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**Determinants of Management Control at
Responsibility Centre Level: Software Industry as a Case**

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Abstract

Current body of knowledge primarily focuses on variations in and determinants of management control systems at organizational level and, to some extent, at Strategic Business Unit (SBU) level. This study proposes that the level of analysis be extended to Responsibility Center (RC) level. Further, the extant studies focus on limited contingent variables like size, top management style, strategy, structure, etc. This paper makes a departure by extending the control system determinants at RC level to also include its own environmental variables in terms of its product market characteristics, client characteristics, and profitability of unit and project. The study is set in the software industry wherein activities are homogenous across divisions and RCs; but operate in different environments which provides ideal research site for study of intra-organizational control variations. An online survey was conducted on two of the leading Indian software firms at the levels of Project Manager and Project Lead. The survey confirmed the hypotheses that control variations at RC level can be explained through strategic determinants specific to their environments. In summary, this study explored the variations in and determinants of control systems at RC level. These variations and determinants are extendable to organizational and SBU levels also.

Key Words: Control Determinants, Responsibility Centers, Strategic Determinants, Market and Client Influence, Software Industry.

Determinants of Management Control at Responsibility Center Level: Software Industry as a Case¹

1 Context

The manifestations of differences in Management Control Systems (MCS) and its determinants at inter-firm and intra-firm level have been studied extensively by the contingency and congruency stream of academicians (Gerdin and Greve, 2004). Control system at organizational and intra organizational level is attributed to various structural dimensions (like responsibility centers, roles, etc.) and control processes (like operations, budgeting, reporting, evaluation, organizational culture, environmental differences, etc) among other things (Chenhall, 2003; Henri, 2006; Khandwalla, 1972). The contingency school, and more so congruence school, mostly focuses on control systems at firm level. While it is appreciable that firms across industry should differ in control characteristics and also at strategic business unit (SBU) level, it is less understood at Responsibility Centers (RC) level. RCs could be profit centers or cost centers and form an important part of control structure. Control variations at intra-firm level – at business unit or sub unit level having similar characteristics under same management should of deep interest. Glaring example are firms from software development industry, where the technology, processes and structure are similar across verticals and its subunits, but control characteristics seem to differ.

The studies of control differences at SBU level got some fillip when strategy researchers started looking at contingency effect of strategy on control (Gupta and Govindarajan, 1984). However, such studies focused on the influence of organizational level characteristics. This study takes a different perspective of management control, taking it truly to RC level and relating it to its own strategic determinants. This is same as refocusing the study of determinants of control variation at intra firm level to their respective contextual and strategic variables. It is hypothesized that these differences at RC level are important to be studied and that these could be emanating from these units facing different environment in terms of product market characteristics, client profile, etc., and not just the usual determinants of scale, technology, etc. that are studied with reference to firm level.

1.1 Study Objectives

The focus of this study is to capture the variations of control characteristics and its determinants at RC level, taking software industry as a case. Software firms present an unique opportunity as, though these are single products firms, their SBUs face multiple

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markets and environment as their clientele could be from banking, insurance, health care, government etc.

The objectives of the study are:

- Capture the variations in Control System (CS) characteristics and perceived level of control at RC level. This corresponds to Project Management level in the software industry, which is below the level of strategic business unit and above team level which is purely operational in nature. This is to explore if control characteristics vary significantly intra firms which are homogenous within.
- Capture the determinants contributing to the perceived differences in CS at RC level.

We hope this will bring research closer to practice. Practice relates control at sub unit level to its own environment whereas research sees it only at organizational level. Nixon and Burns (2005) mention the gap “between extant management control literature and management practice, especially the new strategies and implementation processes that are evolving in organizations and networks” (p 262). They mention that increasingly there is evidence to suggest that practice may have evolved in ways making traditional management control paradigms obsolete. Here we are not saying it is obsolete but we are trying to extend the framework and take it new frontier to which CS belongs to.

2 Literature Review

The scope of the paper being study of control variations at RC level and its respective organizational and environmental determinants, the literature review focuses on control characteristics and determinants; control at intra organizational level, and level of analysis.

2.1 Control Characteristics and Determinants

Control characteristics at organizational level have been studied on various parameters at organizational and divisional levels (Luft and Shields, 2008). The structural characteristics have been studied with reference to hierarchy and distance factors, formal specifications of roles, etc (Chenhall, 2003; Marginson, 2002; Henri, 2006). The process characteristics have been studied with reference to budgetary control dimensions like tightness, participative nature, top down – bottom up, etc.; accounting, costing and information system in terms of its impact, usage of financial and non financial information, content and frequency, applications of activity based costing, economic value added, etc. One important stream of process control has been the determinants of Management Accounting System (MAS) in organizations (Khandwalla, 1972; Jermias and Gani, 2004; Baines and Langfield, 2003; Bouwens and Abernathy, 2000; Van der Stede, 2000). Performance evaluation, another aspect of control system has been studied in terms of feedback loop, behavioural manifestations, linkages with rewards, strategic fit, etc. Financial measures like sales volume, return on investment, and profits are also

used for performance (Henri, 2006; Perera et.al., 1997). However, all these studies focus on control characteristics and determinants at organizational level.

The challenge in studying control determinants and effectiveness of MCS has been in defining 'selection, interaction and system' of factors (Chenhall, 2003). Chenhall writes, "Researchers have attempted to explain the effectiveness for MCS by examining designs that best suit the nature of the environment, technology, size, structure, strategy and national culture" (ibid, p127). It is a reference paper on CS and the relevant constructs are environment (uncertainty, turbulent, hostility among many); technology (complexity, task uncertainty, interdependency'); size; and strategy ('entrepreneurial – conservative', 'prospectors – analyzers' – 'defenders, 'build – hold – harvest', and 'product differentiation')), Control characteristics ('dimensions of budgeting', 'non financial performance measures', 'sophistication of controls', and 'dimensions of budgeting') (ibid, p150, p129). Baines and Langfield (2003) conducted an organizational level analysis of MAS changes using Structural equation model. He lists eight areas of change in environment some of which relevant to us are: 'prices and products'; 'customers' expectations in regards to price, quality, and delivery'; 'suppliers' actions in respect of price, quality, delivery, and availability'; 'development of new products or services in the industry and regulations' and government policies, national and international economic factors etc. (p684). Mode of Control has been studied in terms of MAS, and MCS including non financial and behavioural control (Jermias and Gani, 2004). The determinants of MAS specified are competition (Khandwalla, 1972), product differentiation, (Van der Stede, 2000), influence of environment, strategy, manufacturing technology and advanced MAS (Baines and Langfield, 2003), etc. These give us the over view of control characteristics, especially the market and environmental characteristics that we propose to focus, but the level of analysis is primarily organizational.

A longitudinal study by Marginson (2002) on the relationship between strategic process and management control system at middle management levels, especially with reference to 'development of new ideas and initiatives within the firm' (p 1027). It concluded that, "belief systems influence managers 'initiation' or 'triggering' decisions, the use of administrative controls affects the location of strategic initiatives and may lead to polarization of roles, and simultaneous emphasis on a range of key performance indicators can create a bias towards one set of measures and against another" (ibid, p1019).

The studies from knowledge intensive firms (Ditillo, 2004) and consulting firms (Alvesson and Karreman, 2004) are of relevance to this study as their focus is on knowledge firms and service firms. Ditillo (2004) studied knowledge complexity in terms of computational complexity, technical complexity, and cognitional complexity. The study concluded, "...knowledge complexity is a driving force in the design and use of management control systems" (p412). Alvesson and Karreman (2004) studied a large management consultancy firm with a focus on "the very high level of compliance with corporate objectives among employees". The study concluded that "the multitude and variety of formal systems of control – affecting behaviour as well as subjectivity – contribute to this intensity and a heightened subjectivity associated with the workplace

and being an organizational person” (p 441). So, control variation is strategic to effectiveness of service firms.

2.2. Control at Intra Organizational Level

The level of study in research has been primarily at organizational level, and the focus got extended when strategic considerations like prospector vs. defender and product differentiator vs. low cost were considered (Gupta and Govindarajan, 1984). The control characteristics have remained same but the determinants got extended when studies tried to incorporate strategic considerations. The earliest study is by Khandwalla (1972) when he categorized competition into product, price and distribution and their influence on control system. He concluded that product competition makes use of control system than price competition. The study by Jermias and Gani (2004) summarizing previous studies mention that while product differentiation companies tend to be more decentralized using more behavioural control and intensive MAS, low cost companies are more centralized and use MAS more towards efficiency (2004, p196).

The study by Gupta and Govindarajan (1984, p25) was probably the earliest study on control system at SBU level. They point that “the near absence of empirical studies on strategy implementation at the SBU level presents a significant research opportunity” and subsequently also this has attracted less attention may be due to lack of availability of information at SBU level. They mention that the style of a general manager of a business unit should be matched with its strategic mission or its stage in the product life cycle.

The important aspect of some studies on strategy is that the unit of analysis moved to strategic business unit level from organizational level. Chong and Chong (1997) studied the influence of environmental uncertainty and performance which is one the aspects of the proposed study. They observed that where there is perceived environmental uncertainty, they use more external, financial and future oriented information or in general broader scope of MAS.

Henri (2006) studied the influence of strategic choices and focused on, “to what extent do the diagnostic and interactive uses of MCS contribute specifically to the creation and maintenance of capabilities leading to strategic choices?” (p531). This study is of relevance to us and it points out that, “an interactive use of PMS fosters capabilities of market orientation, entrepreneurship, innovativeness, and organizational learning’, and that “a diagnostic use of PMS exerts negative pressure...” (p546). The direction of relationship in this study is that internal control system design can help market orientation, entrepreneurship etc whereas we propose that control system is influenced by its environmental variables.

Kober et al (2007) hold that while the traditional view on management control sees it as flowing from strategy, they proposed it can also influence strategy. The authors concluded based on a retrospective study of a public sector entity, that there is an ‘existence of two-way relationship between MCS and strategy’ (p425). This is also echoed by Ghoshal and Nohria (2005) when they said, “organizations facing

heterogeneous task environments seek to identify homogeneous segments and establish structural units to deal with each” (p105). Miles and Snow (1978), writing on Configuration of system, mention that “...the Defender aligns itself with a particular portion of the overall environment and manages the internal interdependencies created by its form of alignment. This adjustment process produces a unique configuration of domain, technology, structure, and process” (p47). Referring to this, Gerdin and Greve (2004) observe that “organizations need internal consistency between multiple contingencies and multiple structural characteristics if they are to perform well (p313). So, there is strong reason to homogenize similar subsystems facing similar tasks and environment. It should be mentioned here that the strategic determinants of control and their influence on control at SBU level and below were not picked up by subsequent studies.

2.3. Level of Analysis

The paper by Spekle (2001) makes an interesting observation that, “...one of the quintessential problems of management control (MC) as a field of scholarly inquiry is to explain control structure variety within and between organizations” which is the main concern of this paper (p419). It comes out with a framework of control system based on three different nature of activities, “ (1) uncertainty, or the extent to which the desired contributions are amenable to ex ante programming; (2) the degree of asset specificity; and (3) the intensity of post hoc information impactedness” (p 428). The combination of these is expected to influence the application of market control, arm’s length control, machine control, exploratory control, and boundary control. This is a conceptual paper and does mention that one has to look beyond the organization and at ‘all kinds of collaborative structured between firms’ for explaining control variety (p439). This study stresses control variety within organizations and among the networked collaborative structures.

2.4. Summary

The review shows that control studies vary with reference to level, selection, interaction and systems of control factors; and applied to various contexts like strategic frameworks like defender or prospector or sectors like manufacturing, services, and knowledge firms.

The proposed study is suggested to fulfill a particular gap. Studies have been mainly focusing on control differences at organizational level with reference to contingent or congruency factors including strategic considerations, and in some cases linking it up with performance. There are few studies at RC (unit) level, which is below the strategic business unit level, and more importantly linking the control characteristics at RC level to its own environmental and strategic determinants. There is little reference to clients or product market characteristics, though competition is discussed in some studies. It is felt that within the contingency approach and strategic frameworks, it will be useful to understand differences in control characteristics at RC level, within an otherwise homogenous organization like software industry. We propose to extend the level of analysis to control variety at RC level, and their strategic and environmental

determinants. Chenhall (2003) points out that units of analysis is critical and that, “care is required in maintaining consistency between the theory, the unit of analysis, and the source of measurements” (p156). He gives the example of budget and says appropriate concept of environment is that which applies to a particular unit and the uncertainty it faces (ibid, p 156). In this study it is proposed to understand the influence of product market characteristics, client profile, and profitability of the sub units as possible factors. In this sense we are also adding to the richness control domain by considering determinants which are hitherto not considered in control literature.

3 Research Hypotheses

Responsibility centers (RCs) form the core of control structure. It is common to designate RCs as profit or cost centers and a priori there is no reason to why perceived control should vary from one RC to other. At this level these operate in similar contexts like comparable size, similar technology (tasks and processes), and same top management style and organizational culture. These also share similar organizational level environment in terms of economy, market impact and business cycle, turbulent technology, etc. Where the verticals or sub units differ are in terms of their own specific strategic dimensions like product market characteristics, client and buyer power, and project characteristics. These factors could be contributing to variations in control system across RCs even though they work under homogeneous organizational contexts.

This study approaches control system from the perspective of perceived level of control. Perceived control varies in terms of empowerment in terms of decision rights and accountability of RC managers. Brickley et al (1995) discuss control system as a balance of “... the assignment of decision rights (rights to decide and take actions) among individuals, the performance evaluation system, and the reward system” (p30). Apart from actual assignment of decisions rights, what is important is the perception of assigned rights. Marginson (2002) pointed out that, even with a liberal administrative control environment, “some felt empowered, and some felt restricted”. His study observed, “One group, ‘enablers’ group, for example, felt restricted in their scope for ‘championing’ their own ideas and initiatives, unlike ‘entrepreneurs’ groups” (p1025).

As mentioned earlier, this study is set in the context of software firms at RC level (typically, projects level). The control system is studied in terms of six variables (dependent variables) and the determinants of control systems are studied in terms of eleven variables (independent variables). Annexure I gives the indicants used to measure these variables. Various hypotheses were generated based on literature review. [See table A for a summary of variables and hypotheses used in this study].

SNo	Hypothesis	Independent Variable	Dependent Variable
1	More Competitive the Product Market of a RC, Higher the Decision Rights of the RC	Product market Competitiveness	Decision Rights
2	More Critical the Client is to the Vertical,	Client criticality	Decision Rights

	Higher the Decision Rights of the RC		
3	Higher the Client Power, Higher the Decision Rights	Client power	Decision Rights
4	Higher the Price Pressure from the Client, Higher the Perceived Organizational level Control (OLC)	Price pressure from client	Organizational level control
5	Higher the Price Pressure in the Market, Higher the Cost Control by Top Management	Price pressure from product market	Cost control by management
6	Higher the Profitability of the unit, Higher the Decision Rights	Profitability of the unit	Decision Rights
7	Higher the Profitability of the Project, Higher the Decision Rights	Profitability of the project	Decision Rights
8	Higher the Product Differentiation, Higher the Decision Rights	Product differentiation	Decision Rights
9	Higher the Client's thrust on QC, Higher will be the unit's emphasis on QC	Clients' emphasis on QC	Unit's emphasis on QC
10	Higher the Client's emphasis on Cost Leadership. Higher the RC's emphasis on Project Level Cost Control	Clients' emphasis on cost leadership	Project level cost control
11	More the QC is followed for Credence Factor, higher will be Perceived QC	QC for credence	Perceived QC

Table A: Hypotheses and Variables

H 1: More Competitive the Product Market of a RC, Higher the Decision Rights of the RC

A software firm is a single product firm but operating in a multi market – environment scenario. A software firm operates in different product markets of banking, insurance, hospital care, transport and logistics, etc. wherein their demand is derived demand of their client market. They face different market structures in different product markets they operate with varying levels of competition. In a diversified company like 3M which operates in different industries like Consumer and Office Business, Electro and Communications Business, Health Care Business, Industrial and Transportation Business, etc. the product group markets are bound to be different and the subsidiaries or SBUs are most likely to be controlled differently. A software company on the other hand operates like a single product industry, that is software development which apparently looks homogeneous across verticals in terms of technology, processes and outcomes, but the product market characteristics could vary significantly. It could be operating in services market or product market, or banking or health vertical, or in Europe or US. Varying levels of competition would require different set of responses. In order to compete effectively in their respective product markets, responsibility center (RC) managers may be differently empowered depending upon the competitiveness of the market. A manager operating in a more competitive market may be delegated more powers or will perceive to be enjoying more delegation than the other. This empowerment manifests as decision rights that pertain to ability to mobilize and deploy resources, take decisions, and negotiate with clients. There are studies which have focused on competition and control

(Khandwalla, 1972; Baines and Langfield, 2003); but we focus on competitive environment and control at RC level.

H 2: More Critical the Client is to the Vertical, Higher the Decision Rights of the RC

Within a SBU or a vertical, it is possible one client is more critical than the other. A RC Manager could be empowered depending upon the perceived criticality of the client. Criticality of a client to a firm or a vertical depends on various factors like size of the client, size of business, scope for continued business, share of the client's business of the total business of the firm, top management interest in the client, contribution in terms of learning value, etc. The criticality could be also dependent on learning value of the project and not just on the financial factors of the project. This is a new control determinant that has long been overlooked by even studies relating strategy to control; and it is only in the recent past the researchers are including in their studies (Gupta and Govindarajan, 1984, Henri, 2006).

H 3: Higher the Client Power, Higher the Decision Rights

Client Buyer power is one of the five components of Five Forces Model as proposed by Porter (1979). The buyer power can come from large volumes, standard products, significant share of cost, etc. The other determinants of buyer power are like share of purchase by the client in relation to total sales, switching costs, threat of backward integration by the buyer, etc (Dess et al, 2006, p 57). The pressure from this dimension depends upon the Principal's market structure, the position of buyer in the sourcing market, etc. Thus this can be a vital source of influence on the empowerment of RC Manager. The Manager facing higher client pressure is likely to be bestowed with more control. Henri (2006) studied customers' expressed need and latent needs and Chong and Chong (1997) studied the relationship between SBU and strategy; and perceived environmental uncertainty on SBU performance.

H 4: Higher the Price Pressure from the Client, Higher the Perceived Organizational level Control (OLC).

As mentioned earlier, the demand for software services is a derived demand and depends on the market structure of the clients. The client himself might be operating in price sensitive market or he may be operating on low cost strategy, which gets transmitted to the vendor also. This puts price pressure across the value chain and not just at intra firm level. Cost leadership arises from 'Aggressive construction of efficient scales facilities', 'vigorous pursuit of cost reductions from experience' tight cost management, etc. (Dess et al, 2006, p151). This extends beyond the boundaries of the firm. Khandwalla (1972) brings out distinction between price competition and product competition, and their influence on control at organizational level. Here the reference is to the sub unit level.

The strategy of cost leadership can affect software industry both ways. It can lead to more spending on software development as this could be one way of reducing cost for them.

Alternatively, it could also mean more pressure on development cost as such firms would be hard bargainers also.

Some clients look at off-shoring software development purely as a cost arbitrage measure. These clients may be putting extensive pressure on pricing and even the evaluation parameters are based on total cost of system management.

Based on these factors, the price pressure from client in general could be understood in terms of the indicants shown in table D.

Under the conditions of price pressure from client, the control may be tuned more towards cost control than differentiation. In this we have introduced another dimension of organizational level control. This goes beyond empowering through decision rights and into the control areas of budgeting, transfer pricing, measuring and reporting, and reviews. RC Managers dealing with price pressure from clients are more likely to be cost focused and their own thrust as well as senior management styles would be to exercise higher degree of organization level control.

H 5: Higher the Price Pressure in the Market, Higher the Cost Control by Top Management

Price pressure from the market is different from the price pressure from client. Price pressure from the product market is a reflection of market forces, industrial structure, product market characteristics, etc. For example, health vertical could be operating under higher price pressure than banking division. The earlier hypothesis refers to a firm which is pursuing cost leadership within a market, in which another firm could be pursuing product differentiator, like Wal-Mart versus Sears. Under these circumstances it is possible that RC Manager operating in health division could be empowered more to cope up with price pressure. Here the thrust of control will be different and is most likely to be cost oriented. Here again what counts is sub unit market environment than organizational environment as discussed in literature. The aspect of cost control refers to extreme focus over budgeting, cost management, resource utilization and productivity.

H 6: Higher the Profitability of the unit, Higher the Decision Rights

In organizations, attention is mostly focused on profitable products which are flag ship products, or bread winners or thrust products. In terms of control system it is likely that these get more preferred treatment than less profitable or even targeted products. RC managers operating in profitable product lines may perceive more empowerment than other product groups. They might have more freedom in deciding on resources, for example, than less profitable units. The top management focus on loss making or less profitable lines may be more on curtailing delegation of powers to spend, tighter budget, higher cost management, more frequent reporting, etc. Hopwood (1972) who studied the influence of accounting on performance evaluation, says "The Profit Conscious style appears to be one aspect of a problem solving style of management, as distinct from a

style which attempts to impose a false measure of cognitive simplicity onto a complex and highly interdependent series of activities” (p175).

H 7: Higher the Profitability of the Project, Higher the Decision Rights

Some projects may be more profitable than others. An unit may be profitable or not so profitable, and a project can be profitable or not so profitable. It could be because of its uniqueness in terms of customization and differentiation, supplier power and buyer power, green field projects, R & D content or onshore-offshore mix. Decision rights will vary depending upon where a particular project falls in this matrix. Under these conditions it is possible RC Managers feel more empowered to take decisions, even if he is operating under tight control. In these projects for example, there may be more cushioning of slack in deliverables which gives them elbowroom or more delegation in mobilization of resources, etc. which leads to perception of higher level control.

H 8: Higher the Product Differentiation, Higher the Decision Rights

Differentiation strategy is defined as “creating differences in the firm’s product or service offering by creating something that is perceived industry wide as unique and valued by customers”. Differentiation can be achieved through prestige, brand, technology, innovation, features, customer service, and dealer network (Dess et.al, 2006). Literature does talk about Customer focused manufacturing strategy and control and use of non financial information (Perera et al, 1997) or customization and interdependence and MAS, but these are narrowly focused or at macro organizational level (Bouwens and Abernathy, 2000). Van der Stede (2000) observed that ‘product differentiation strategies lead to less rigid control and organizational slack’.

In the context of software industry, the differentiation factors can be domain and platform skills that a company can offer, innovations in process delivery capabilities, quality processes, etc. The RC Manager may enjoy more control, more complex the project.

Another aspect of differentiation could be the level of value chain at which the unit operates. Products which fall in the lower level of value chain are fairly routine and organizations follow routine control. At higher end, tasks become complex and control become more expert based and non routine type. Here the delegation of powers may have to be commensurate with the requirement of the tasks.

Product differentiation complexity can also arise from green field nature of the product. In the beginning there could be difficulties in defining specs, deliverables, milestones, etc. It may be a learning experience for both the parties. In the beginning, since the product features or service content or levels cannot be defined properly, it is left to the relationship and comfort level between the organizations. Over the years, systems emerge as expertise is gained. Here again, it is necessary the RC Manager enjoys the confidence of the top management and higher levels of decision rights.

H 9: Higher the Client's thrust on QC, Higher will be the unit's emphasis on QC

Clients operate with different levels of expectation about quality processes and certifications. Some clients insist on following documentation and quality processes like SEI - CMM Levels 4 or 5 but others may not insist on these. The development organization may be CMM Level 4 or 5 but the quality orientation in the project will depend on the client's orientation towards quality processes. Also, in dedicated third party development centers catering to specific client, it can happen that the systems get more dovetailed to client's system than their own. This happens especially where the organizations have long relationship. This is counterintuitive in the sense firms are expected to follow quality processes as per their systems and in their interest. But this hypothesis states that the level of quality processes depend on clients' priorities and thrust.

H10: Higher the Client's emphasis on Cost Leadership. Higher the RC's emphasis on Project Level Cost Control

This is similar to Hypo 5 on price pressure. Price pressure could be market driven whereas cost pressure comes from client's strategic thrust. Literature has shown that product differentiation will lead to more decentralized structure than cost leadership (Jermias and Gani, 2004). Cost leadership and cost arbitrage has been one of the selling points of software companies in India and this is an important contingent variable. This also means where the thrust is not cost leadership, the control may not be primarily cost oriented. Here the focus is on project level cost control whereas in the earlier hypothesis dealing with price pressure from market we were referring to organizational level cost control system.

H11: More the QC is followed for Credence Factor, higher will be Perceived QC

Earlier hypothesis on quality processes states that it would depend on client's thrust on quality. Independent of this, it can be stated that if a quality process is followed more to demonstrate to client, than from an internally driven felt need, then perceived control over quality processes may be weak. Here the quality control is undertaken mainly for credence factor. Darby and Karni (1973) define credence properties as, "characteristics which the consumer may find impossible to evaluate even after purchase and consumption". In this it is generally perceived to be undertaken for reasons of establishing credibility with clients. Corollary to this hypothesis is, if QC is followed to meet internal felt need, then perceived control will be more. Ideally following quality processes should lead to less development and support cost in terms of system integration cost, testing costs, bugs fixing costs, less cycle time, less customer complaints, etc. But, if a firm does not see its intrinsic value and see it only for its credence factor, implementation may be more ritualistic, whereas if it is for intrinsic benefit, it will be implemented in spirit. Also, where it is done for client sake there are issues of sharing of costs and extent of documentation. In cases where the company is following quality processes because it perceives a value, it would be then open to bearing the cost of the processes. Carr et.al. (1997) studied management practices and performance reporting between ISO accredited and non ISO accredited companies. Darby and Karni (1973)

stressed the credence factor, and observed that Quality Improvement Projects can arise from: (1) cost of poor quality reduction, (2) external customer impact, (3) ability to control the solution, and (4) degree of difficulty in resolving the problem.

4 Research Setting

The study was conducted in two large Indian multinational software companies. Each company has turnover of about US \$ 5 billion and employs more than 100,000 software employees. Both are SEI CMM level 5 companies and known for their pioneering work in off shore development and professional management. The design of software companies are generally similar, and in these cases their structures are more or less similar with verticals headed by a SBU heads, assisted by Project management and business development team, delivery teams, with similar hierarchies.

The study is based on survey method. The respondents are from various locations in India and throughout the globe. The target group for the study was project manager / team manager level in these organizations which will be at least two levels below the heads of strategic business units. They constitute the delivery teams and middle management of these firms. Their level corresponds to RC or unit level that we proposed to study. The respondents would be typically heading a project team and they are referred as profit center heads in these organizations. It was ensured in the survey that they are more or less at similar level but from different verticals and geographies.

A questionnaire was designed to capture the dimensions of control system and their determinants (see Table A) drawing upon previous literature and discussion with the software professionals. Several items (indicants) were developed to indicate each of the research variables. The respondents were required to respond to each of these items on 5-point Likert-type scale. Annexure I gives a list of these items. The questionnaire design was fine tuned to reflect the organizational and operational characteristics of software organizations. The authors had the advantage that one of them had worked in a software company and had the opportunity to observe it from close quarters.

The questionnaire items were presented to some experts for the purpose of content validation. They were given these items and asked to match them with the research variables. The match was found to be acceptable. The questionnaire was also first administered to select software professionals from different software companies at different levels to understand their interpretations of the items. This is to test the selection of control characteristics of software industry, interpretation issues, and relevance of selected items. Some clarifications were sought and the relevant items were accordingly revised.

The basic premise of this work is to study the control system at project level. Hence project is taken as a unit of analysis. The questionnaire asked the respondents to give their responses keeping a recently completed project as the referral project.

The survey was administered through the Human Resources departments of the two software companies. The questionnaire was posted on the website of the Institute of the authors. The HR departments sent mails to the potential respondents – project managers, team leaders, business heads typically with a total experience of 5 years plus and managing teams of strength ranging from 5 to 60 team members. They were also from different verticals like banking, health care, transportation, etc. which is critical to our analysis. These mails provided the web link to the questionnaire. They were given two weeks time to complete the questionnaire. One more reminder was sent at the end of the two weeks with an extension of one week.

		Location				Total
		India	US	Europe	Others	
Organization	Firm-1	37	2	0	0	39
	Firm-2	26	6	3	2	37
Total		63	8	3	2	76

Table B: Organization and Location Cross Tabulation

	N	Median	Mean	Std. Deviation
Experience (months)	76	7.00	6.2632	3.50759
Experience with company	76	4.00	4.5605	2.87403
Professional man-month (estimated)	72	40.00	161.7083	277.51226
Professional man-month (actual)	72	41.50	165.2500	281.88874
Project duration (estimated)	73	13.00	21.6781	18.22341
Project duration (actual)	73	14.00	21.7329	18.41612
Share of offshore work	74	75.00	69.9595	17.63903
Team size	75	20.00	29.1867	58.02532

Table C: Descriptive Statistics

5 Discussion

5.1. Respondent Analysis

Each company sent the mails to about 100 professionals and a total of 76 responses (39 from firm-1 and 37 from firm-2) were received. See Table B. About 80% of the responses were received in response to the first mailer itself. A profile of respondents is given in Table C. On an average these respondents have a total work experience of 6.2 years of which 4.5 years are with the latest company. Man-months and project duration [months] of these projects are 165.25 and 21.7 respectively which make it a fairly midsized to large sized projects. So, a fairly representative sample of professionals working at middle level of a typical large software company was obtained.

5.2. Questionnaire Analysis

At the outset, the questionnaire was tested for validity and reliability. Each variable is factor analyzed using principal component method, and cronbach's alpha (with all hypothesized items and least cronbach's alpha when one item is removed at a time).

s.no.	Variable	Principal Component Method		Cronbach' alpha
		No. of dimensions	% variance	
I1	Product Market Competitiveness	1	53.2	0.696
I2	Client criticality	1	52.8	0.806
I3	Client power	4	73.1	0.835
I4	Price pressure from client	1	57.3	0.751
I5	Price pressure from product market	1	64.1	0.439
I6	Profitability of the vertical	2	74.3	0.755
I7	Profitability of the project	1	63.3	0.704
I8	Product differentiation	2	62.4	0.630
I9	Clients' emphasis on QC	1	48.3	0.778
I10	Clients' emphasis on cost leadership	1	59.5	0.659
I11	QC for credence	2	67.8	0.519
D1	Decision Rights	2	70.8	0.916
D2	Organizational level control	2	73.4	0.932
D3	Cost focus by top management	1	67.4	0.878
D4	Unit's emphasis on QC	1	56.6	0.791
D5	Project level cost control	1	64.0	0.883
D6	Perceived QC	1	68.7	0.883

Table D: Summary of Questionnaire Analysis

The purpose of this work is not the development of the scales for the variables that are used in this study. However, some preliminary analysis was done to investigate the dimensionality and internal consistency of the measures used. All the measures were factor analyzed using principal component analysis.

As Table D indicates, the factor analysis resulted in one factor with considerable percent variance explained for several variables. Other measures resulted in two factors with exception of ‘client power’ which had four factors. In all, variance explained for any variable is above 50% with the exception of ‘clients’ emphasis on QC’ which is 48.3%.

In order to interpret the variables that resulted in more than one factor on principal component analysis, they were subjected to Varimax method of factor rotation. Client power, on factor rotation, resulted in four dimensions which could be named as (a) client’s competency (consisting of variables: client’s vendor management skills, client’s vendor management processes, his belief in outsourcing, his EDP involvement which reflect); (b) team stake in the project (consisting of variables: importance of project to team manager evaluation and compensation, and team evaluation); (c) clients’ influence (consisting of variables: client’s role in deciding reporting, in deciding off shoring, and in team selection); and (d) clients’ power to ‘effect’ changes (consisting of variables: Fourth one is regarding scope changes and modifications made to the project by the client which is usually resisted).

Likewise, other variables which have more than one factor as a result of principal component analysis were examined. Table E gives the explanation of the rotated factors. Thus, all variables are validated for content validity.

S.No.	Variable	Dimensions
1	Client power	a. Clients’ competency b. Stake in the project c. Clients’ influence d. Clients’ power to effect changes
2	Profitability of the vertical	a. share of the contribution b. client centricism as a strategy towards profitability
3	product differentiation	a. product technology characteristics b. product niche characteristics
4	QC for Credence	a. external thrust of client b. burden of cost on client
5	decision rights	a. planning focus b. estimation focus
6	organization level control	a. resource utilization centric b. deviations centric

Table E: Varimax Rotated Dimensions of Some Variables

These variables were also analyzed for reliability using Cronbach’s alpha. Cronbach’s alpha is above 0.5 for all variables except for ‘price pressure from product market’ for which Cronbach’s alpha value is 0.439. But for this exception, the items developed for measuring these variables appear to be internally consistent and the reliable. Further work

is needed to improve the reliability of this variable measurement. For each variable, further analysis is conducted using corrected item-total correlations to see change in Cronbach's alpha if any item is dropped. Cronbach alpha values did not significantly vary indicating relevance of the items for the variables and good amount of reliability for the measures developed.

5.3. Tests of hypotheses:

In order to test the hypotheses, correlation analyses were performed (Ref Table F).

SNo	Hypothesis	Correlation	Signif. Level
1	More Competitive the Product Market of a RC, Higher the Decision Rights of the RC	0.276	0.016
2	More Critical the Client is to the Vertical, Higher the Decision Rights of the RC	0.457	0.000
3	Higher the Client Power, Higher the Decision Rights	0.373	0.000
4	Higher the Price Pressure from the Client, Higher the Perceived Organizational level Control (OLC)	0.432	0.000
5	Higher the Price Pressure in the Market, Higher the Cost Control by Top Management	0.504	0.000
6	Higher the Profitability of the unit, Higher the Decision Rights	0.245	0.033
7	Higher the Profitability of the Project, Higher the Decision Rights	0.395	0.000
8	Higher the Product Differentiation, Higher the Decision Rights	0.418	0.000
9	Higher the Client's thrust on QC, Higher will be the unit's emphasis on QC	0.699	0.000
10	Higher the Client's emphasis on Cost Leadership. Higher the RC's emphasis on Project Level Cost Control	0.336	0.003
11	More the QC is followed for Credence Factor, higher will be Perceived QC	0.421	0.000

Table F: Tests of hypotheses

The results validate all the hypotheses stated above. Table F indicates the correlation coefficients and the observed significance levels for each hypothesis. First and sixth hypotheses are significant at 5% significance level and the rest are significant at 1% significance level. The results show that the differences in control system at intra-organizational level can be better explained through characteristics like product profitability, client and market structure, apart from much discussed determinants like size, technology, top management style, delegation, etc.

The results show that it is important to study control system at RC level and that it is necessary to capture the differences in control at RC level and its determinants. This paper has extended the level of analysis to RC level from organizational and SBU levels.

One significant contribution of this work is relating the manifested control system to the respective environment of RCs; and relating it to additional dimensions as control system determinants, a gap identified in the literature review. It emerges that perceived controls do vary among RCs and that these are influenced by variables which are usually studied at the level of organization or SBUs only. For example, the influence of competitiveness of product market or profitability of the product line on MCS has been studied at organizational or SBU level, but was not extended to sub unit or RC level. This work has confirmed that these factors are relevant at RC level as well.

This study has shown that certain dimensions like the influence of the product markets, client power and client characteristics, and their strategic thrust do matter for control systems at RC level. These dimensions can be and need to be studied at Organizational and SBU levels also as determinants of control system. The contingent studies need to extend determinants to strategic and product market characteristics also. For example, Organizations which operate in markets with high buyer power may adopt tight MCS vis-a-vis organizations which operate in markets with seller power. Thus this study tries to link strategic considerations and control system, and throws up several research possibilities at RC level and equally extendable to organizational level.

The results show that, in a given organization, MCS varies at RC level depending on certain contingent determinants. In other words, it is probably not appropriate to have a uniform control system all through the organization, particularly when the organization is dealing with significant variation on the fronts of products, markets, and clients.

It is important to note that the hypotheses are not about the effectiveness or ineffectiveness of the control systems. The study indeed is set in the context of contingency model to identify the determinants of the control system at RC level. However, going by congruence school of thought, the fact that the respondent organizations are high performing organizations suggests that the control systems designed consistent with the hypotheses studied here are likely to perform better.

6 Conclusion

The study proposed that control system variations at unit level is an useful field of analysis. It proposed that manifestations of control system and its variations at RC level are best explained by factors like unit and project profitability, client characteristics, and product market characteristics. A survey was undertaken in software industry as tasks at operational level are fairly similar and standardized. The study validated all the hypotheses stated. We find evidences also for hypotheses on influence of QC, cost leadership and quality as a credence factor. It can be said that given the technology, organizational environment, organizational structure, top management style; the intra organizational differences in control characteristics at unit level can be attributed to influences of sub unit client profile, product market and unit and project profitability.

This study is not without its limitations. As pointed out earlier, Cronbach's alphas for most scales used to measure the research variables in this study are acceptable except for

one variable, namely, price pressure from product markets. This study needs to be extended to other types of industries as well.

The study will be useful to system designers and control specialists in many ways. The merit of the finding is that organizations should be aware of differences in the manifestation of control system and not just go by formal structures and distribution of control. The challenge is in simulating price pressure and market pressure even where it is weak to ensure effective control. That a client's pressure is low or profitability is high is no reason why the vertical or unit can be lax in control.

Software industries are primarily project management oriented firm. So, this can also be taken as study of control system in organizations which are structured primarily around projects like construction companies. This study can be extended to firm from other industries which are project oriented.

This study has basically supported the view that, in case of managing the projects in software firms, the control system variables are related to the project related context variables. It is now appropriate to further explore this line of research. It is now imperative to understand these types of controls and develop reliable measures for further research in this field.

Annexure I Questionnaire items:

Decision Rights (D1):

- D1-1. Your Role in effort estimation
- D1-2. Your Role in final quote
- D1-3. Your Role in deciding deliverables
- D1-4. Your Role in deciding scheduling
- D1-5. Your Role in deciding on shore - off shore mix
- D1-6. Your Role in team selection
- D1-7. Your Role in deciding head count
- D1-8. Your Role in deciding skill selection
- D1-9. Your Role in deciding experience mix
- D1-10. Your Role in deciding hiring temporary professionals

Organizational level control (D2):

- D2-1. Control focus in the Project on cost
- D2-2. Budget tightness
- D2-3. Control focus on offshore resources
- D2-4. Control focus on head count
- D2-5. Focus of Monitoring on mile stones
- D2-6. Focus of Monitoring on man months
- D2-7. Escalations in the project on budget issues
- D2-8. Budget variance in the project in the end
- D2-9. Contribution of Control process towards controlling costs
- D2-10. Top Management focus on cost control

Cost control by management (D3):

- D3-1. Control focus in the Project on cost
- D3-2. Control focus on offshore resources
- D3-3. Escalations in the project on budget issues
- D3-4. Contribution of Control process towards controlling costs
- D3-5. Top Management focus on cost control

Unit's emphasis on QC (D4):

- D4-1. Control focus in the Project on Quality
- D4-2. Extent of documentation in the project
- D4-3. Monitoring on specifications
- D4-4. QC usefulness in ensuring quality assurance in the project

Project level cost control (D5):

- D5-1. Control focus in the Project on cost
- D5-2. Control focus on head count
- D5-3. Focus of Monitoring on man months
- D5-4. Escalations in the project on budget issues
- D5-5. Budget variance in the project in the end
- D5-6. Contribution of Control process towards controlling costs

Perceived QC (D6):

- D6-1. Control focus in the Project on Quality
- D6-2. Extent of documentation in the project
- D6-3. QC usefulness in ensuring quality assurance in the project
- D6-4. QC process similarity with other projects
- D6-5. Top management focus on quality control

Product t market Competitiveness (I1):

- I1-1. Competitive level of Vertical's product market
- I1-2. Vertical competes on price factor
- I1-3. Level of competition from Indian company for the vertical
- I1-4. Level of competition from foreign company for the vertical

Client criticality (I2):

- I2-1. Criticality of the project to your vertical as referral value
- I2-2. Learning value from this project in Domain
- I2-3. Learning value from this project in Skill
- I2-4. Criticality of the project to your vertical for product development
- I2-5. Learning value from this project in Quality Processes
- I2-6. Learning value from this project in Project Management

Client power (I3):

- I3-1. The importance of this project to your evaluation
- I3-2. The importance of this project to your compensation
- I3-3. The importance of this project to your team evaluation
- I3-4. Client's intensity of involvement in the project
- I3-5. Client's Emphasis on Documentation
- I3-6. Client's vendor management skill
- I3-7. Client's vendor management processes
- I3-8. Client's belief in outsourcing
- I3-9. Client's EDP dept involvement
- I3-10. Role of the client in deciding reporting system
- I3-11. Role of the client in deciding on shore / off shore mix
- I3-12. Role of the client in Team selection

Price pressure from client (I4):

- I4-1. Price Pressure on this project
- I4-2. Bid was won on cost considerations
- I4-3. Significant cost savings to client possible from the project
- I4-4. Client's focus on cost control

Price pressure from product market (I5):

- I5-1. Price pressure on this project
- I5-2. Clients focus on cost control

Profitability of the unit (I6):

- I6-1. The profitability of the vertical
- I6-2. Profit growth of this vertical
- I6-3. Vertical competes on Niche factor
- I6-4. Contribution by your vertical to the overall profit of the organization

Profitability of the project (I7):

- I7-1. Overall profitability expected at bidding stage
- I7-2. Price Pressure on this project
- I7-3. Profit variance of the project
- I7-4. Criticality of the project to the overall profitability of the vertical

Product differentiation (I8):

- I8-1. Bid was won on quality / technical considerations
- I8-2. R & D Content
- I8-3. Modifications made to specs during project
- I8-4. Can make Significant contribution to client's service quality
- I8-5. Vertical competes on Niche factor

Clients' emphasis on QC (I9):

- I9-1. Bid was won on quality / technical considerations
- I9-2. Can make Significant contribution to client's service quality
- I9-3. Client's intensity of involvement in the project
- I9-4. Client's Emphasis on Documentation
- I9-5. Client's vendor management skill
- I9-6. Client's vendor management processes

Clients' emphasis on cost leadership (I10):

- I10-1. Bid was won on cost considerations
- I10-2. Significant cost savings to client possible from the project
- I10-3. Client's focus on cost control

QC for credence (I11):

- I11-1. Additional cost incurred to meet QC processes should be borne by the vendor
- I11-2. Your organization thinks QC is followed more to satisfy clients' requirements
- I11-3. You think QC processes are followed more to satisfy client's requirements
- I11-4. Top management focus on quality control

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