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The Cultural Ecosystem of Megaprojects: The Interconnectedness of Organizational Elements and their Wider Institutional Contexts

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Abstract: In the multi-layered structure of megaprojects, organizational cultures emerge within different temporary multi-organizational teams (TMOs) responsible for execution. The cultural ecosystem in megaproject is conceptually articulated at the levels of their institutional settings to increase sustainable delivery. TMOs as meso-level coalitions are complex systems comprised of diverse public-private organizations responsible for delivering individual projects within the programme. Understanding these social and structural milieus provides a new groundwork for conceptual development and theorization of megaproject culture formation. Mirrored through its dynamics, ecology and development, this paper unravels how cultural features are affected by environment, effected in development, and transformed during the megaproject life. Contributions are made by shifting discourse towards a dynamic understanding of causal diversity that shape culture within TMOs to improve transferable practice. This investigative strategy challenges extant normative viewpoints. Indicating the need to reconsider existing perceptions and to embed norms of reflexivity beyond the mainstream megaproject management thinking.

Keywords: Organizational culture, TMO, ecosystem, institutional context, megaprojects

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1 INTRODUCTION

The study of megaprojects has received growing attention since the late 1980s (e.g. Morris and Hough 1987). Within the construction industry, knowing-doing gaps within megaprojects studies have been dominated by cause-effect analysis focusing on high-cost/high-risk analysis of economic efficiency and management performance (cf. Stinchcombe and Heimer 1985; Flyvberg et al. 2003; Flyvberg 2005; Miller and Lessard 2000; Olds 2001). A similar take in the setting of industrial megaprojects has been undertaken by Merrow (2011). Using the lens of business objectives and the shaping process (cf. Miller and Lessard 2000), Merrow suggested a shift in focus towards a more front-end planning and management. This brings about the perspective in viewing a megaproject as the end product of its own fragility. Thus, underpinning the mechanism of causal diversity and contextual factors that shape the megaproject environment is crucial to getting it delivered safely through its lifecycle.

Given the fragility of megaprojects and the number of interfaces, this paper focuses upon the problems of culture and coordination (e.g. Berggren et al. 2001) in megaproject planning and management. Organisational fragmentation occurs that requires systematic management for integration. However, over-determined integration induces conflated thinking and confused action in practice. This provides a theoretical contribution to the question "is there a new way forward to underpinning culture in the dynamic ecosystem of construction Megaprojects beyond the static perceptions that dominate theories and practices?" The aim is to introduce a 4-class system in the attempt to increase the ability to measure cultural dynamics in a megaproject temporary multi-organisational team (TMO). In this sense, culture can materialise for a more transferable, optimized and effective coordination of the T-

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MO's performance throughout the project lifecycle.

This paper will begin with a brief review of extant culture and coordination-related research focusing on megaprojects in particular. Here, nagging questions on why extant literatures dealing with this issue have differing results and conclusions will be discussed. Then, we will move on to identifying three areas of complexity shrouding the notion of culture and cultural ecosystem that undermine efforts to address the issue. Discourse will focus on the issues surrounding: (i) top-down and bottom-up interplay and (ii) corporate-project dimension and the TMO in megaproject environments. Arguments will be developed and anchored upon literature reviews on the notion of culture in organisational theories. Seeing culture in terms of its dynamic ecology and development helps unravel how environments affect cultural features, effected in development, and transformed during a megaproject. Starting with the social and structural milieu of megaprojects, the threads of cultural ecosystem surrounding the context will be articulated. Finally, concluding comments about the dynamism of causal diversity and contextual factors that shape organisational culture will be used to suggest the way forward to expand the existing body of knowledge.

2 CULTURE, COORDINATION AND MEGAPROJECTS

First, it is important to reiterate that a megaproject is seen as a single project firm where coalition is formed in a temporary basis managing a programme of projects. This is further comprised with a number of TMOs managing different projects within the programme. Megaproject TMOs are complex due to its structure consisting of a variety of interrelated parts. Its operation is characterized in terms of differentiation and interdependency through the engagement of several separate different organizations (Baccarini 1996). Thus it is important to understand the role of culture in complementing this dynamic coordination mechanism.

Historically, construction project management researches have focused heavily on improving project efficiency rather than effectiveness (cf. Shenhar et al. 1997). Yet, Morris et al. (2011) suggested that there is the danger of stereotyping the approach to managing projects as an "execution-only oriented discipline". That is, relying only on the Weberian view of a precise application of skills, knowledge, tools, and techniques whilst undermining the socio-cultural system embedded within the organization and project itself. Gellert and Lynch (2003) support this stating, "the ideologies and cultural biases of epistemic communities shape project processes in ways that foster displacement". The traditional cause-effect efficiency analysis therefore needs to be supplemented through understanding of the discourse on institutional context for the management of projects. Further, Miller and Lessard (2000) also revealed that efficiency and effectiveness should not be equated and that megaproject TMOs struggle more in achieving effectiveness due to ambiguous perceptions toward the project and inability to comprehend - and hence, manage project externalities.

This section begins with a brief introduction on the past culture-related research in the context of megaprojects, then moves on to evaluate the dynamic characteristics of culture and ends with a theoretical stance on how measurements and dimensions of culture should be approached in megaprojects.

2.1 The Relationship between Culture and Coordination in Megaprojects

Researchers in project management have linked cultural differences at the national level as one of the factors that affect - to some extent - those at the organizational level and further to the organizational effectiveness (e.g., Pant et al. 1996; Chen and Partington 2004; Phua and Rowinson 2003; Bredillet et al. 2010). In other words, the concept of culture has become a social paradigm that cannot be separated from any management and organizational analysis.

Of course, one may argue that the implications of cultural differences in projects as well as megaprojects may not be as blatant and easily identified in which consequences are plain and direct as other issues. Others argue that standardized processes are the ultimate key to project success (cf. Milosevic and Patanakul 2005). However, reducing project management to sets of tools, procedures and higher levels of standardization of project management process provides insufficient conditions to "automatically lead to increased project success" (Milosevic and Patanakul 2005; Levitt 2011).

Moving on, the context of megaprojects is unique and novel, comprising of members from different organizational and institutional settings with different interests and priorities that are not unitary. It is a "complex system of interest groups, some congruent, some competing" (Cherns and Bryant 1984) where the "logic of action" (Bresnen et al. 2004) is autonomous. Thus, a megaproject coalition embody uncertainty and ambiguity, novelty, and complex systems suggesting rigorous integration across diverse public and private organisations responsible for planning, design and construction of individual projects within the programme. This accentuates the coordination complexity of the construction project teams managing the operations i.e. the megaproject TMOs.

In a megaproject context specifically, arguably only a handful of extant literatures have explicitly looked at the impact of culture to coordination. Among earliest works in this area, in the late 90s, Winch et al. (1997) published an article based on the Transmanche

Link. In this study, the authors used Hofstede's five dimensions of national culture and tried to apply it as a theoretical framework to assess cross-border management at the organisational level. The authors found that Hofstede's measurements did not reflect what happened on the ground at both the strategic programme level and operational project level. In fact, the reality reflected the opposite of the original five dimensions scores. Thus, a generic conclusion was drawn stating that the relationship between culture and coordination in megaproject exists, posing a negative impact and that it needs a more in-depth understanding of the relationships between the industry, organisation and national cultural interactions. Thus, it can be said that national cultural difference is only an overarching indicator to achieve collaborative success.

In the early 2000s, Clegg et al. (2002) found that culture in a mega infrastructure project is regarded as a governance tool. Project wide culture is therefore nurtured vigorously from the top-down emphasising much on awareness and solidarity across the coalition. However, the focus of the study would seem to suggest that culture is something that can be scientifically managed. Thus, brushing over the contextual and dynamic element of the concept. In this sense, relational and organisational interfaces in which value-based exchanges occur are reduced to a single layer interaction. Van Marrewijk and his colleagues have also done similar studies of culture in megaproject environment (e.g. van Marrewijk 2005; van Marrewijk 2007; van Marrewijk et al. 2008; Smits and van Marrewijk 2012). The authors took a dynamic process approach based on Martin (2002) anthropological research framework to studying the impact of culture towards coordination and project success. These studies are based on a single case study analysing different points of events. However, simplifications are present regarding the interconnectedness of diverse organisational elements and the implications coming from the wider institutional context. Further, the authors have not yet provided a conclusive theoretical framework for a way forward to capturing, operationalizing and measuring key constructs of culture in the dynamic megaproject context. Thus, the levels of analysis seem overshadowed by the richness of the data itself where distinctions between implications coming from the national or organisational levels of culture are jumbled. A summary overview of the extant research findings on the culture-coordination relationship in construction megaprojects is presented in Table 1.

To conclude, with current thinking in managing and understanding the implications of culture in megaprojects, it is not far-fetched to say that it is challenging to predict the upfront nature and magnitude of effect coming form the dynamics of cultural diversity. This brings us to the next sub-section.

Table 1. Major cyclones that hit Bangladesh coast

Article Details	Key Findings	Cultural Framework	Generalization of Frameworks and Findings
Winch et al. (1997)	National cultural scores do not reflect what happened at the organizational and project level.	Hofstede's 5 dimensions.	Static interpretation. Findings points to a way forward to the body of knowledge.
Clegg et al. (2002)	Organizational culture impacts project processes and designs. Culture is socially constructed and cultural fit should be vigorously nurtured top-down for it to facilitate bottom-up interactions.	Casey's Designer Culture.	Internal observation. Findings are contextual to the single megaproject studied. No generalizable tangible artifacts to underpin cross-cultural development in dynamic megaproject environment.
van Marrewijk(2005, 2007)	Organizational culture is a set of two different episodes (Gideon's Gang and Diplomat) depending on the stage of the lifecycle. Conflict and power is the focus.	Martin's (Anthropological) Three Perspectives of Culture.	Internal observation. Findings are contextual to the single megaproject studied. No generalizable tangible artifacts to underpin cross-cultural development in dynamic megaproject environment.
van Marrewijk et al. (2008)	A joint paper presenting the findings from the previous two papers above. Organizational culture is seen as ambiguous at start, developed through conflict and negotiations and is directly proportional to cooperation between project partners.	Martin's (Anthropological) Three Perspectives of Culture and Casey's Designer Culture.	Internal observation. Findings are contextual to the single megaproject studied. Culture-coordination distances are measured through situational power, ambiguity and paradoxes of the project partners.
Smits and van Marrewijk (2012)	Examining contract-based collaboration. Basing mainly on power and conflict, more dominant project partner is seen to "chaperone" the less dominate partner. Dominance is seen from national superiority perspective.	Ethnographic and Interpretative Study largely based on Martin's (Anthropological) Three Perspectives of Culture.	Internal observation. Findings are contextual to the single megaproject studied. No generalizable tangible artifacts to underpin cross-cultural development in dynamic megaproject environment.

2.2 Culture as Dynamic

Culture has been regarded as both broad and complex, yet a critical organizational concept in construction (cf. Tijhuis and Fellows 2011). The concept is a ubiquitous part of organizational studies and encompasses shared values and beliefs as well as aligned behaviour and common action. Since the introduction of Hofstede (1980) seminal study surrounding the five dimensions of national cultural differences, culture at the organisational level has been highlighted further and has been developed drawing upon anthropological and sociological views to something (e.g. Douglas 1999) that can help improve organizational and individual performance. Hence culture serves as a fundamental factor and milestone to achieve effectiveness and coherence between the different business units inter and intra organizations.

Further, authors have acknowledged that culture is dynamic and multiversal, evolving incrementally in context. However, culture has largely been distinguished according to understanding largely based upon eastern and western conceptions in project management literatures (cf. Pant et al. 1996; Chen and Partington 2004; Phua and Rowinson 2003; Bredillet et al. 2010). From the brief review in Table 1, it can be seen that universal, reductive and static conceptions of and attempts to manage culture fail. French (2007) suggested 5 major cultural layers:

i Global - a primary influence upon behaviour,
ii National - a primary influence upon attitudes,
iii Regional - a primary influence upon beliefs (within an ethnic group),
iv Community - a primary influence upon values (within an organization, group, or team),
v Personal - a primary influence upon taken for granted assumptions.

Each of these layers affects one another. It is argued that culture, at any one layer or level, is complex and multifaceted relative to a "range of institutional or society-wide factors" (French 2007). This multifaceted dimension of culture generates dynamic interplay from top-down and bottom-up value-based exchanges. In a megaproject these dynamic value-based exchanges mainly stem from:

i Diversity of stakeholder influence as well as constraints (different stakeholder influence at different times within the project lifecycle),
ii Variation of socio-cultural contexts affecting operation,
iii International stages with geopolitical interests. Especially within high visibility projects where many subjective functions and political critics are involved,
iv Differentiation of units and specialization,
v Temporary - Has a beginning and ending. However, members of the coalition have homes to go to before and after the lifecycle period,
vi Decentralized command systems with dominant coalition,
vii Reciprocal interdependency between the contracting organizations.

Therefore, an effective megaproject culture should be redefined as to establish knowledge of consistent recipes within the project coalition for the other folks to come through with their part without watching them all the time, thus establishing a precept for actions, a scheme of expression, and a scheme of interpretation. This view and approach to the concept concerns and addresses how different institutional levels of culture are assimilated, becoming the accepted organizational culture and further involved and influence decision-making processes, mechanisms and its structuration both at the organizational and project levels. These institutional levels and structuration processes constitute what the paper terms as Cultural Ecosystem and are unpacked in the next section.

3 CULTURAL ECOSYSTEM: DYNAMICS, ECOLOGICAL AND DEVELOPMENTAL COMPLEXITY IN MEGAPROJECT TMOS

This section will deal with analysing the reasons that undermines previous research findings in culture and megaprojects. It is essential to recall the central argument of this paper is that the measurement of culture and coordination in megaprojects suffers from theoretical and practical simplification that leads to brushing over the foundation of megaproject development dynamics. Implicit assumptions (Table 1) shroud the importance of top-down and bottom-up vs. coordination interplay in megaproject organisations.

Cultural ecosystem is defined in a megaproject context as a temporary symbiotic compendium of interacting organisations and their institutional environment that strives to achieve coherence and consistency in executing diverse organisational processes. Thus, conditions necessary to render organizational culture a positive feature in a megaproject context manifest in two different types of interface challenges (cf. Winch 2014):

i The corporate-project relationships - managing relational interfaces to align the programme-project goals,
ii Changing project environment - managing relational interfaces between project functions and the extent of alignment in exchanges of values/beliefs in pursuit of project goals. Thus, diversity in terms of cultural ecosystem poses coordination challenge in four different elements:
iii Identity and core purpose - who we are and what do we stand for,
iv Values - espoused beliefs, perceptions and judgments made,

v Behaviours - relational attitudes and actions in evidence through observed norms and informal routines,
vi Formal Mechanisms - organisational structure and routines.

These four elements can be categorised into three different complexity themes namely, Dynamics, Ecology and Development of organisational culture within a megaproject context.

3.1 Dynamics

With reference to Davies and Frederiksen (2010), a megaproject is seen as single project firm where coalition is formed in a temporary basis managing a programme of projects. This is further comprised with a number of TMOs managing different projects within the programme. It is proposed by Baccarini (1996) that megaproject TMOs are complex due to its structure consisting of a variety of interrelated parts and its operation is characterized in terms of differentiation and interdependency through the engagement of several separate different organizations. This complexity spans over several dimensions of project management process in terms of culture and climate manifested within different organizations, environments, systems, and decision-making processes and mechanisms. Where culture is the top-down enduring values, climate is the relative enduring qualities perceived bottom-up.

Furthermore, according to Lehrer and Laidley (2008) "The diversity of forms and uses employed in these megaprojects inhibits the growth of oppositional and contested practices, fragmenting opposition through the wide range of choices and options offered". In other words, in addressing cross-cultural management issues, institutional dynamics must be taken into account operating on several levels (cf. Söderlund and Tell 2011):

i The national level (the permanent system/institutional/network/societal),
ii The organizational level (the permanent system/corporation),
iii The project level (the temporary system/team-individual).

Institutional dynamics comprised of the regulative, normative and cultural-cognitive elements (cf. Scott 2012) that constraint the development of a megaproject organisation and its operations. In other words, a symbiotic relationship underlined by dynamic exchanges in culture-influenced interactions exists. Hence, as opposed to the mechanistic and rigid approach of the functionalist view, this presents a dynamic and integrated view of a megaproject Cultural Ecosystem, illustrating the dynamics of both the project and the firm through the lens of the interaction of culture and climate at these different levels. The dynamics of this top-down and bottom-up vs. coordination interplay is illustrated in Figure 1.

Translating Figure 1 to practical terms, the primary dynamics of the cultural ecosystem in megaprojects span over different organisational levels. These are:

i Programme level - where culture is nurtured top-down,

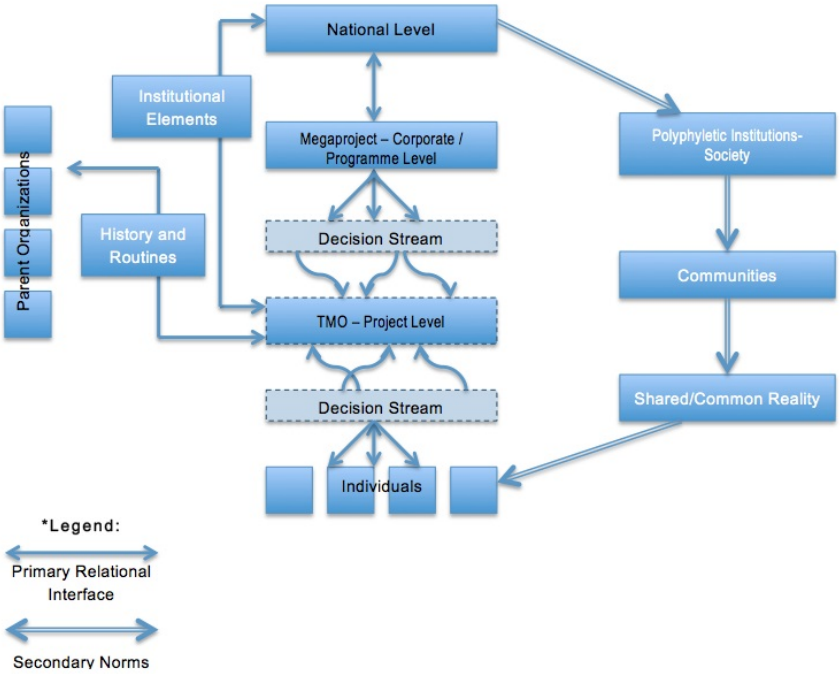

Figure 1. The cultural ecosystem of megaprojects - interconnectedness between cultural levels

ii TMO level - where climate is interpreted and translated as culture that is built bottom-up,
iii Individuals involved,
iv At the relational interfaces between these levels.

TMOs are not therefore unitary or static. Resources are therefore configured accordingly both in explicit and implicit terms. Culture is interpreted differently over different points in time in the project lifecycle. This manifests in the way decision mechanisms are structured and relating back to accentuating the coordination complexity of the TMOs and their institutional environments. To illustrate, decisions imposed from above in the form of introducing new performance frameworks and how these are interpreted at the micro individual level generates a dynamic interplay on how a TMO culture is affected. In relation to the extant megaproject management view, literatures suggest that standardization of culture and hence rigidly imposed structure and processes, are nearly impossible due to environment volatility and change between each project in practice. Hence, every project must be treated as separate with its own individual settings, each having different boundaries in 'time' and 'space' (Ive and Gruneberg 2000; Dvir et al. 1998); managerial effectiveness being strongly influenced by this unique characteristic between each project (cf. Baccarini 1996) and the interplay between the corporate-project interface and institutional externalities.

From the above, at the meso-level, the TMO must be regarded as an organization capable of developing its own culture and structure proclaiming independence and cognitive cultural distance from its parent organizations to some extent in order to be able to find a coherent balance between cultures imposed from the parent headquarters and megaproject headquarter managing the programme. Therefore, the structures of both the parent and megaproject organizations (cf. Engwall 2003) should facilitate the flexibility that is needed by the organizational functions that are involved within the TMO. Analogously to a Russian Matryoshka doll, each of the organization's elements is carved according to the culture in which they reside and vice versa. It enables each to flexibly use the espoused values and credo of the parent organization and absorb other cultural values derived from the institutional megaproject environment. On the one hand, this flexibility helps reduce investment by reducing the rigidities of the authority and the need for accountability. In this sense, the problem of overlapping identities and core values (Brown and Lewis 2001) can be minimised, enabling the TMO to be more proactive in responding to external changes. On the other hand, this distance helps the TMO to absorb cultural values imposed from the programme level; hence, enhancing awareness, inclusion and solidity.

The arguments made in this sub-section emphasise that culture is strongly embedded in the formal mechanisms in the form of structure and routines established. Structure implies a notion of "social whole which can be conceptualized as consisting of interdependent parts" (Baber 1991). According to Giddens (1981), structure is both "the medium and outcome of the practices which constitute social systems". The author continued to state that structure has two main elements, which are rules and resources including norms that govern behavioural interactions. Rules being all the varieties of "cultural schemas ... that make up a given society's fundamental tools of thought ... the various conventions, recipes, scenarios, principles of action" (Sewell 1992) and resources being both human and non-human being the "manifestations and consequences of the enactment of cultural schemas" (Sewell 1992). Both these rules and resources exist at various levels within structure and will have different logics and dynamics (Sewell 1992).

The organizational structure therefore is distinct from function (the term function will be articulated later on in the paper). Traditional conceptualisations of the megaproject management thinking tend to conflate the two. Not only that this is due to the diverse nature of the internal and external environments surrounding these organizations but also due to the dynamic factors influencing the processes of the megaproject lifecycle. The differentiation of needs between the strategic programme level and the operational project level leads to a significantly more complex organizational structure. In this sense, the structure in a megaproject is the coordination link between these two levels. Since - in the remit of cultural ecosystem - structuring is dynamic, involving the top-down and bottom-up interplay between levels, structuration arises from this.

In sum, it is argued that the effectuation of TMO culture development starts with the structuring of formal mechanisms (the 4-th coordination element), which extends towards identities, core purpose and values. In order to understand these wholly, one needs to go from this internal relational factor to evaluate the external relational factors, discussed in the following section.

3.2 Ecology

The concept of ecology in organisational studies was first introduced in the work of Hannan and Freeman (1989) and is considered a fundamental aspect to explain the cultural dynamics of an organization by heavily incorporating an open systems point of view.

The concept of ecology is very useful to acknowledge, explain, and describe the dynamics of cultural interplay by systematically mapping and illustrating what happens to different kinds of entities and how it happens overtime (cf. Baum and Singh 1994).

In the project management context, the concept of project ecology is considered new (cf. Morris et al. 2011). Grabher and Ibert define the project ecology as,

"A relational space, which affords the per-

> *sonal, organizational, and institutional resources for performing projects. This relational space encompasses social layers on multiple scales, from the micro level of interpersonal networks to the meso level of intra- and inter-organizational collaboration to the macro level of wider institutional settings." (Grabher and Ibert 2011).*

To understand the relevance of project ecology to the established cultural ecosystem we need to further unpack the issue of culture as a socially and dynamically constructed concept.

It has been emphasized that a megaproject TMO should be regarded as a social construct with levels and layers (Levitt 2011) and as such, it should be seen as a "system of inter [and intra] relationships which connects individuals together" (Giddens 2001). As a part of a symbiotic ecosystem, the megaproject's success and even long-term survival and competitiveness are contingent on the actors' understandings of it. In this sense, the critical success factors of a megaproject move toward a more external-institutional aspect of the ecosystem, in which cultural differences have become more and more significant as one of the critical factors. To recall, these ranges of factors, including the implications of culture, are manifested through the interplay (Figure 1).

As such, the Ecological complexity can be illustrated from the diverse ways extant research have defined culture relative to acknowledging the megaproject's cultural ecosystem as stated in the previous section. Although culture as an organizational theory has been widely recognized since Hofstede's study in the 1980s. Previously, studies of sociology and anthropology applied culture as an explanatory variable of human behaviour. The study of Schuetz (1944), "The Stranger: An Essay in Social Psychology", can be referred to as the root from where other definitions of national culture and organizational culture stem:

> *"The cultural pattern peculiar to a social group ... determines the strata of relevance for their 'thinking as usual' in standardized situations and the degree of knowledge required for handling the tested 'recipes' involved ... [whereby] the knowledge ... is not homogeneous; it is (1) incoherent, (2) only partially clear, and (3) not at all free from contradictions". (Schuetz 1944)*

Schuetz's view on the concept suggests that culture is absorbed and learned more than inherited or simply passed on; it is the relational interplay between the knower and the stranger about how we came to understand how things come into being and "work". Thus the ecology of the TMO is "stratified in different layers of relevance, each of them requiring a different degree of knowledge" (Schuetz 1944), some of which is prior knowledge from previous experience as the "strangers" come together, some of which is learnt as shared understanding and negotiation in situ.

In the project management stream, researchers (cf. Kendra and Taplin 2004; Du Plessis and Hoole 2006) tend to regard culture as "the way we do things around here". However, this definition is general and assumes too much is pre-given i.e. simplifying the multilevel characteristics. Du Plessis and Hoole (2006) then elaborated the definition as:

i The way = refers to the project process (how)
ii We = refer to the people in the project, i.e. project team and stakeholders (who and for whom)
iii Do things = refer to the Project Management methodology (what)
iv Around here = refers to the project environment (where)

There are two things that can be drawn from this elaborated definition of culture in terms of relevance to project ecology and relational spaces. Firstly, by referring to the people, the definition acknowledges the project as a social construct that has direct relationship and interdependence with the external environment. Hence, a megaproject TMO is part of a wider ecosystem as opposed to existing in isolation. Secondly, the culture within the relational space of the megaproject's ecosystem, although acknowledged, is not seen as something with a history or only in the static sense of culture being pre-given. The dynamic development of culture in the TMO thus emerges and unfolds so as to establish knowledge of consistent recipes within the project coalition for the other folks to come through with their part without watching them all the time, thus establishing a precept for actions, a scheme of expression, and a scheme of interpretation. There are different institutional levels of culture assimilated, becoming the accepted organizational culture. The institutions are formal and informal forms of organising in time but not the project space. The TMO (re)-constructs the external institutional influences through locationally embedded sense making (Weick 1969). The project is located in space so there are institutional influences in the locational context. The institutional cultures surrounding the TMO coalitions are thus involved in the degree of transferability of the standardized managerial and organizational processes of the parent organization from one project to another. In a more familiar "organizational" explanation, as Hofstede (1980) noted everybody is culturally conditioned by the way we have learnt to see the world. This limits our ability step out of the boundaries of our conditioning.

This is further reflected in Lim and Mohammed (1999) examination of the macro and micro viewpoints of a project success. The authors suggested that the macro viewpoint (culture) "takes care of the question does the original concept tick?" and the micro (climate) concerns "the construction parties" (Lim and Mohammed 1999). In other words, this relational s-

pace is where the vertical and horizontal coordination interplay takes place.

Taking into account the arguments so far, it can be concluded that the achievement of a successful coordination in megaprojects can be argued from integrating the relational spaces of the project ecology between the macro and micro organisational levels to overcome uncertainty and ambiguity between the different levels. What then, are the constraints stemming from the Dynamics and Ecology complexities for the TMO's cultural development exactly? For this, we need to consider the cultural ecosystem and the interconnected organisational elements wholly. This brings us to the next sub-section.

3.3 Development

In the previous sub-section, it has been signposted that the development of an effective TMO is influenced and dependent upon the interplay between the top-down and bottom-up within the relational space of the project ecology. In this sub-section, it is argued that cultural development becomes a problem when assessing its impact in relation to Dynamics and Ecology complexities.

An effective working culture embodies the values, beliefs, formal and informal rules and procedures as well as norms that steer individual behaviours and the differences of perceptions between the different levels of structure of the megaproject's environment as mentioned. Conversely, the extent to which values, beliefs, formal and informal rules as well as norms do not steer towards positive outcomes is a measure of ineffectiveness. It is argued earlier that a megaproject TMO is a complex society of its own, exhibiting 7 characteristics surrounding the notions of open systems, chaos, self-organization and interdependence.

From these characteristics, projects are executed within the boundaries of uncertainties and ambiguities that arise from different individual (and of course, organizational and institutional) perspectives toward the project (Lim and Mohammed 1999). These boundaries provide constraints as to which cultural and organisational forms can materialise in megaproject TMOs. For example, the complexities of the Channel Tunnel were due to the different perceptions arising from two different organisational histories (British and French) that had not been quite amalgamated yet.

Both organizational and project ecology encompasses some heavy elements of history that is embedded within the process by which new organizational forms are created. They also introduce an element of path dependency (cf. Eisenhardt and Martin 2000). Thus, history helps shape cultural development through the path set. In this case, the new organizational form is the megaproject TMO. With this in mind, TMOs as opposed to having no history and no future due to its temporality and one-off ventures (cf. Lundin and Söderholm 1995), borrow the histories - the repetitive operating routines, procedures, and rationalizations - of the parent organizations as means of providing the first stepping-stones of knowledge towards developing its own. Putting it another way, organizational histories are deeply reflected in the organizational processes. It both produces and is a product of culture and overtime it becomes part of the organizational custom, habit, and traditions.

In the dynamic ecosystem of megaproject TMOs, these fallback notions to known routines provide a "comforting - if false - sense of continuity and stability" (Schoenberger 1997). As suggested by Cherns and Bryant (1984) that the progresses of a construction project "cannot be adequately explained without a reference to the past" (see also, Engwall 2003). These past (the histories) are brought upon mainly from the firm level through the taken for granted cultural values that are already understood (as well as imposed) by the individuals and embedded in the formal routines and procedures. In this sense, projects are not drawn in a white blank canvas - where the canvas is the project externalities - as it is often approached and perceived. Rather, projects must be seen as operating in a canvas that has been previously drawn where the TMO is seen as an object to be added and hence must fit into the overall picture.

Further, Berger and Luckmann (1966) and Engwall (2003) put it that histories are produced through the manifestation of human activities. As such, as a socially constructed universe, these histories are continuously realigned throughout the project lifecycle. Thus, the apprehension of reality shifts from autonomous creation of meaning by isolated firms to the project team taking over the world in which others already live Berger and Luckmann (1966); mediating a common reality, but from considerably different perspectives Berger and Luckmann (1966). Or, figuratively speaking, this is analogous to the puzzle connect the dots - where the dots represent the established cultural values in the ecology - but without the numbers to act as a top-down guidance to associate or make sense of the different cultures in creating the intended picture. In this sense, the bottom-up (climate) perceptions then take over through the process of quantifying and associating the different cultural values. Hence, interpretations will be different between the parent organization and the different elements involved within the TMO depending on the extent of interplay within the ecosystem as illustrated in Figure 1.

These fragmented perspectives can be traced back to something called cultural efficacy, whereby, to the degree that culture is followed by success (success being winning the tender for example), it is a "besetting fault ... that they become fossilized in their moment of glory" (Keegan 1993), trapped in their own perfectly isolated little world. It becomes a fallacy in interpretation between the abstraction of functional rules and the

reality of the current megaproject situation. Decisions coming from the stereotyped culture of the corporate-level functionalist system can no longer grasp and visualize the situation at the TMO's operational-level interface - impeding effective development. For example, although the emphasis on project management have shifted towards a more front-end relationship management approach (through the introduction of the shaping process as stated by Miller and Lessard (2000) to better leverage on value, traditional arm's length methods focusing on transactional aspects still dominates leading to disjointed systems across functions and service incoherence.

To conclude, it has been cited that a megaproject TMO operates in diverse environments. Hence, as the environment shifts during the lifecycle, fallback strategies to the rigid and functionalist culture lead to stereotyped behaviours that resist change. However, as cultural patterns are context embedded in itself, these stereotyped acts of reflection will not be able to fully grasp the current reality. Therefore, knowledge of coordination is based mainly on interpretations of the relative enduring quality of the existing top-down and bottom-up interplay within the ecosystem. These relative enduring qualities are those underlying the difference between before (the plan) and after (the actuality) of the project where planned action more or less crashes as soon as the action starts due to circumstances and context of the present. This development is illustrated in the figure below.

From Figure 2, it can be said that the impact of Development in relation to Dynamics and Ecology complexities to coordination in a megaproject TMO's cultural ecosystem stem from the following three categories:

i The structure of populations, in other words, the structure of the socio-cultural systems that exists between the project ecologies, hence, influencing the norms and values and their interpretations within a particular relational space. It has been argued that this is the basis for the process of structuration in which culture influence processes and vice versa. The greater the size and variability in the structure, the more rapid and vigorous the selection becomes.

ii Adaptive and developmental constraints, at the corporate-project interface, the constraints are argued to come from the external institutional and internal corporate levels culture that limit the extent to which the TMO's structure and functions are able to flexibly develop. Therefore, also consequently what the TMO is able to achieve in delivering the megaproject. In other words, these constraints poses selection in that incremental development of the TMO's culture can only advance along a certain path.

iii Changes in the direction and intensity of variability at different ecosystems in different megaprojects and along the megaproject lifecycle, as argued earlier, the historical and environmental contingencies in a megaproject make it so that there will be more than one top-down and bottom-up value-based interplay within the TMO for each project at the operational level. That is to say, each changes along the project lifecycle informs (and re-informs) the TMO's perceptions and therefore define (and re-define) the organizational interactions in the ecological space and act as the stimuli for developmental adaptation.

From the three categories above that underline the cultural ecosystem of megaprojects, it can be said that

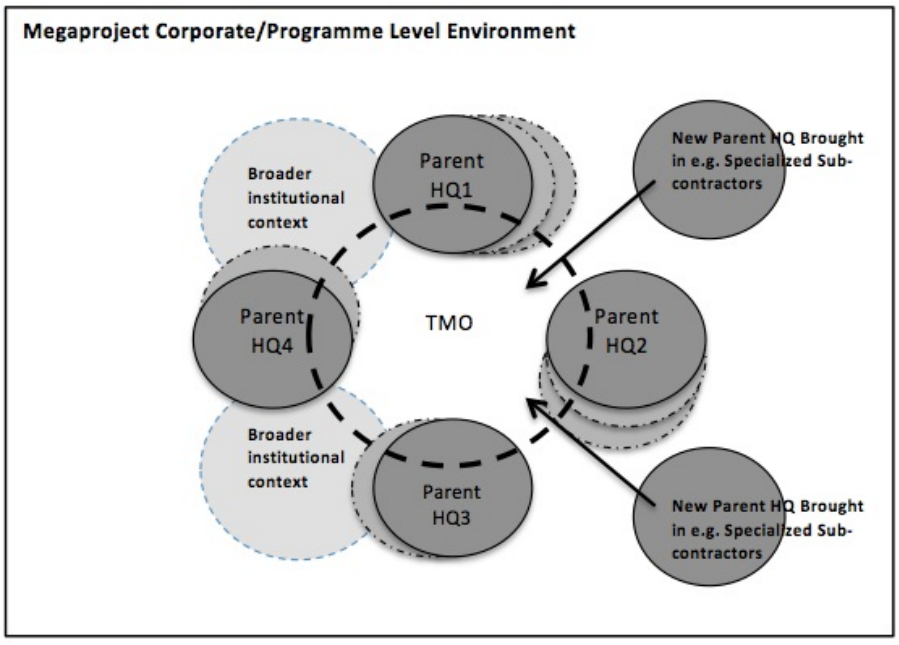

Figure 2. TMO cultural development - The interplay between corporate-project interface and changing project environment

the constitutive complexity (cf. Mitchell 2003) of the megaproject TMOs - as a temporary organization comprised of numerous different parts - at the start of the megaproject lifecycle will become an evolved complexity (cf. Mitchell 2003) at the completion of the megaproject. That is to say, the organizational form at the end is the resultant divergence of adaptive challenges that occurred along the lifecycle.

As can be seen, these three categories carry in their very essence the notion and the need to integrate between Dynamics, Ecology and Development if we are to attempt any coordination measurements with regards to culture. Hence, they bring us to our theoretical contribution; to introduce a conceptual theoretical framework. The framework is introduced to carry an explanatory power to signpost and predict the propensities and trajectories of said cultural development path as part of the paper's theoretical objectives. Keeping in mind that the ultimate aim is to - at the very end - really conceptually underpin the concept of culture in the megaproject management context and also to increase the transferability of processes for better coordination and project outcomes.

4 MEASURING THE MECHANISMS OF CULTURE: INSTITUTIONAL ELEMENTS AND THE 4-CLASS SYSTEM

In the earlier sections, it is argued that cultural models tend to provide static views or under-estimate the dynamic interplay in culture. A dynamic ecological and developmental perspective goes a considerable way to addressing the shortcomings. Cultural interplay within the construction TMO has been broken down and illustrated in Figure 1. We call this, the logical construction of the TMO's cultural ecosystem. Further, this paper has also argued, cultural implications is only apparent or starts giving out problems in different levels of the TMO's relational spaces. As we know it, it is the notion of relational space in construction project management context termed as the project ecology.

Brooks and McLennan (1991) have developed a 4-class system classification to integrate "the causal and reciprocal interrelations between Dynamics, Ecology and Development at multiple scales and multiple levels of analysis" (Müller 2007). Further, Stone and Hall (2006) stated, ecology and incremental development have been "flirting for a long time". Therefore, integrating ecology would be beneficial because then, incremental development of relationships between structures/systems as cultural schemas Sewell (1992) "could be considered more-completely as modification over time that is wrought by environmental effects" on developmental progress (Stone and Hall 2006). In other words, the 4-class system aims at explaining as well as mapping:

i How development [of culture within organisations] itself evolves, and,
ii How the control of developmental processes is mutually effected by the culture surrounding the internal, external, and institutional systems embedded within the network of contracting organisations, imposed to and inherited within the megaproject TMO.

As a systematic comparative method, in the field of social sciences, Winterhalder and Smith (1992) stated that the theory directs a researcher's attention to "the role and characterization of the environment". In this sense, Dynamics, Ecology and Developmental combination focuses its attention to predict the diversity and flexibility of behaviours in complex systems that are contingent upon localized and often changing environments as argued within (Scott 2012) institutional approach to the study of organisations.

It is further argued that the institutional context of the management of project concerns the relationships between the strategic top management level and the operational project level within and across the networking organizations - "one that is more engaged with the outside looking in" (Morris et al. 2011). In this sense, there is increasing awareness of the importance of linkages between corporates (firms) and projects, "an appreciation of the role of governance and control. This is essential to foster and assure effective use of resources within and across organizations", building competence and creating appropriate contexts for the project as well as "seeing projects as often complex organizations involving cross-firm relationships engaged in addressing uncertainty and novelty" (Morris et al. 2011).

As stated in the previous sections, the institutional-based approach focuses on the notion of the three pillars of analytical constructs, "intended to identify underlying ingredients in institutional systems" (Scott 2012). These are namely, regulative, normative and cultural-cognitive elements argued to be contributing to the construction, maintenance and change of a system. Scott (2008) described the explanation of each pillar elements as follows,

i The regulative element deals with rule-setting and arenas of control based on compliance to established system regulations,
ii The normative element deals with the importance of prescriptive, evaluative and situational obligations that predominate an organisation,
iii The cultural-cognitive element point to the centrality of cultural schemas as symbolic aspects within organizational structures that constitute the basis construction of reality (Berger and Luckmann 1966). To avoid confusion, herein this pillar will be referred to as cognitive.

Although Scott (2012) argued that these three pillars represent their own distinguished empirical elements,

in that each works in different ways, this study believes that the three corresponds to the three processes of selection as explained in the previous section. In other words, this paper argues that within the concept of cultural ecosystem, the essences of the three pillars can be incorporated into Brooks and McLennan (1991) 4-class system to form an integrated approach to our evolutionary ecological and developmental study of culture in construction project management. Thus, the three pillars of the institutional theory come in as an auxiliary filter concept in the quest to unpacking the dynamic mechanism of the TMO's cultural development. This pluralistic approach affords more thorough comprehension concerning how cultural features are affected by environments, effected in development, and transformed during evolution than do more conventional cultural values approaches. The reasoning for a fit in this theoretical juxtaposition is illustrated in Figure 3.

From above analysis and discussions, it can be seen that the dimensions for measuring culture in megaprojects should not focus on the notion that cultural differences is a strong factor for explaining the degree of coordination in megaprojects. Instead, the analysis showed that given the number of complex variables and value-based interdependencies within a megaproject's cultural ecosystem, it would be more helpful to explore culture through these complexities in itself. Thus, we arrive to elucidating our conceptual work in progress that is trying to develop some explanatory power to shed light to help researchers diving into accurate measurements about culture-coordination relationships.

4.1 The 4-Class System - A Conceptual Work in Progress

In the previous section, it was argued that Dynamics and Ecology lead to a complex interplay between a megaproject TMOs form, congruence and function within the symbiotic nature of the ecosystem. Developmental complexity then stems from the three relative enduring qualities that arise and informed the institutional pillars. Thus, in developing the 4-class system conceptual framework, the three factors for complexity - Dynamics, Ecology and Development - need to be integrated. Thus, the following postulate is generated,

> *The dynamics, ecology and developmental processes and features of culture can be mapped systematically through a 4-class combination of features: form, congruence, function and development. This gives 16 possible trajectories and categories of potential cultural evolution paths to increase organisational functional transferability. This combination constituting the 4 classes encompasses the aforementioned interplay between the three levels of cultural hierarchy, thereby, facilitating the aforementioned conceptual organisational culture synthesis among Dynamics, Ecology and Development within the construction TMO.*

As the rationale behind this arose from Brooks and McLennan (1991) and Stone and Hall (2006) biological terminologies in their study A System for Analysing Features in Studies Integrating Ecology, Development and Evolution, translating and redefining technical terms for operationalization into a megaproject and TMO context is necessary. The 4-class system is comprised of three binary super-categorical features, form, congruence and function with two conformant developmental modes, comparable and non-comparable. Each feature has different traits, which are observable properties exhibited by organisations

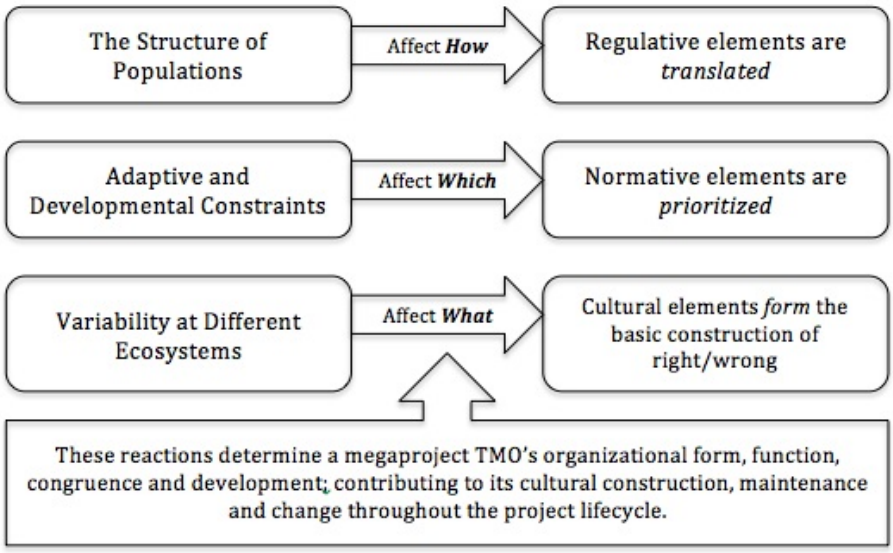

Figure 3. Elements of institutional constraints and how they materalise, affect and ahape the 4-Class system

at any level from microscopic to macroscopic. In this sense, traits represent the different levels of culture exhibited from the macro national/institutional/network level to the meso-corporate/project interface and the micro individual level. The theoretical fit with the three - Dynamics, Ecology and Development - enduring qualities will also be addressed in the following paragraphs, starting with the super-categories.

Form

According to Bock and van Wahlert (1965) a form can be defined as "the class of predicates of material composition and the arrangement, shape or appearance of these materials". In other words, feature form is equivalent to what Sewell (1992) term as the structure of an organization, which may be described through size, shape, position, typology and others. Together with Weeks and Galunic (2003), these authors agree that the structure of an organization is a representation of its cultural schema i.e. an organization is an accumulation of culture(s). The emphasis therefore, is on the exhibition of histories inherited and structural similarities or dissimilarities to the current megaproject's cultural environment (e.g. as illustrated in the works of Casey 1996; Clegg et al. 2002). Thus, form reflects the first culture-coordination complexity i.e. Dynamics.

Congruence

Feature congruence deals with descriptions of an organisation's cultural orientations within an ecosystem context, which are defined on the basis of comparative analyses of the relational spaces between the three organisational levels (programme-project-individual). These taxa comprise of a reference group, the outgroup and the ingroup. Relating these back to Scott's institutional theory, as units of production from the parent organisation moves into the TMO, its cultural orientation becomes part of the ingroup cognitive element. The congruence in the TMO's cultural state is measured through synapomorphic regulative elements coming from the parent organization(s) that has become the outgroup. Thus, synapomorphy - a common cultural trait shared within the corporate-project interface - of the TMO's cultural characters are classified as either shared (homologous) among the corporate-project interface (between outgroup and ingroup) or as unique (homoplastic) to the ingroup TMO itself. The reference group then comprised of any cultural orientation at the national/institutional/network level i.e. what Scott (2008) termed as the normative elements predominating value-laden realms within the relational spaces of the project ecology.

In sum, congruence involves topographic, structural and compositional similarity that concerns the dynamic and developmental relationships of cultures between form, development and position. Putting it another way, any changes in the relational ecological space will induce the TMO (and consequently the parent organisation's unit of productions forming the TMO) of a pre-existing historical background to develop differently structurally and behaviourally overtime. Thus changing the relative relationship and association between the different socio-cultural systems within the TMO and hence ultimately the frequency of hereditary elements from the respective parent organisations.

Function

According to Stone and Hall (2006),

> *"The association between function and environment can provide information that is useful for inferring developmental modes, and thereby, categorization. Feature function may be described in accordance with the term 'aptive' [adaptive], which refers to the advantages that are conferred to [organisations] possessing particular features - literally, 'fitting' them for particular conditions." Stone and Hall (2006)*

Although this study does not embrace a resource-based view of an organization, the essence of the argument still stands. As stated in the previous section, in empirically addressing the incremental development of culture (firstly at the TMO's project level and secondly at the corporate programme level), three factors will be considered as constituting the relative enduring qualities as mentioned earlier.

Within these processes of selection, three institutional pillars - regulative, normative and cognitive - affect functional adaptability through associations with the external institutional environments both from which these feature functions originated and currently situated in. For example, similar organizational forms that persist in dissimilar environments may be interpreted as a result of strong cultural constraint if the congruence trait that defines the organizational cultural state is homologous. Thus, as opposed to structure, feature function is a representation of existing organisational processes and routines that is embedded in behaviours, values, identities and core purpose culture-coordination elements.

Development

The previous three super-categories elaborated juxtapositions for theoretical fits. However, each is a static stand-alone theoretical mobilization. A dynamic view is needed to underpin and unthread the incremental development of culture in megaprojects and their TMOs. This is embedded in this feature i.e. development. Development is equivalent to incremental changes within a given period of time as illustrated in Figure 2. In other words, development is the difference in the TMO's cultural state before and after the project, which has undergone incremental transformations during the life-

cycle of the project. In this sense, feature development incorporates more continuity, in which if combined with the previous three super-categories, provides a mean for analysing and systematically categorizing the incremental and path-dependent trajectory(s) of the TMO's culture as well as the propensities for any conformational and non-conformational features within the resultant culture as the final product. Another way of putting it, feature development as conformational or non-conformational measure provides a mean for analysing the path-dependent trajectory of the cognitive element in response to the other two (regulative and normative) as the institutional pillars contributing to the TMO's construction, maintenance and change of culture.

To sum up the arguments within the section, let us recall Stone and Hall (2006) - and therefore ours - abstraction of the three super-categories and developmental modes and their roles in integrating dynamics, ecology and development. The authors stated,

> *"Form is central to development ... but peripheral to ecology. Congruence is applied at different hierarchical [cultural] levels ... [and] function is central to ecology but peripheral to development." (Stone and Hall 2006)*

From the breakdown of the 4-class system, it is hoped that they provide some clarity as to the extent to which:

i The complex cultural ecosystem,
ii The interconnectedness of organisational elements within it,
iii How they interface with one another.

Should be regarded when researchers attempt to unravel culture in a megaproject and its diverse TMO environment.

5 CONCLUDING THOUGHTS

To begin with, this paper is meant to be a literature reflection of how cultural studies have been and should be focusing upon in megaproject context. It offered an evolutionary perspective in viewing the management of megaprojects as a kaleidoscope of temporary structures in the form of TMOs. The third wave notion renders the traditional Hofstede-inspired and other conventional values studies in evaluating the implications of organizational culture based on static right and wrong or coherence and incoherence cumbersome. The level of analysis in extant literatures differ with one another. On the one hand, national level measurements are used to explain cultural differences that occur at the organisational level. On the other hand, these levels are jumbled together and it was argued that culture could be scientifically managed from the top-down, overlooking the bottom-up resistance.

Tackling the enigma of cultural studies, this paper tried to integrate between cultural Dynamics, Ecology and Development to underpin how culture evolves overtime within megaproject TMOs. Linkage between cultures at the national, institutional, organisational, and project levels needs to be isolated and determined given the complex and temporary context of a megaproject TMO coalition. Therefore, providing new theoretical starting point in attempting to increase the ability to notice propensities and predictions for a more transferable, optimized and effective continuity of the TMO's performance throughout the project lifecycle.

It is illustrated that culture in a diverse megaproject environment exists as an ecosystem of symbiotic inter-organisational relationships. Through identifying two major coordination challenges arising from this ecosystem, relational interfaces faced by the TMO as a social construct poses constraints in the dynamics and development of an effective culture.

This paper suggests that dimensions for measuring culture in megaprojects should focus not on the notion that cultural differences is a strong factor for explaining the degree of coordination in megaprojects. Nor should it focus on only situational power relations, ambiguity and paradoxes. Instead, the analysis showed that given the number of complex variables and interdependencies within a megaproject's cultural ecosystem, it would be more helpful to explore culture through these complexities in itself. That is, through its Dynamics, Ecology and Development within the megaproject as temporary single project firms. It may not be too far-fetched to say that the field of cultural studies in the management of megaprojects is too 'green' to accurately measure culture-coordination relationships.

Arguing that it is possible to predict the trajectory of a megaproject TMO's cultural development, the 4-class system as a mapping instrument have been conceptually introduced. The aim is to predict the upfront nature and magnitude of effect coming from the dynamics of cultural diversity. Thus, facilitating the development of a generalizable operationalization of construct that transcends across megaprojects.

Although scarcely discussed, it is also recognised that decision-making processes and outcomes moulds a megaproject TMO's culture through a cycle of structuration process. Further studies could follow up on this line of thought in underpinning the meaning and implications of culture in megaprojects and in the construction industry. For example, this gives a starting conceptual point for a longitudinal case-study research following the question "how does the project team and the permanent organisations view each other throughout the project lifecycle?" Thus, form, function, congruence and development are ecological factors and point towards a need to explore cultural dynamics as a process of organisational evolution. That is to say, the 4-class system is not an overthrow of what has gone before but as a significant and potentially exciting move

forward. This adds to the original contribution of this paper.

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