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LARGE-SCALE PROJECTS MANAGEMENT

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Large Scale Infrastructure Projects: The Art of Project or Change Management?

Abstract Although it is generally understood that change is a fundamental component of managing projects in the construction industry in general and an inevitable challenge for large scale infrastructure project in particular, there has been little to no attention in the literature to understand change in this context from a more holistic perspective. For this purpose, this work looks at change through the eyes of a framework of six batteries of change that seem essential to charge an organization's capabilities for change. The framework brings together the expertise of four specialists that all have developed their insights over many years of study and practice, and has been validated through an extensive review of the management literature on organization development and change. Reflections on the application of this model in the construction industry and in large scale infrastructure projects demonstrate that energizing organizations to successfully deal with change goes beyond the traditional techniques of managing change from a program or project management perspective. Assessing the six batteries of change in this context can help organizations to develop capabilities for change that build change energy by balancing formal/rational methods with informal/emotional interventions at both a local (department/subproject) and global (business) level.

Keywords: large scale project management, organization development and change, batteries of change model

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1 Change management as a critical component of project management

As the construction industry counts for roughly 5% of the world's gross domestic product, it represents a significant part of the world economy and thus contributes to a large extend to wealth creation around the globe. The importance of this sector is generally even bigger in emerging and developing countries. Especially large scale infrastructure projects are critical to stimulate economic development related to mining, production and supply chain activities and thus to assure development and growth of other industry sectors as well. As such, they can also be seen as important vehicles to drive the well-being of the society. They can have an important impact on the quality of life of the local population, provided that they consider environmental constraints and assure the sustainability of the proposed infrastructure solutions.

Running successful large scale infrastructure projects in a fast changing world can be a daunting task however. The literature is full of illustrations that report up to 200% of cost and schedule overruns, unacceptable quality issues, or even complete project failure. Change is known to be a common problem in all construction projects, imposing a huge burden on the success of construction projects in general. It is even more problematic in large scale infrastructure projects that, through their size, scope and complexity, typically run over several years, if not decades, and as a result, many decisions have to be made based on incomplete or changing information, assumptions and personal experiences of construction professionals (Hao, Shen, Neelamkavil, & Thomas, 2008). Frequent changes are also known to lead to absenteeism, which further affects productivity (Mechanda, 2005).

As such it is generally understood that in construction engineering, project changes are hardly inevitable, with changes coming from various internal and external sources at various stages of the project life-cycle (Mechanda, 2005). Several authors have studied the impact of relatively small changes introduced by contractors and subcontractors during the construction phase in comparison with

significant design changes that are the result of incomplete or inconsistent drawings during the design stage, and the often catastrophic stakeholder/client/owner shifts in requirements during the specification phase as well as throughout the whole project life cycle. It should therefore be no surprise that managing changes effectively has been identified by several authors as a critical success factor for construction projects in general, and for large scale infrastructure projects in particular.

The focus of most papers however, has been on the identification of a generic change process model. Hao, Shen, Neelamkavil, and Thomas (2008) for example, propose a model based on five stages: identify, evaluate and propose, approve, implement and review. Putting this in practice is far from trivial, as it requires an integrated solution to manage documentation, drawings, processes, and information to support scope, cost, schedule and personnel decisions. From this perspective, change management quickly becomes an application-oriented 'control' issue, similar to handling engineering change proposals that deal with any type of changes in traditional manufacturing environments. In this context, ECM focuses on the integrations of the Product Life-cycle Model (PLM) and the enterprise management models implemented in the organization's ERP system, for which there is a vast list of integrated systems such as CAD/CAE/CAPP, PLM, and ERP software tools available on the market.

In large scale infrastructure projects, all this typically happens within a strict context of formal agreements with external parties. Building effective construction change management system that can offer the required traceability in terms of contracts, documents, approval process, and payment claims remains very challenging. Hao, Shen, Neelamkavil, and Thomas (2008) conclude that much more work needs to be undertaken to develop innovative and practical solutions that can be easily adopted by the construction industry, which is rather fragmented in nature and can be characterized by temporarily structures and alliances of partners with limited adoption of IT technologies.

However, the more fundamental limitation of this research stream on change management within the construction industry is that it addresses change management issues mainly from a project and program management context. It remains largely silent toward issues that need more than an automated standard process that assesses and manages the impact of inevitable changes. Whereas formal approaches toward handling changes are both essential and far from trivial in the context of large scale infrastructure projects, at the end of the day, any system is as good as the people that use it. The reality is that most people don't welcome change and therefore are likely to resist changes that threaten their needs. The best organizational systems can be ignored or even abused if the culture of the organization doesn't support learning from mistakes. And last but not least, even large scale projects that are in perfect alignment with the strategic objectives behind the project, can be easily countered by political maneuvering of the top team that is confronted with shifting interests and support from major stakeholder groups. The goal of this paper is therefore to pull change management as often perceived in construction engineering out of its typical context of program and project management-oriented action planning and implementation, in order to understand its implications from a holistic organizational development and change perspective.

2 Dominant organization development and change strategies

The literature on management of change is dominated by two large research streams that have foundations of their associated theories on fundamentally different perspectives (Palmer & Dunford, 2002). The underlying assumptions of the classical approaches toward the management of change are well reflected in the work of Beer (2001), who distinguished two dominant strategies for change.

Theory E: The Economic Top-Down Strategy. Beer's Theory E (Beer, 2001) has as its purpose the creation of economic value, often expressed as shareholder value. According to this theory, change should be planned and programmatic, focusing on formal structures and systems. It is typically driven by the top with the help of specialist consultants and financial incentives. As such, the Economic Top-Down Strategy can be largely characterized by Fayol's (1949) characterization of management as planning, organizing, commanding, coordinating and controlling. From this perspective, change is often defined as a shift from a present state to a desired future state (Beckhard & Harris, 1987), to be achieved through deliberate management actions. The underlying assumption is that strategic choice should determine the organization's formal development and that survival is mainly a matter of self-determination (White, Marin, Brazeal, & Friedman, 1997). It is seen as the responsibility of the top to align the organization with the changing environment (Rajagopalan & Spreitzer, 1997).

This strategy aligns with the dominant approach taken in large scale infrastructure projects, as described above. The requirements stage of the project defines the critical success factors of the projects (which in the case of large scale infrastructure projects needs to be treated as a program) based on the needs of its major stakeholders and translates this in an overall strategy that specifies the overall program requirements. During the design stage, these requirements serve as the criteria for the evaluation of design alternatives, which ultimately leads to specific objectives for the selected design that serve as the foundation for detailed program planning. Finally, during the execution

stage, we will monitor the implementation of various subprojects of the program. Deviations of these subprojects will trigger the change management process, which eventually leads to formally approved changes and adjusted budgets and schedules.

Theory O: The Organization Development Bottom-Up Strategy. As opposed to Theory E, Theory O is characterized by a completely different approach toward change (Beer, 2001). Here, the purpose is to develop an organization's capability to implement strategy and to learn about the effectiveness of change from actions taken. Theory O assumes change is emergent and therefore less planned and programmatic. The focus is on the development of a high-commitment culture and the creation of a learning organization. The characteristics of this strategy can be clearly recognized in the organization development (OD) literature. The traditional OD focus is on incremental, developmental change that shapes organizational capabilities through the improvement of organizational problem solving, leadership, visioning and task accomplishments between groups of a major subsystem or even an entire organization (French & Bell, 1999). This research stream emphasizes the socio-technical character of change in organizations and the participatory forms of management that it requires. This approach assumes that change cannot be predefined and thus encourages organizations to focus on developing individual and organizational change capabilities.

In the construction industry, this strategy aligns with the work of a limited number of authors that have called for a different research on change in construction. Harrington, Voehl, and Wigging (2012) have pointed to the potential benefits but also the difficulties of introducing TQM in the construction industry, emphasizing in particular the difficulties of creating employee involvement in developing nations. While studying the factors that influence the implementation of lean in the construction industry in China, Shang and Sui Pheng (2014) concluded that factors such as employee resistance to change and the rigid hierarchies found in most organization structures, have not received enough attention. A more general need for cultural change in the construction industry of developing nations has been highlighted by other authors as well. Hao, Shen, Neelamkavil, and Thomas (2008) identified serious ethical problems and disputes such as owners that are blamed for bid shopping and for playing tricks in payments. These illustrations emphasize cultural change from this perspective as well.

3 The batteries of change model

While there is a wealth of literature that defines different theories of change, there is no single well-defined path that leads to a certain future. Whereas a Top-Down approach is essential to achieve focus and alignment, successful change also implies mastering informal coalitions that drive the hidden dynamics of organizational change. As such there is a general need for integral theories that are designed to integrate all the various emergent models cited in the transformative organization development and change literature (Cacioppe & Edwards, 2005). This paper presents an integrated model developed by Boers, De Prins, Letens, and Verweire that, similar to other integral theories, proposes that at least two fundamental dimensions need to be considered to support holistic change management.

The first dimension contrasts formal/rational components of change with more informal/emotional components. This dimension finds its origin in studies of Burell and Morgan (1985) that point out that all organizational studies can be categorized by their objective or subjective orientation toward their topic. Edwards (2005) pointed out that there are associated dimensions, such as e.g. Barrett's (1998) tangible-intangible dimension, that emphasizes similar distinctions to Wilber's (2000) interior-exterior perspective of his Integral Theory and the more common subjective-objective dimension. As a result, within this research, all these distinctions will be considered together to characterize the first dimension of the proposed assessment framework (vertical axis in *Figure 1*).

The second dimension distinguishes between components that are aimed at optimizing the organization as a whole while assuring it's connection with the environment (Business/Global), and components that focus on local initiatives (e.g. at the department, process and project level) and recognize the individual perspective of employees toward change (Department/Local). This dimension refers to the different orientations with regard to issues that drive organizational change (Reed, 1997). The local/individual side of this dimension comes from theories of organizational agency that see change as a function of organizational regulation/control, directive management and transformative leadership within the entity, while the collective dimension can be associated with research that sees change as a result of power relationships, communal networks and cultural identity (Deetz, 1996).

The components of the integrated transformation model (*Figure 1*) are referred to as batteries of change that provide the necessary energy for organizations to successfully launch new implementation initiatives. Some of the batteries deal more with the strategic side of the spectrum while other batteries typically focus on the operational side of change. Similarly, the authors identified batteries that capture the more formal and rational elements of change and batteries that help to charge the informal and emotional side of change. The remaining part of the paper clarifies the importance of the six batteries in the context of large scale infrastructure projects.

Strategic orientation and direction. As already clarified in the first paragraphs of this paper, large scale infrastructure projects can be real drivers for economic activities in a particular region. As a result, it is important to

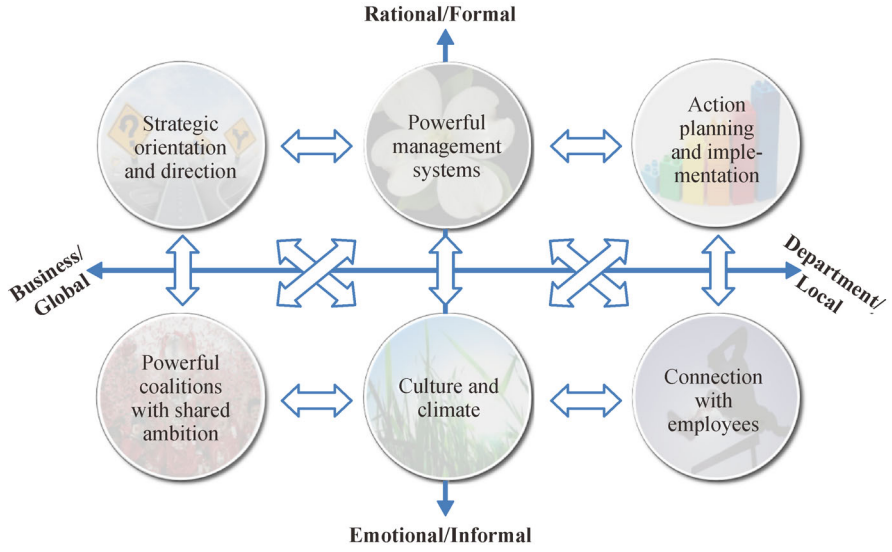

Figure 1. The batteries of change model.

define the overall design principles and design requirements based on a significant analysis of the environment's trends and needs in order to appropriately assess both internal and external factors that can influence the success of the project (Love, Holt, Shen, Li, & Irani, 2002). Defining a design strategy that is aligned with the overall environment and the strategic needs of the client and stakeholders during the pre-design stage of construction projects can be the source of change orders, rework and contractual claims (Smith, Love, & Wyatt, 2001). To avoid scope creep from the start, it may be essential to include a 'strategy of Not,' that clearly defines what should not be considered as part of the infrastructure project. It is important to consider alternative scenarios to demonstrate the robustness of project objectives in a turbulent environment and to define boundary conditions as well as value and risk from a multiple stakeholder perspective. Involving major stakeholders through engagement, explanation, and expectation clarity is critical for creating change energy through strategic orientation and direction.

Powerful coalitions with shared ambitions. Large scale infrastructure projects are subject to an array of influences, from regulatory control to political and industrial intervention (Sidwell, 1990). Creating an ambition that inspires all stakeholders is important for any change initiative. This is however even more critical for large scale projects as the duration of a project often spans multiple election periods of changing political leaders. The political dimension of large scale infrastructure projects also introduces the danger of being confronted with a top team with dysfunctional team characteristics: absence of trust, fear of conflict, lack of commitment, avoidance of accountability, or sometimes even inattention to results (Lencioni, 2002). Being successful in this context also implies selecting emotionally mature leaders, as has been emphasized by Butler (2005), who identified high levels of emotional intelligence for construction industry leaders that held executive positions and were listed in Engineering News Record's (ENR) Top 400 Contractors list from 2004.

Powerful management systems. Large scale projects really need to be managed through sound program management, not just advanced project management. Traditional control mechanisms (such as Work Breakdown Structure, Gantt Charts, PERT/CPM networks, Project Crashing Analysis, Trade-off Analysis, etc.) are not entirely adequate for managing complex infrastructure projects (Love, Holt, Shen, Li, & Irani, 2002). This implies contract monitoring as well as effect measurement, prioritization and capacity management of subprojects as well as training and competence management of all the involved employees. This is extremely challenging due to the temporarily nature of collaboration between the overall project and its various subprojects that often cover activities with limited scope and duration.

Culture and climate. In the presence of strict contractual requirements, there is a need to avoid the creation of a culture of blaming and conformance. Although in an empirical study of 181 construction firms in the UK, Jashapara (2003) found that learning and a cooperative culture had a positive impact on organizational performance; Love, Li, Irani, and Faniran (2000) found that many construction organizations still have to change their mindset in order to learn from their mistakes and adapt to the changing environment. A learning organization culture stimulates individual excellence as well as team learning across the various sub-organizations that may be involved. It implies the creation of a shared overall picture that encourages entrepreneurship toward common goals that go beyond the traditional procurement practices that often discourage effective learning practices, and explains why

the construction industry allows the continuation of 're-inventing the wheel' and experience of good practice is often wasted (Biloslavo & Friedl, 2009).

Connection with employees. Behavioral responses of individuals directly affect the performance of an organization. This is not different for large scale infrastructure projects. To instill the right set of behavior and manage potential resistance against change, the organization needs to have an eye for individual motivation, education, role relationships, and personal goals and values (Nesan & Holt, 1999). This implies driving change through clarity of open an honest communication, winning the hearts and minds of all involved employees through a better understanding of their personal needs, as well as building trust through coaching, role modeling, recognition and rewarding but equally important, emotionally mature resistance management.

Action planning and implementation. Although the basic tools are not sufficient to manage the overall program, they still remain essential to effectively manage change at the subproject level. Low level (sub) project managers need strong mandates that allow them to undertake detailed planning at their level, but they also need to monitor and report changes that interfere with the intended progression of work (Love, Holt, Shen, Li, & Irani, 2002). To deal with uncertainty at this level, a structured though agile approach toward problem-solving and risk management is essential (Akintoye & MacLeod, 1997).

4 Insights and future research

Although improving the construction industry has received significant attention from governments and practitioners around the world for several decades already, there are few studies that adequately recognize the interest of stakeholders and take sufficient account of concepts such as power, status, learning, boundaries, goal evaluation, innovation and group values. This paper demonstrates how looking at change in the construction industry through the eyes of an integrated change model such as the batteries of change model can support addressing this research gap.

Each method of company change is optimal in different circumstances, and its selection is influenced by many factors in a company's internal and external environment (Biloslavo & Friedl, 2009). The batteries of change model allows project managers to go beyond their traditional role and to pick up their role as agents of change by building energy for change in six critical domains. This includes well known practices relating to traditional project and program management, but also stretches the importance of various other factors that are needed to assure balance and flow of change energy from a more holistic perspective. As each method of company change (formal or information, local or global) is optimal in different circumstances, and its selection is influenced by many factors in a company's internal and external environment (Biloslavo & Friedl, 2009), the batteries of change model can help to identify the most appropriate change strategy within a given context. It allows change managers to navigate the organization through the complexity of multiple variables (context, political processes and consultation) by identifying the range of change options based on a holistic assessment of the six batteries of change.

Future research needs to further validate the application of the batteries of change model within the context of the construction industry in general and large scale infrastructure projects in particular. This may be even more essential for managing change in transition economies, since the traditional methods of change are all too often taken over from environments that are politically, economically and culturally different (Dubrovski, 2009).

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