

Cultural analysis for ICT integration: Case study analysis of a construction project

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ABSTRACT: Culture is considered central to the way an organization forms and performs. In this regard it can be used to understand and explain organizational phenomena including the level of engagement with Information and Communication Technology (ICT). The aim of this paper is to discuss the impact of culture on the extent of ICT integration within the context of a construction project, using the cultural analysis framework proposed by Gajendran & Brewer (2007). This framework maps the influence of culture on the seventeen aspects of ICT integration, enabling the assessment of the impact of culture on the extent of ICT integration. Application of this framework requires deciphering the cultural assumptions or beliefs of key project team members. Therefore an ethnographic interview approach, being a commonly accepted data making technique in cultural studies, was used to extract the tacit cultural beliefs. These beliefs are then transformed into the cultural analysis framework to assess the extent of ICT integration. It was found that the ICT engagement in the case study project was dominated by fragmentation arising from a lack of project leadership combined with non-aligned technology. These negative aspects were offset by underlying trust and respect in the project team.

1 INTRODUCTION

Culture is a critical phenomenon that has the ability to influence all areas of the life of an organization. It has been observed that the culture of a construction project influences the level and quality of Information and Communication Technology (ICT) uptake and integration. Previous research has deciphered the range of values held by industry practitioners, and identified the espoused values that leads to critical success factors for integration of ICT (Gajendran and Brewer 2007). In doing so it has revealed that the culture espoused by the industry in this regard is in fact an analogue of the desired cultural values a project environment, which in turn should engender ICT integration. Unfortunately in practice it has been found that very few real life project cultures reflect these cultural attributes. This results in widely differing levels of ICT integration (or fragmentation) across different projects, and makes the transition for a practitioner or firm from one ICT-enabled project to another quite problematic. It follows that a comparison of the actual culture of projects with the

espoused culture provides a basis with which to identify the issues in that lead to sub-optimal levels of ICT integration. The aim of this paper therefore is to present the results of a single case analysis that maps the actual culture of a construction project to the espoused culture of the industry.

This paper employs the Cultural Analysis Framework for ICT integration proposed by Gajendran and Brewer (2007) to map the actual cultural characteristics of the environment into which ICT is deployed, using a case study of a construction project. It uses ethnographic interview techniques, together with open and axial coding protocols to make data for this case study. The underlying assumptions and beliefs held by the members of firms in the project are then deciphered from this data using a further round of coding leading to abstraction. Thereafter, the underlying cultural beliefs held by the project members are taken as manifestations of the actual project culture. This paper concludes by identifying the cultural issues that impact on the level of ICT integration or fragmentation in the case study construction project.

2 CULTURAL ANALYSIS: EXPLAINING THE FRAMEWORK FOR ICT INTEGRATION

2.1 Background to culture and cultural assessment

'Culture' is a complex concept in terms of conceptualization and assessment. Culture researchers and their work are divided along the lines of culture conceptualization, manifestations that represent culture and how culture is assessed. The organizational culture in literature is conceptualized as both a 'strong prescription for success' and 'interpretation for better understanding'. Although literature on culture generated no clear agreement as to what culture actually was, or how it could be measured/assessed, an agreement on using cultural analysis as an approach to deal the concept of culture has emerged (Martin et al., 2004, Willmot, 2000).

A culture emerges from the underlying assumptions and beliefs of a group about how the world operates and what a group of people share. This determines their perceptions and feelings, and to some degree, their overt behavior. Schein (2004) defines culture as:

'a pattern of shared basic assumptions [beliefs] that was learned by a group as it solved its problems of external adoption and internal integration, that has worked well enough to be considered valid and, therefore, to be thought to new members as the correct way to perceive, think, and feel in relating to those problems' (p 17)

The manifestations that represent culture can be from the surface layers to inner layer of culture. Artifacts such as rituals and behavior represent surface layers, while the inner layers of culture are reflected by the underlying beliefs held by the members of a group (Schein, 2004; Rousseau, 1990). The cultural beliefs are also classified into to: espoused and actual. Espoused or claimed (beliefs) are that people

desire or think they should adopt. Actual beliefs are the ones they adopt in their workings. Literature suggests that that deciphering of culture through surface level manifestations such as overt behavior is not a reliable and recommends deciphering deep level of manifestations such as underlying assumptions or beliefs. Therefore, one can observe "inconsistencies" or "conflicts" in overt actual beliefs leading to a behavior and the claimed values (i.e. espoused values.)

2.2 ICT Integration

The term 'ICT integration' is synonymous with optimum level of organizational effectiveness, although the meaning of 'integration' is less well understood in terms of ICT. The review of literature proposes number of different views of ICT integration and proposes that ICT integration is more meaningful when it is conceptualized across the supply chain of a TPO. Moreover, the need to conceptualize ICT integration beyond technology was evident. (Wainwright & Waring. 2004; Gajendran & Brewer 2007).

Therefore, a focus on organizational and strategic aspects along with the technical aspects provides a wider and proactive approach for implementing ICT Systems. Although it is believed that, extensive levels of ICT integration in a project would lead to efficiency gains, in reality the complexity involved in achieving integration in terms of system-wide, strategic and organizational issues, when progressing along a continuum from intra-firm automation to project-wide integration is enormous. This complexity is best understood by the cultural analysis.

2.3 The cultural analysis framework

Gajendran & Brewer (2007) identified seventeen

No.	Aspects of ICT Integration	Espoused Value	Cultural Perspective Integration	Cultural Perspective Differentiation	Cultural Perspective Fragmentation
Organisational Integration Issues					
1	<u>Organisational Commitment</u> Successful ICT implementation requires the:	The espoused value is that the organisations: (a) Senior management should embrace ICT and commit to implement ICT in their organisation/when there is potential for ICT to support operations.	There is a shared understanding and consensus among: (a) Senior managers of organisations on the potential role of ICT and the required level of their commitment to ICT ventures	There is shared understanding and consensus within, but not across, the sub groups or sub cultures of: (a) Senior Managers (e.g. managers in charge of- Estimating, Site administration, Human Resource, Head contractor, Sub contractor, Architect etc.) about the ICT commitment	Ambiguity and un clarity prevail in the working environment, therefore: (a) Senior managers from difference organisations do not have a shared commitment (and conflict) on ICT drive.
2	(a) The commitment of a firm's senior management.	(b) Employees need to commit to engage with ICT tools those support/enhance their personal work environment	(b) Employees of different sections of a firm and across a project believe in the contribution of ICT and understand the required level of commitment to ICT engagement.	(b) Employees (Drafting/ architects vs. model building or a specialist vs. trade sub contractor) on commitment level on ICT engagement	(b) Employers have conflicting believes on the level support that ICT provides to them
3	(b) The commitment of an organisation's employees	(c) Members of the team should develop trust and transparency within the project environment	(c) Members of organisations about developing trust and transparency among themselves	(c) Projects about the nature working relationship with other members. e.g. an architect group may hold, an assumption of not trusting	(c) Flow of information may be hindered driving preconceived professional notions and developing lack of trust and transparency among members
	(c) Transparency and trust among project team participants				

Figure 1: Extract of a section from the Cultural Analysis Framework for ICT integration (adapted from Gajendran & Brewer 2007)

ICT dimensions grouped under six ICT aspects that the construction industry participants claimed should prevail for effective ICT integration. These were gleaned from an industry-wide survey to extract the espoused values relating to ICT integration, these being the claimed values the members of an organization display.

As per Schein's definition, the actual culture is best deciphered through the underlying cultural beliefs of project team members. Although the construction industry members may claim that certain values for ICT integration are essential, their actual cultural beliefs and associated behaviors may not adhere to this.

Each project environment is different from any other due to the unique nature of its construction process and the particular project team composition. Correspondingly the nature of the team's beliefs, including those based on their past experience, will be distinct and likely not to generate a unitary project culture. Based on the level of shared understanding and consensus of the cultural beliefs of project team members the eventual project culture can take an integrated, differentiated or fragmented form.

The cultural analysis framework enables each project environment to be culturally profiled in regard to each ICT integration aspect. The cultural profiling of a project will likely result in a varying map of the project environment, including the regions that are predominantly integrated, differentiated or fragmented. Figure 2 provides a sample of the connections between the cultural forms associated with an ICT integration aspect. It characterizes the range of possible 'shared beliefs' (an analogue of 'assumptions') that members of projects could hold as a result of belonging to one or more of three cultural perspectives, namely Integration, Differentiation, or Fragmentation.

In summing up (Gajendran & Brewer 2007):

"In the integration form the "underlying assumptions of the members an organization or project are shared and consistent across all units, which provides harmony among members and promotes effectiveness. The projected outcome or the strategy implementation in this cultural environment is based on removal of formal irrationality"

"In the differentiation "sub groups ... share the same beliefs creating sub cultures. However, assumptions are not shared across groups and therefore conflicts may be observed among groups, but not within groups. The projected outcome or the strategy implementation in this cultural environment is based on removal of misunderstanding"

"In a fragmentation perspective, "assumptions of the members are not shared and ambiguity and confusion dominates the environment. The projected outcome or the strategy implementation in this cultural environment is based on removal of socially unnecessary suffering"

By the way of example and in regard to the particular issue of senior management commitment to ICT engagement the following scenarios would arise depending upon the cultural perspective (Ref. Fig 1): In an integrated environment - almost all senior managers of the firms part of a project believes in ICT and are willing to commit to ICT.

In a differentiated environment - groups of senior managers have varying beliefs about the ICT engagement and therefore commit to different levels of ICT engagement.

In a fragmented environment - there are no consistent beliefs.

Utilizing this model requires actual cultural beliefs to be deciphered from a cultural context, in this case a construction project. The research method section below describes the method employed.

3 RESEARCH METHOD

This research employed an in-depth ethnographic interview technique to extract data from five members of a construction project. "Any person-to-person interaction between two or more individuals with a specific purpose in mind is called an interview" (Kumar 2005, p 123). The interview design (script and interview process) for this research used semi-structured questions, and applied the principles raised by Spradley (1979) in conducting the ethnographic interviews to extract rich data.

The interview questions were constructed with the intention of extracting the influence of culture on the ICT integration issues in the construction project. The aim of this ethnographic interview is to extract the tacit underlying assumptions and beliefs held by the project team members in relation to ICT integration.

Table 1: Cultural Analysis: Cultural forms influencing aspects of ICT integration

No.	ICT Integration Aspect	The espoused value is that the organisations:	Actual Cultural Form
Organisational Integration Issues			
<u>Organisational Commitment</u>			
	Successful ICT implementation requires the:		
1	(a) z The commitment of a firm's senior management.	(a) z Senior management should embrace ICT and commit to implement ICT in their organisation/when there is potential for ICT to support operations.	Differentiated
2	(b) z The commitment of an organisation's employees	(b) z Employees need to commit to engage with ICT tools those support/enhance their personal work	Differentiated
3	(c) z Transparency and trust among project team participants	(c) z Members of the team should develop trust and transparency within the project environment	Integrated
<u>Rights and duties</u>			
	Successful ICT implementation requires:	The espoused value is that the organisations:	
4	(a) z The identification and sensitive handling of the ownership of the intellectual property generated during a project	(a) z Contractual arrangements should encompass safeguard on intellectual property rights.	Integrated
5	(b) z The project team members to acknowledge the sensitivity and confidentiality of other participants' information	(b) z Members are guided by explicit codes of practice and informally held ethics and moral values. The source of these value codes may come from the organisation's procedures, personal upbringing or by	Integrated
6	(c) z A powerful ICT 'champion' to support the technologically weaker organisations in project teams	(c) z Powerful member should support the weaker members through leadership, collaboration or as a result of their positional power.	Fragmented
Strategic Integration Issues			
<u>Organisational Commitment</u>			
7	(a) z An organisation's continuous and conspicuous investment in staff development and training	(a) z Should continuously invest in their staff ICT development programs and training	Differentiated
<u>Support and Assurance</u>			
	Successful ICT implementation requires:	The espoused value is that the organisations:	
8	(a) z A 'powerful organisation' within the team to impose ICT adoption	(a) z Could impose 'power positions' within the project to encourage appropriate level of ICT use in a project environment	Fragmented
9	(b) z A 'champion' to support all new technology that is to be used across a project team within a firm/Project.	(b) z Leadership structure should engage in giving proactive direction in the use of new ICT tools and techniques	Fragmented
<u>Organisational Attitude</u>			
10	(a) z Standard conditions of contracts that specifically accommodate the issues raised by the use of ICT	(a) z Need to maintain contractual clarity in ICT employment through stipulating conditions of contract and adherence to the conditions. This also could be viewed as an industry regulators role.	Differentiated
11	(b) z An organisation to be prepared to engage in long-term collaborative relationships	(b) z Preparedness to engage long-term relationships with trading partners.	Differentiated
<u>Investment drive</u>			
	Successful ICT implementation requires:	The espoused value is that the organisations:	
12	(a) z Organisations to commit to ICT as a long-term strategic decision.	(a) z Commitment to engage in long term strategic relationships with trading partners to foster return on large ICT investments	Integrated
13	(b) z Organisations to commit to ICT as a project-based tactical decision.	(b) z Commitment to engage with ICT in project to project basis in short run in small ICT investments	Differentiated
14	(c) z The organisations to monitor competitor's ICT adoption.	(c) z Need monitor the competitors to gain potential competitive advantage	N/A
<u>Communication structure</u>			
	Successful ICT implementation requires:	The espoused value is that the organisations:	
15	(a) Addressing the fragmentation issues of the project team for improved performance of ICT-enabled operations.	(a) z Must engage in procurement methods that minimises fragmentation of project teams.	Fragmented
Technical Integration Issues			
<u>Communication structure</u>			
16	Organisations try to limit their use of multiple online systems promoted by different project participants.	This factor can be viewed purely as a technical (interoperability) issue, outside of cultural considerations. However, one can relate the espoused values to Item 12	Fragmented
<u>Support and Assurance</u>			
17	The security of information is vital in an ICT-enabled project environment.	this can also relate to the espoused values relating to the level of acceptance of ICT security by members of	Differentiated

4 DATA ANALYSIS

4.1 Background to the case study

The case study project is an extension of a facility for an educational institute. This project was procured through the construct-only traditional procurement path. The principal contractor was appointed through a competitive tendering process, while the consultants were appointed through a design competition. This project employed limited ICT to assist design and construction processes.

The use of a Building Information Modeling (BIM) in the design stage by the architects was not continued into the construction stages, as the project team was not capable of dealing with BIM. Moreover, none of the project team members engaged with the online communication system introduced by the architect. The lack of engagement was partly caused by a lack of awareness of the existence of the system by some members, and partly because its use was not mandated in the conditions of contract.

Team members used emails and printed media. The principal contractor did not use any online collaboration platform to communicate with the subcontractors. All parties used email and telephones as a communication medium. This project was characterised by a very low level of ICT tools. With the exception of the architect and the structural engineer, the project team members did not have any prior working relationships.

Table 1 maps the cultural forms (namely integrated, differentiated or fragmented) that influence the adoption of ICT in the case study. This framework translates the cultural beliefs in order to identify the prevailing form of culture that influences each aspect of ICT integration. The results in Tables 2 & 3 are then transformed into quantitative percentages to give a sense of the prevailing forms of culture - that is the level of integration, differentiation and fragmentation of ICT aspects. Textual description of the culture further explain the actual cultural context and behaviours behind the percentage numbers.

4.2 Organisational commitment

A lack of commitment to ICT was evident from some senior managers. The principal contracting firm showed a disinterest in changing their normal practice. The engineering firm was cautious in committing to ICT initiatives. However, commitment was evident from the QS and architect firms in developing ICT-led processes. Therefore there was shared understanding and consensus by some, but not all the senior managers and employees about committing to engaging with ICT (No- 1 & 2-Differentiated).

Project Engineer: “We are careful not to jump in too soon ...we are not super high-tech here. ... And we need to be able to talk to architects at their level, using the same software.

Principal Contractor: “But as far as our business is concerned, you know, we can receive drawings over e-mail and stuff like that ourselves, so as long as we have got that facility, our subbies don't need it as much. ... Your concretors and your bricklayers and stuff like that -- they operate out of the back of a truck so I don't think they are going to change very much”....

Quantity surveyor/Project Manger: “we are in a very very fortunate position in that we can assist in developing it [ICT].

Although the engineers, architects, contractors and sub contractors acknowledged the importance of ICT and training, they displayed varying levels of commitment for ICT training. Therefore, shared understanding and consensus was evident in places, but not across the entire project in regard to the required level of ICT training for employees (No 7-Differentiated).

Project Engineer: “.... Not everybody is trained and able to look at AutoCAD, for example. ..., then that's the sort of thing that we have to look at, training up people to use it, providing the cost implications are not too way out.”

Distrust among firms was not evident. Therefore, there was a shared understanding and consensus within and across the project about developing trust and transparency among themselves (No 3- Integrated). This assisted in avoiding conflicts.

Project Architect: I think there was a certain level of trust.

Principal Contractor: A lot of the work up here is done more on trust “

Client: “ ... Not at all in fact. People were very easy about that. There were no trust issues. I think there was a certain level of trust.”

Overall the aspect of ICT integration known as ‘organizational commitment’ was characterised by a mixture of ‘Integration’ and ‘Differentiation’.

4.3 Rights and duties

Some firms were dissatisfied with the level of adherence to their rights and duties in the project by other firms. The contractor's team felt that the client, project manger and consultants did not perform their duties appropriately. Consultants showed marginal interest in the project during the construction stage and did not attend site meetings and did not respond to site-specific queries in an orderly manner. Although this caused significant anguish in the construction team they did not exercise their contractual rights to address this issue. This avoided creating an adversarial atmosphere. That is the contractor did not take an opportunistic approach to exploit the un-

certainties generated by the lack of commitment from the design team. The Contractor's team suppressed the possible adversarial impacts that otherwise would have caused chaos by choosing to be less contractual.

There was shared understanding and consensus within and across the project on the intellectual property rights structure (4- Integrated). Moreover, there was a shared understanding and consensus across the project on the information security issues (5-Integrated).

Principal Contractor: "they gave drawings in a CAD format so they could be changed... In most jobs we don't find [obtaining CAD drawings is an issue]. ... There is still the little Copyright thing down at the bottom even if it is in PDF or CAD or whatever."

Project Architect: People were very easy about that. There were no trust issues. ...

It was evident that the architect chose not to support technologically weaker firms to take up the technology. This was partly attributed to dealing with communication in an ad-hoc manner and consequently creating disorderly information flows. Therefore, a shared understanding and consensus did not develop on power structure and the level of support each member can expect from the others (6-Fragmented).

Overall the aspect of ICT integration known as 'rights and duties' was characterised by a mixture of 'Integration', 'Differentiation' and 'Fragmentation'.

4.4 Support and assurance

In this case study none of the firms or project team members displayed any leadership characteristics. The contractor took initiatives to draw a close to the dragging project, due lack of directions from the client and project manager. In terms of ICT implementation the architect did not have the authority or power to craft policies for engagement of ICT. The client and project manager who had the authority

were not interested. Therefore, no shared understanding and consensus existed within or across the firms about the power positions to provide ICT directions (8-Fragmented).

Project Architect: "... In this project particularly we had no control over the fee for the other consultants so they weren't control by us they weren't paid by us. The project manager, who controls the fees, has a much greater chance of getting them to do things their way because they can write it into the agreement ...or tell them "go jump".

Principal Contractor: "it is just business as usual. We have the way we operate and we just get on the job, and if other members in the team want to do it slightly differently, well we try and adapt to that, but otherwise we just get on with the way we have always done it."

The construction team believed that non-commitment of power positions or non-emergence leadership roles thwarted the project. Therefore, a shared understanding and consensus was not evident within sections or across TPO about leadership roles (9-Fragmented).

Principal Contractor: "There was a couple of times where it was a bit tense. One of the consultants sort of..... well it came down in the end to a fee sort of thing. They had spent their fee during the design stage and everyone was supposed to be involved a little bit later on, and he wasn't involved for a long time, and then he came to site and there are a few things there that he wasn't aware of because he wasn't bothering to keep himself in the loop. He was getting all the information sent to him but he wasn't bothering to keep up with it so that caused a bit of friction and a few issues. Anyway, everyone, we all worked very well."

Client: "Some of the initial consultants were probably a little bit sidelined. We did have..... Not so much issues, but.... their design and documentation did then tend to take a back seat during construction and I think that sometimes happens...That can be a problem at the end of the project when, all

Table 2: Cultural Analysis: Extend of ICT integration across the ICT aspects

	Organizational commitment			Rights and Duties			Support and Assurance			Communication Structure			Organization Attitude			Investment drive		
	I	D	F	I	D	F	I	D	F	I	D	F	I	D	F	I	D	F
Form of culture impacting on aspects of ICT integration as a %	25 (1 out of 4)	75 (3 out of 4)		66 (2 out of 3)		34 (1 out of 3)		34 (1 out of 3)	66 (2 out of 3)			100 (2 out of 2)		100 (2 out of 2)		50 (1 out of 2)	50 (1 out of 2)	

Table 3: Cultural Analysis: Cultural forms influencing aspects of ICT

	Overall			Strategic Integration			Organizational Integration			Technology Integration		
	I	D	F	I	D	F	I	D	F	I	D	F
Form of culture impacting on aspects of ICT integration as a %	25 (4 out of 16)	44 (7 out of 16)	31 (5 out of 16)	12 (1 out of 8)	50 (4 out of 8)	38 (3 out of 8)	50 (3 out of 6)	33 (2 out of 6)	17 (1 out of 6)		50 (1 out of 2)	50 (1 out of 2)

Note: I- Integration D- Differentiation F- Fragmentation

of a sudden, they are looking at what has been built and there's issues that arise there.... And if there isn't a certain amount of leadership, those aren't resolved, and they hang on, and hang on and they don't get resolved, and eventually they become a problem.”

There was shared understanding and consensus within sections, but not across the TPO on the level of acceptable security of ICT systems for them to work without fear of information piracy (17- Differentiated)

Project Engineer: “in terms of electronic security, and having to go through a password type situation, those safeguards are there... Because, I guess, when it gets down to it, if somebody really wants to get their hands on a set of plans it is probably easier to do that -- break in to the site shed for example -- it is certainly not as well protected electronically as money.

Overall the aspect of ICT integration known as ‘support and assurance’ was characterised by a mixture of ‘Integration and Differentiation’.

4.5 Communication Structure

Not adopting appropriate processes to address the typical fragmentation issues faced by construction TPOs created some level of disorder in the project. For example, firms were not made aware of the ICT assisted online documentation process initiated by the architect. . Lack of explicit and documented project communication protocols made the information management ad hoc. However it was evident that the negative fragmentation impacts arising from inadequately developed formal contractual/procedural arrangements were negated by the trust factor. Ultimately though no shared understanding or consensus was developed on the processes adopted to deal with fragmentation (15-Fragmented).

Quantity surveyor/Project Manger: “.... It was probably the architect who tried to implement it [online platform] and the architect was unsuccessful in terms of, you know, advising his consultant team that that was how it was working... But I don't think it was implemented correctly by the architect.”....

The technology was not consistently aligned across the project. Contractors were low-level ICT users (networked PC and emails) while architects were high-level ICT users including Building Information Modeling. Some of the sub contractors in the project did not have a need to engage with ICT tools. Therefore, low-level ICT use (email) and paper based trails were used to cater the project communication needs (16-Fragmented).

Project Architect: “We experimented using a BIM [Building Information Modeling] approach to learning documentation, which was quite successful. Up to a certain point. ... Some consultants were quite sophisticated in that respect, in terms of mov-

ing information around, and some were very unsophisticated to the point of electronic communication was almost non-existent. To their inability to produce drawings to scale and distribute them electronically, and that sort of thing. Or have the right information on the drawings at the right time., but it [ICT communication] was ad hoc rather than vigorous processes.”

Overall the aspect of ICT integration known as ‘communication structure’ was characterised by fragmentation.

4.6 Organizational attitude

Risk allocation in the project was based on both formal/contractual and informal-relationships. The uncertainty created by inefficient communication process was partly mitigated by the trust factor developed through the informal relationships. Therefore, shared understanding and consensus was observed within some sections, but not across the TPO about apportionment of project risk and contract enforcement (10- Differentiated).

Shared understanding and consensus was observed within some, but not across all the firms on the need to work in long-term collaborative relationships (11-Differentiated).

Client: “..because of its procurement processes, it tends to be competitively tendered. So that tends to affect the contract tenderer.”

Project Architect: “We had a long relationship with the structural engineer and the mechanical engineer on this project and that, if you like, allows the project to start rapidly..”

4.7 Investment drive

The contractor was not interested in short-term ICT investments. The engineering firm believed in cautious short and long-term investments in ICT. The Architect believed in both short and long term investment, based on the nature of the project into which it was to be deployed. Therefore, a shared understanding and consensus existed within sections of, but not across the entire TPO, to engage (where required) in short term project-related ICT investments, combined with the ability to recoup ROI (16-Differentiated).

All project members believed that long-term relationships required investment in ICT. Therefore, a shared understanding and consensus developed within and across the TPO on the need to foster long term relationships, which in turn required them to commit to large ICT investments (15- Integrated).

Project Architect: “The issue is though that consultants have to be on the latest iteration of software that they use. Otherwise instantly, compatibility issues come in and high-level CAD software is very expensive and consultants tend not to upgrade

unless they actually have to. So the cost not to upgrade = cost not to collaborate. ...

Principal Contractor: "No. For the jobs that we do where 12 months is probably the average time on-site -- I don't know, I suppose -- long-term bit probably would be..... And the subbies want to be involved for as long as they can, so they will make the investment to get all that gear and to be able to do it."

The shared understanding and consensus on the need to monitor competitors' behaviour was not explicit in the case analysis (17- Not evident).

Overall the ICT integration aspect 'investment and drive' in CS3 was influenced by a mixture of 'Integration' and 'Differentiation'.

5 DISCUSSION

Tables 1, 2 and 3 illustrate that this project culture can be categorised as a mixture of 'integration' (25%), 'differentiation' (44%) and 'fragmentation' (31%). However, the fragmentation cultural form dominated the ICT integration aspects.

Fragmentation in the 'communication structure' had a significant impact in creating ambiguity and frustrations among the contracting team. Some sections of the project team not performing their duties, and others not exercising their rights also contributed to some level of fragmentation. Moreover, inadequate consideration to 'support and assurance' by stronger firms to weaker firms contributed the lower than expected level of ICT integration. On the other hand, partially integrated 'organizational commitment' and 'rights and duties' provided a sense of confidence and strength among the firms. The technical aspects of the project were partly fragmented (50%) and partly differentiated (50%).

ICT aspects from the 'Organizational Integration Perspective', were dominated by the 'Integration' (50%) form of culture. The integration was related to trust building, and respecting others information rights. From the organizational perspective, fragmentation negatively impacted upon the issue of supporting the technologically weaker firms. From a 'strategic integration perspective', the project displayed fragmentation in terms of powerful players providing leadership and direction to the issue of ICT engagement (Ref. Table 3).

The client and contractor team had different perceptions on the emergent project culture. The contracting team experienced frustrations while the consultants' experienced a positive environment. The construction team's decision not to exploit the lack of contractual commitment displayed by the consultants' generated a positive feel among the consultants. Therefore, the effects of fragmentation had a minimal negative impact on the project.

Client: "(Contractors name) were extremely good about pushing on regardless, which was probably a good thing. actually we were fairly lucky in that respect. ..."

Quantity Surveyor/Project Manager: ...There was times when that whole communication process I guess fell over a bit. I guess the development of communication is such that if one person doesn't pick up an e-mail it's copied to three other people, so it is likely that if the first person doesn't see it the other three do. ...But, there were certainly times when communication was a little bit ...

Principal Contractor: "... We wanted to get the job finished, this is the only way it is going to happen. Without pointing fingers, the project manager or (company name) in this case should have had that role,.... It sort of fell to us to a certain extent but we just got on and done it well we could have been finished a lot earlier if things had been answered and organised and sorted out, when they should have... so that has left a bit of a sour taste in our mouth, and some of the subbies as well, because they were stuffed around for the last ...

The underlying message relating to the overall project culture was both positive and negative. ICT engagement was at a level considerably lower than what was intended. Information related issues faced by the construction team were not resolved in time creating sluggishness in the project operations leading to frustrations among the team members. Overall, culture of the case study project did not create a favorable setting to achieve the expected level of ICT integration (Refer Table 2 and 3).

The overall view of the project team members echoes the level of differentiation and fragmentation forms of cultural dominating the project (ref. Table 3).

6 CONCLUSION

The aim of the paper is to present the finding of a cultural analysis for ICT integration in a construction project, using a framework proposed by Gajendran & Brewer (2007). The analysis establishes the extent of ICT integration (or fragmentation) in a construction project and identifies the beliefs that contributed to the status of ICT integration. The conclusion makes two distinct contributions. One relates to ICT integration in construction projects and the other relates to the verification of applicability of the cultural analysis framework.

The case study project was construction of an extension for a facility in an educational institute. The project was procured through a construct only procurement. Although the intended level of ICT engagement was high, the actual engagement was much less than anticipated by the consultants. The cultural environment was dominated by fragmented

culture. ICT in the project was dominated by fragmentation. Out of sixteen espoused aspects of ICT integration only four (25%) were integrated. Seven aspects (44%) were differenced and four (31%) were fragmented.

Although the ICT environment was a mixture of 'integration', 'differentiation' and 'fragmentation', overall it was dominated by fragmentation. The fragmentation was engendered by non-alignment of technology and lack of leadership. Not clearly articulating the power positions and the assumed power positions not performing their role or providing direction also contributed to the fragmentation. However, the ICT aspects that were integrated counteracted and cushioned the potential devastating impact that fragmentation could have caused. Trust and respect enabled to reduce the impact of fragmentation. Majority of the ICT aspects were differentiated, meaning that sections of the project or a group team members having similar beliefs relating to the ICT aspects. In essence the lessons that can be learnt from this project are the critical role of leadership and trust in creating an environment conducive for ICT integration. Moreover the findings reinforced the essence of understanding technology capability of the project team members before committing a ICT strategy for the project.

The outcomes of cultural analysis framework were reinforced by the overall perceptions of the project team members. This verifies the relevance of each ICT aspect and its impact on level of integration. Therefore, the ability to assess the potential level of ICT integration based on the cultural beliefs of project members prior to implementing an ICT strategy will enable to counteract the unnecessary fragmentation.

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