problem resolution at lowest level	0.000	08.358	06
C04	Open and effective communication	0.000	08.042	08
C16	Ethical conduct and discipline	0.000	08.019	09
C11	Integrated team building	0.000	07.996	10
C06	Sharing risks and rewards	0.000	07.830	11
C02	Mutual trust	0.000	07.482	12
C14	Mutual respect	0.000	06.937	13
C03	Cooperativeness and collaboration in relationships	0.000	06.297	14
C12	Long term relationships	0.000	05.822	15
C09	Informal agreements	0.000	04.937	16
C10	Workshops	0.000	04.559	17
C13	Contractual flexibility	0.000	04.360	18
C20	Relational selection	0.003	03.215	19

Further, the characteristics were analysed to identify their importance for improving the performance of infrastructure development projects in terms of *Cost, Time, Quality, Health and safety and Environment*. Traditionally success of construction projects is measured with *time, cost and quality* (A.P.C. Chan and Chan, 2004) while health and safety issues and environmental impact are among other two aspects commonly dealt with infrastructure projects (Eriksson and Westerberg, 2011).

According to the results, all significantly existent 19 characteristics were found significant for overall performance improvement of infrastructure development projects (refer Table 2). Among them, 'C01: Commitment to achieve project targets' is the RC element having highest contribution. Moreover, 'C08: Continuous effort on performance improvements' is the most important characteristic for 'Time' performance. 'C05: Mutual project goals' was identified as the most significant contributor to both 'Cost performance' and 'Environmental performance' while 'C01: Commitment to achieve project targets' is most important for both 'Quality' and 'Health and safety' performance.

Table 2: RC Characteristics and Infrastructure Development Project Performance

No	Significantly Existent Characteristics in RC Systems	Performance Indicators																	
		Time			Cost			Quality			Health and Safety			Environment			Overall		
		Sig (2 tailed)	t-value	Rank	Sig (2 tailed)	t-value	Rank	Sig (2 tailed)	t-value	Rank	Sig (2 tailed)	t-value	Rank	Sig (2 tailed)	t-value	Rank	Sig (2 tailed)	t-value	Rank
C05	Common project goals	0.00	14.20	05	0.00	20.26	01	0.00	13.92	04	0.000	8.82	02	0.000	7.53	01	0.00	15.39	01
C08	Continuous effort on performance improvement	0.00	25.68	01	0.00	18.16	02	0.00	13.11	06	0.000	6.42	05	0.000	4.54	05	0.00	15.31	02
C01	Commitment	0.00	15.87	04	0.00	13.33	04	0.00	14.60	01	0.000	9.19	01	0.000	5.38	04	0.00	14.49	03
C18	Enthusiasm	0.00	16.84	03	0.00	10.52	07	0.00	14.43	02	0.000	8.28	03	0.000	6.29	02	0.00	12.49	04
C10	Workshops	0.00	10.27	11	0.00	9.12	11	0.00	14.09	03	0.000	5.75	07	0.000	4.00	07	0.00	12.27	05
C04	Open and effective communication	0.00	13.12	07	0.00	11.20	06	0.00	13.85	05	0.000	6.56	04	0.003	3.18	11	0.00	12.18	06
C11	Integrated team building	0.00	10.60	10	0.00	7.57	13	0.00	10.00	10	0.000	5.04	08	0.000	4.45	06	0.00	10.32	07
C20	Relational selection	0.00	11.50	08	0.00	9.16	10	0.00	10.80	09	0.000	6.04	06	0.000	5.80	03	0.00	9.91	08
C03	Cooperativeness and collaboration in relationships	0.00	13.26	06	0.00	8.94	12	0.00	11.12	08	0.001	3.54	10	0.010	2.73	12	0.00	9.72	09
C07	Immediate problem resolution at lowest level	0.00	7.60	15	0.00	13.47	03	0.00	8.36	11	0.009	2.80	14				0.00	9.52	10
C15	Mutual understanding	0.00	17.19	02	0.00	12.35	05	0.00	12.76	07	0.002	3.34	12				0.00	9.45	11
C02	Mutual trust	0.00	9.05	13	0.00	10.20	08	0.00	8.32	12	0.008	2.83	13	0.001	3.64	09	0.00	8.92	12
C06	Sharing risks and rewards	0.00	11.17	09	0.00	9.69	09	0.00	6.08	15	0.013	2.65	15	0.024	2.38	13	0.00	7.7	13
C14	Mutual respect	0.00	6.44	17	0.00	4.90	18	0.00	8.18	13	0.046	2.08	16				0.00	6.95	14
C17	Resource sharing	0.00	7.64	14	0.00	6.98	15	0.00	7.00	14	0.000	4.27	09	0.001	3.66	08	0.00	6.51	15
C16	Ethics and discipline	0.00	7.14	16	0.00	7.12	14	0.00	5.53	16	0.001	3.49	11	0.002	3.44	10	0.00	5.39	16
C09	Informal agreements	0.00	6.19	18	0.00	5.27	17	0.00	4.57	18				0.037	2.18	14	0.00	5.2	17
C12	Long term relationships	0.00	9.08	12	0.00	5.47	16	0.00	3.97	19							0.00	4.67	18
C13	Contractual flexibility	0.00	5.16	19	0.00	4.48	19	0.00	4.82	17							0.00	4.30	19

However, only sixteen (16) characteristics out of nineteen are highly important for the improvement of *health and safety* performance of infrastructure development projects. Further, almost all these RC characteristics demonstrate a lesser contribution level for *health and safety* performance compared for time, cost and quality. Results revealed that the construction industry experts perceive the *environmental performance* as the least effected performance area through the RC concepts and only fourteen characteristics are important. Experts viewed that, this is because it is mandatory for all the construction projects to follow rules and regulations imposed on environmental protection hence the value of RC characteristics in this regards tends to fall behind these legal requirements.

3.2. BEHAVIOUR OF SIGNIFICANT RC CHARACTERISTICS

3.2.1. COMMON/MUTUAL PROJECT GOALS (C05)

RC aligns every participant's effort on fulfilling a joint task, and hence concentrates the 'focus' of all the parties on the work issues rather than contractual issues (Rowlinson and Cheung, 2004; Khalfan *et al.*, 2007) while minimising conflicts (Bennett and Jayes, 1995). Reflecting this, t-test results established 'common goals' as the top most significant factor contributing to the project performance in related to all five areas (refer Table 2).

The study revealed that the unit formed with two or more contracting parties is considered as a small company by the employer and is expected to perform joint tasks. Thus, experts expected that, the parties would share the project scope among them and better perform their part of work while achieving the overall project targets.

3.2.2. CONTINUOUS EFFORT ON IMPROVING PERFORMANCE (C08)

Continuous improvement reviews pave the way to address the important issues immediately and motivate the recovery of falls in performance with no delay before propagating into an unrecoverable failure (Bennett and Jayes, 1995; Thomas and Thomas, 2005).

In the local practice, the unit formed with parties in a RC system continuously draw their attention on improving performance as they are compelled by the joint investment of resources and shared scope of work in the project. Further the experts believed this has contributed significantly to improve the project performance though it was not embrace the systematic procedure of periodically measuring and improving performance against established KPIs, as expected in perfect RC systems.

3.2.3. COMMITMENT TO ACHIEVE PROJECT TARGETS (01)

'Commitment' implies a person's intention to try or to keep trying for a goal (Leung *et al*., 2004). Goal commitment among construction parties is the key to achieve project targets (Liu 1999 cited Leung *et al*. 2004 p.701) by making the participants more agile and flexible in achieving the project outcome (Walker, 2002). As viewed by the industry experts, all partners in the RC system are committed to project targets due to resource contribution and limited scope for one partner.

3.2.4. ENTHUSIASM FOR PROFESSIONAL DUTIES (C18)

Enthusiasm makes the project participants to be agile to perform their duties, to be flexible, adaptable and responsive to changes and challenges and to work co-cooperatively and collaboratively to achieve project goals (Walker, 2002). As revealed by this survey, enthusiasm is highly important for all performance areas of infrastructure projects. Further it identified that, contribution towards shared scope and resource in the RC system makes all parties more enthusiastic on performing the given tasks and duties.

3.2.5. WORKSHOPS (C10)

Workshops in RC systems are conducted for establishing mutual objectives and problem resolution process (Bennett and Jayes, 1995), roles of parties and work processors (Swan and Khalfan, 2007) and selecting partners (Yeung *et al.*, 2012). Though this is not well functioned in SL, industry experts

believed that conducting workshops could have a higher impact on the project performance. Workshops, by facilitating face-to- face discussions serves as a better communication medium that improves awareness of all the parties regarding the project matters and supports to raise and to solve problems jointly (Cheng *et al*, 2004). Further, it provides the project participants the opportunity to draw initial plans and to control the procedures to achieve anticipated outcomes (Swan and Khalfan, 2007). Thus, it is expected that workshops could highly improve quality performance of these projects.

3.2.6. OPEN AND EFFECTIVE COMMUNICATION (C04)

Shortfalls in timely communication of information, exchange of ideas and maintenance of open and direct lines of communication between all project participants can block the smooth flow across all activities in a project as construction projects involve several phases, activities and a number of professionals with different expertise (Chan et al., 2006; Cheng et al., 2001; Chan and Kumaraswamy, 1997). Moreover, strong cross-links through effective communication are critical in RC where more than one party work for the same goal, to prevent conflicts and confusions. For instance, when work done in one phase or one party provides inputs to the other phase or party hence if not communicated properly conflicts and confusions occur impeding the total project performance.

3.2.7. INTEGRATED TEAM BUILDING (C11)

Relational contracts in Sri Lankan context are generally formed between client-client, contractor-contractor or consultant-consultant. Thus, even though team building between parallel parties exists, integration of demand and supply sides do not exist in local practice. Hence there is lack of opportunities for local practitioners to appraise its bursting benefits.

However, it is recognised that "integrated team building" could motivate the parties to perform in the best way by making the parties to assume individual and collective responsibilities (Austrlian Constructors Association, 1999), by making the ownership of the outcome to be held by all the team members (Mclennan, 2000) and by bringing together wider range of ideas (Construction Excellence, 2004).

3.2.8. RELATIONAL SELECTION (C20)

Relational selection includes early, unbiased, performance linked, transparent and value focused selection and harmonious negotiation arrangements (Palaneeswaran *et al*., 2003). Thus, it minimises the risk of time and cost overrun resulted from high possibility of change orders through contractor selection merely based on lowest bid price as mentioned in Assaf and Al-Hejji (2006 cited Eriksson and Westerberg 2011 p. 200).

In line with realising these benefits, in forming RC systems, local practitioners are motivated to select the party who has more experience, related skills, capacities and better performance records. However, industry experts further revealed that considerations for soft and behavioural parameters expected in perfect RC systems are lacking in local selection practices.

3.2.9. COOPERATIVENESS AND COLLABORATION IN RELATIONSHIPS (C03)

Collaborative or co-operative relationships urge the parties to rely on negotiations in resolving claims before any legal procedures (Bresnen and Marshall, 2000a), leading to reduction in transactional cost (Rahman and Kumaraswamy, 2002). In addition, Rahman and Kumaraswamy (2002) advocated that contractor-consultant co-operation lead to early, favourable and justified solutions for claims and variations and contractor-client co-operation ensures the progress. Contradicting to these highlighted benefits, t-test results indicated middle level of importance (Rank= 9) for overall project performance. This may be due to hindered benefits triggered by the weak collaboration between client-contractor and client-consultant in the local practice.

3.2.10. IMMEDIATE PROBLEM RESOLUTION AT LOWEST POSSIBLE LEVEL (C07)

RC normally appraises the relationship with more value and hence the contracting parties are in a position to mutually discuss and solve if a problem arises, and hence contribute towards saving time and

transactional cost (Walker and Hampson, 2003). This study is also identified that early resolution of problems is a significant characteristic in RC systems as all parties could avoid disputes through clear splitting up of work scope among them. JV Agreement too promotes settlement of any dispute in good faith, through negotiations and mediation before referring it to the arbitration.

3.2.11. MUTUAL UNDERSTANDING (C15)

Mutual understanding is recognised as team members' understanding on the position of other members in the project team, others' goals, needs and confronted difficulties, enabling to achieve project targets (Black *et al*., 2000; Khalfan *et al.*, 2007). As expressed by industry experts, in local RC systems, it provides the opportunity for all parties to understand the interests and goals of each other. For instance, the background created by RC makes the parties attentive on tracking whether the others focus on the project goals.

3.2.12. MUTUAL TRUST ON COMPETENCE AND SUPPORTIVE BEHAVIOUR (C02)

In the construction environment, trust means decision to become vulnerable or dependent on another party whose behaviour is beyond the control, in return for successful project completion (Munns, 1995). Researchers conducted in several countries (e.g. Rahman *et al*., 2007) revealed that 'mutual trust' is the most important factor facilitating RC while 'lack of trust' is one of the top most deterring factors. Absence of trust requires checks and controllers, which consumes resources adding to cost (G. Thomas and Thomas, 2005). By trusting the contractor, consultant's time is not wasted on always supervising the contractor instead get enough time to creatively focus on the project (Rowlinson and Cheung, 2004). However, it was highlighted through the survey that mutual trust exists at a lower level in the Sri Lankan practices.

3.2.13. SHARING RISKS AND REWARDS (C06)

According to industry experts, Relational Contracts make the parties to agree the percentage share of each party with respect to profit, loss and benefits, in order to prevent problems among them. Sharing risks and rewards changes the attitude and behavior of all team members to work hard in achieving targets (Zaghloul and Hartman, 2003). However, industry experts revealed that, pain share/gain share arrangement including the client's participation as stated in ACA (1999) is not practiced in the local industry and hence such benefits are not appraised.

3.2.14. MUTUAL RESPECT (C14)

As viewed by industry experts, responding favourably to a request made by the other party, is an example for the existence of mutual respect in the project environment and is an essential feature when two parties get together and performing a job. Further according to them, the project is automatically adjusted to deliver the best outcome if each party respect the others' requirements. However the highlighted benefits are not fully absorbed due to lack of practices in the local industry.

3.2.15. RESOURCE SHARING (C17)

Sharing resources enables the project to consume best resources of each participant and also enables the project to be benefitted with more appropriate procedures and adequate finance (McLennan, 2000). In general, RC allows project participants to pool their resources including financial resources, knowledge, expertise, technology and skills for joint management (Carrillo, 1996; Walker and Johannes, 2003). In the local practice, joint venture which is the most common RC system in Sri Lanka, are formed in situations where the resources of one contracting company are not enough to carry out a certain project and further companies seek new business opportunities through the strengths of the other partners such as reputation, stable position, business relationships etc. Thus, there is an avenue created for resource sharing through this current practice. However, it is at its adolescent stage in the local industry.

3.2.16. ETHICAL CONDUCT AND DISCIPLINE (C16)

Trust based RC approaches encourage the parties to conduct in an ethical manner (Rowlinson and Cheung, 2002). Presence of unethical behaviour of construction professionals such as negligence, incompetence, misconduct, lack of duty of care results in poor quality and further, time and cost is wasted for repair and reconstruction work (Abdul-Rahman *et.al.*, 2010). Besides according to them, construction professionals owe responsibility to the general public. Therefore, concern on good quality of work, environmental protection and health and safety of workers and neighbours are essential aspects. Due to different regulations and practices in the local industry, practitioners are geared to maintain this characteristic.

3.2.17. INFORMAL AGREEMENTS WITHOUT LEGAL ENFORCEABILITY (C09)

RC approaches involve informal agreements such as verbal promises, letter of intent etc (Rahman and Kumaraswamy, 2002). According to industry experts, there is a mutual agreement (Memorandum of Understanding) between the joint venture parties to agree on resource allocation and on other matters within the unit but are not important for the employer to know. Further, they serve as records on what has been agreed between parties. Moreover, industry experts expressed that this provide flexibility in course of work affecting favourably to the project outcome.

3.2.18. LONG -TERM RELATIONSHIPS (C12)

RC approaches induce long-term effect either through series of exchanges (e.g. in strategic partnering) or through one-off but long term contracts (e.g. in PPP/PFI) (Smyth, 2006). According to expert view, mutual understanding developed through working more closely together in a similar arrangement, makes it easier to carry out the work and thus more successful outcome is achievable in terms of time, cost and quality. This is supported by the view of Palaneeswaran *et al*. (2003) that is, long term relationships lead to stronger commitments and closer bonds. Contradicting to these highlighted benefits, local expert mentioned the disadvantages of creating "monopoly" along with these long-term business relationships.

3.2.19. CONTRACTUAL FLEXIBILITY (C13)

RC brings in flexibility into the contracts by considering the contracts as relationship between the project participants (Macneil 1980 cited Rahman and Kumaraswamy 2002 p.46). According to local industry experts, mutual agreement between the parties in the RC system can be changed through negotiations. However it is possible only for certain matters and circumstances, even though according to literature, flexibility is a basic characteristic in RC. The t-test indicated that this feature contributes to time, cost and quality performance while is the least effective contributor to overall performance. Contractual flexibility provides the background for effective risk management through facilitating the risks to be managed continuously according to changing circumstances (Rahman and Kumaraswamy, 2005a).

4. SUMMERY AND CONCLUSIONS

The aim of this research study was to explore how Relational Contracting (RC) systems contribute to improve performance of infrastructure construction projects. Twenty-one RC characteristics were extracted through the literature survey and pilot survey, which are expected to be incorporated in perfect RC systems. Nineteen out of the identified twenty-one characteristics were established through questionnaire survey as significantly existent characteristics in RC systems in the Sri Lankan construction industry. 'Resource sharing' is the most strongly existing characteristic. Finally, impact of identified RC characteristics on infrastructure development project performance was assessed by analysing the questionnaires through t-tests. All of the 19 characteristics which significantly exist in RC systems, were proven as significant contributors to improve time, cost and quality performance where only 16 and 14 characteristics were identified as highly important for 'health and safety' and environmental performance respectively. 'Continuous effort on performance improvements' is the most significant contributor to improve time performance. 'Mutual project goals' is the most important characteristic for both cost and environmental performance improvements while 'Commitment to achieve project targets' is the characteristic affecting to the highest degree on both quality and 'Health

and safety' performance. Further, most of the characteristics have a stronger importance level for the time, cost and quality performance than for the 'health and safety' and environmental performance. In addition, majority (13) of strongly existing characteristics in RC systems in Sri Lanka are important for all performance areas. Among 19 RC characteristics, 'Mutual project goals' is the most powerful feature in achieving total performance of infrastructure projects. Besides, interviews with industry experts revealed that some RC characteristics in Sri Lankan practice incorporate only the basic concepts but not the exact procedures as defined. These RC characteristics in Sri Lankan industry, contribute to improve infrastructure development project performance, only up to the extent that these basic concepts exist.

Thus, the research discloses the level of relational qualities in the present RC systems in Sri Lanka as well as the effective level of each RC element on different performance areas of infrastructure development projects. Accordingly, the industry practitioners are benefitted through this research in adopting the RC systems designed in the best way to deliver the anticipated project outcome while addressing the weaknesses in the current practice. Moreover, the research study encourages the usage of RC systems by affirming on the value of relational concepts on the construction industry.

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