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IS AGILE PROJECT MANAGEMENT APPLICABLE TO CONSTRUCTION?

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ABSTRACT

This paper briefly summarises the evolution of Agile Project Management (APM) and differentiates it from lean and agile production and 'leagile' construction. The significant benefits being realized through employment of APM within the information systems industry are stated. The characteristics of APM are explored, including: philosophy, organizational attitudes and practices, planning, execution and control and learning. Finally, APM is subjectively assessed as to its potential contribution to the pre-design, design and construction phases.

In conclusion, it is assessed that APM offers considerable potential for application in pre-design and design but that there are significant hurdles to its adoption in the actual construction phase. Should these be overcome, APM offers benefits well beyond any individual project.

KEY WORDS

Agile, Project Management, Construction

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INTRODUCTION

The evolution of Agile project management (APM) has its foundations in the management science of Deming and is described more fully elsewhere (Owen and Koskela, 2006b). However, it is important to point out that APM, as it has evolved within information systems development, is synonymous neither with agile manufacturing, despite some common roots and similar characteristics, nor with 'lean'.

Whilst some see agility as a state of mind, others focus on methodologies; those who implement 'agile' frequently confuse it with 'lean'. In terms of manufacturing, lean and agile are different, as pointed out below (Sanchez and Nagi, 2001):

> *'Lean manufacturing'* developed as *'a response to competitive pressures with limited resources. Agile manufacturing, on the other hand, is a response to complexity brought about by constant change. Lean is a collection of operational techniques focused on productive use of resources. Agility is an overall strategy focused on thriving in an unpredictable environment. …… Flexible manufacturing systems* (offer) *reactive adaptation, while'* agile manufacturing systems offer *'proactive adaptation'.*

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In other words, to be agile an enterprise or project must be structured appropriately to proactively and quickly adapt to change, seizing such opportunities to enhance value outcomes. It should be noted here that 'lean construction' contains some aspects of both lean and agile production and the 'Last Planner' method (Ballard, 2000) can even be seen as partially agile. An alternative and interesting view of merging lean and agile techniques ('leagile') has been proffered (Naim and Barlow, 2003); however, this only considers the 'pull' nature of agile customer demand on the lean construction supply chain and does not embrace APM holistically. A summary comparison of some of the similarities and differences between lean construction and APM is shown in Table 1.

Table 1: A Comparison between Lean Construction and Agile Project Management

	UK Lean Construction	**IGLC Lean Construction**	**Agile Project Management**
Evolved from	Toyota Production Methods/ Egan/ Construction Lean Improvement Programme	Toyota Production Methods/ Koskela TFV Theory/ Theory of Constraints/ Complexity Theory/ Systems Thinking	Reaction to Information Systems poor performance/ Complexity Theory
Key Tenets	Waste Reduction & Bench Marking	Waste Reduction, Flow & Value	Emergent Value & Rapid Feedback
Signature Methods	Supply Chain Relationship Change/ Just In Time/ Performance Measurement/ Customer Pull	Collaborative Working & Distributed Management (Last Planner)/ Customer Pull	Embedded Customer/ Empowered, Multi-disciplinary Teams
Essential	Repeatability/ reliability	Reliability	Reliability
Continuous Type 2 Learning	Push/ Top Down	Partial (Design & Last Planner) but evolving	Yes
Decisions Delayed Until Last Responsible Moment	No	Partial (Last Planner) but evolving	Yes

Metrics summarised in Boehm and Turner (2004), Shine (2003) and Stapleton (2003) showed dramatic changes in customer and business satisfaction in the information systems industry through the use of APM. Specific contributions included significant improvements in productivity, quality, predictability and both development personnel and managerial organisational skills. There was also a significant reduction in cost, though that was, in APM terms, a secondary effect.

APM CHARACTERISTICS

APM can be expressed in terms of an underpinning philosophy; this philosophy affects how APM is most effectively applied, whether in the field of information systems or elsewhere. Some outline rationales for adopting APM have already been explored (Owen and Koskela, 2006b); there is potentially more to offer in construction than the application of 'agile' customer pull on the customisation of products (Naim and Barlow, 2003). The application of APM can be described in terms of organisational attitudes and practices, its impact on project planning and execution, and its impact on methods of control and organisational learning, as shown in Table 2.

Table 2: Project Management Method Comparators

Philosophy	
Organisational Attitudes & Practices	Attitude to Chaordic Change
	Management Style
	Organisation Type
	Work Group Structure
	Approach to Risk
Planning	Nature of Planning
	Requirements Capture
	Work Package Structure
Execution	Development Approach
	Quality Approach
	Customer Involvement
	Value Delivery
Control & Learning	Project Metrics
	Attitude to Learning

PHILOSOPHY

The area of philosophy and metaphysics has been well reviewed in terms of production (Koskela and Kagioglou, 2005). APM fits within the philosophy of process metaphysics through its embracing the emergence of value as a process throughout the project life cycle. On the other hand, traditional manufacture, construction and sequential project management tend towards an emphasis on defining value up-front as something to strive to deliver.

In terms of project management theory, APM is very much aligned to the discovery of emergent business needs to provide value, primarily using management-as-organising (but in a very light-weight manner, i.e. facilitation). Project flow is typically managed in a regular ('time boxed') manner to ensure that value is generated continuously throughout the project. APM is strongly focussed on the scientific experimentation model as its primary control mechanism. (Koskela and Howell, 2002a). In terms of practice, APM could almost be considered as the opposite of a systems engineering approach, which relies on detailed knowledge elicitation and modelling up-front (Bonaceto and Burns, 2005).

ORGANISATIONAL ATTITUDES AND PRACTICES

APM requires significant changes to traditional attitudes and practices, not least being the attitude to change itself.

Attitude to Chaordic Change

It is significant that lean production and APM have different aims: lean seeks essential repeatability, whilst agile seeks essential reliability (Highsmith, 2004). An alternative view is that lean focuses on efficiency and requires stability, whilst the agile process focuses on effectiveness (Naim and Barlow, 2002). APM recognises change as inevitable and as an opportunity to enhance delivered value (Owen and Koskela, 2006a); APM can be seen as *harmoniously blending characteristics of both chaos and order*, thus being 'chaordic' (Hock, 2000).

On the other hand, change has traditionally been seen as a threat to conformance to plan. The difficulty with such a view is that we are unable to adequately describe an interactive system in the first place (Owen and Koskela, 2006a), so to try to persist in initial exhaustive requirements definition is to ignore the opportunity to improve understanding throughout the project.

Management Style

Traditional hierarchical management relies on the largely unidirectional flow of communication, thus denying opportunities for retrospection which are afforded through APM (Boehm and Turner, 2003).

The 'command and control' style of management used in many industries and projects inhibits trust and hence reliability, whereas APM provides, together with facilitating leadership, an effective managerial motive force and fosters creativity.

Organisation Type

In view of the stress on small, facilitated and empowered teams, McGregor's theory Y (McGregor, 1960) practices of consensual management (Massie and Douglas, 1992) are obviously more relevant to agile than theory X, traditional western autocratic organisations. Ouchi's theory Z (Ouchi, 1981) attempts to merge the best of theory Y into modern western organisations, adding a large amount of freedom and trust of workers. However, it also assumes that workers have strong loyalty and an interest in team-working and in the organisation itself. Therefore, although theory Z 'pragmatic oriental' practices of collective decision making, employee-employer relationships and long-term employment organisations would prove a natural management fit with agile techniques such as Scrum (a Japanese-derived management method – see Koskela and Howell, (2002a) and Schwaber (2004)), it fails to cross the cultural divide inherent in many western enterprises.

Work Group Structure

In APM the use of small, empowered, multi-skilled teams is a common trait. These teams rely on tacit knowledge and dense communications to create innovative solutions through swarm intelligence (Bonabeau and Meyer, 2001) and are typically self-managing; the project manager provides leadership and facilitates progress. It can be argued that spontaneous, self-organising teams would prove even more productive (Anderson and McMillan, 2003).

APM relies on a flatter, team-based structure rather than traditional close, hierarchical management. The removal of tiered management effectively removes communications protocol overheads, as well as reducing unnecessary systems noise and the probability of compounding errors.

Approach to Risk

For apparent pragmatic reasons, organisations are often 'risk averse'. As a consequence, financial, legal and insurance frameworks have evolved to ensure that risk is passed as far down the contractual food chain as possible (Pietroforte, 1997), resulting in companies divesting themselves of organic expertise, as in much of the construction industry. Such risk distribution and management mechanisms are obviously causal in the development of adversarial business relationships.

Written evidence supplied to The House of Commons by IBM (Cornielle, 2004) states: *'A system designed to pass off risk to one party, without also encouraging the other party to work to mitigate that risk, is doomed to failure'*.

The alternative and agile approach is that risk is passed to whichever actor is most capable of resolving it, irrespective of initial contractual relationships. In other words, risk is apportioned from a total value maximisation perspective, rather than a(n apparent) local financial risk management perspective. Such actions typify the network of trust which is necessary for true teamwork.

Planning

Most project managers will recognise the need to following a well-prepared plan, and the ensuing fight to get back on plan when things go wrong. However, this is not the APM way.

Nature of planning

Traditional project management tools expect a sequential plan to be prepared in detail for the entire project, and then to be rigidly followed. Deviation from plan is expected to be resolved with an overall aim to get back on plan.

APM also expects that a plan is prepared but at a level that is both realistic for the planners to act on in the short term in order to deliver early value, and to mitigate risk for the entire project. Where possible, decisions are delayed until the 'last responsible moment'.

Requirements capture

APM recognises that change is inevitable during a project and therefore embraces it as an opportunity for enhancing customer-perceived value. This is particularly important in the case of information systems as they are so difficult to visualise, and: *'We can not completely specify an interactive system*.' - Wegner's Lemma (Wegner, 1995)

However, many construction projects could also be categorised as interactive systems and research shows that significant uncertainty remains as to what is to be constructed, as late as the start of construction. (Howell et al., 1993).

Traditional requirements capture can be shown to be less than optimal: 'The definition and dissemination of initial objectives was not significantly related to the success or failure of a project.'; and: *'Successful projects were able, over their lifetime, to resolve the initial uncertainty associated with their technical and commercial goals and objectives.'* (Baker et al., 1986)

APM recognises that changes throughout the project force scope control to be an ongoing task: project scope should only be defined as far as we are currently truly able to comprehend and prioritise it, from the perspectives of value realisation and risk mitigation. We can then use project team (including the customer) learning for control and rapid feedback.

Work package structure

Instead of the traditional task-based WBS being used to realise the project plan, APM utilises its dynamic work backlogs. Typically, 'stories' are first developed to describe the wider business value priorities, facilitate rough estimation and showing how value will be validated.

A prioritised backlog is then produced of value generation and risk mitigation tasks which will change during the project based on organisational learning. Each value generation or risk mitigation task is structured and sized in such a way that its package can be delivered within a regular and sustainable time(boxed) period (30 days for some APM methods) (this can be considered as analogous to Takt time in the Toyota Production System (Liker, 2004)).

Execution

Agile project management can be seen as 'management as organising' (Koskela and Howell, 2002b), indeed, an agile project manager is very much seen as a facilitator who enables small, self-organising multi-disciplinary teams to decide for themselves how they satisfy their value goals.

Development approach

Traditionally requirements capture methods usually discourage further adaptation once the plan is running. After the requirements are described they are broken down and recompiled into logical groups, often to create delivery milestones. It is obviously in the developers' interest to strive to meet these milestones as payment is usually attached to them; change is seen as adding risk.

APM relies on incremental and iterative development with continuous learning being essential to the evolution of the optimal value (to the customer) within the constraints of time and cost. Thus, the 'iron triangle' of traditional project management is turned on its head, as shown in Figure 1 (after Cockburn, 2003).

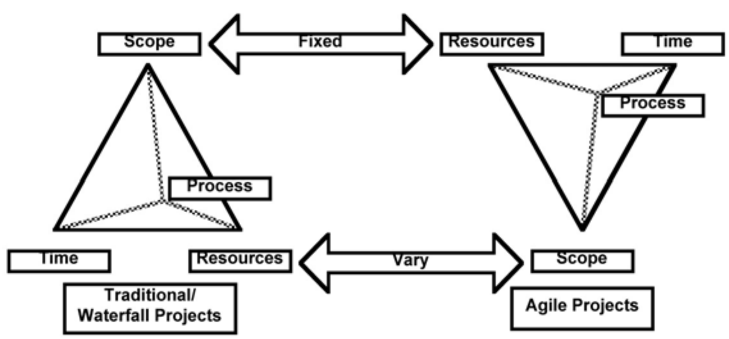

Figure 1: Traditional versus APM

Quality approach

Compared with structured sequential (Royce, 1970) or 'waterfall' PM, APM was reported as delivering defect rate improvements of 61% in two case studies (Bowers et al., 2002), whilst 83% of 131 respondent companies in an online survey reported better or significantly better quality (Shine, 2003). The reasons for improvement in both defect rates and perceived quality are not fully understood; however, it is probable that defects are caught and corrected much earlier because of the nature of APM teams, work structures and feedback mechanisms. APM also concentrates on evolving customer perceptions, rather than conformance to an early plan.

Customer involvement

Every project manager must see customer involvement as vital at the requirements collection and specification stage, and most would carry this through to the design phase. In the author's own experience, many managers of sequential development projects act as if customer involvement at later stages of production is a necessary but irritating obstruction to efficient completion of the plan; such involvement must be managed and minimised.

However, APM emphasises that customer involvement right through the project is key to the organisational learning required to iteratively and incrementally produce the best possible value yielded through Type 2 learning. The result of such change must be reflected in the reported 83% improvement in business satisfaction from using APM (Shine, 2003).

Value delivery

A major focus of APM is the early and sustained delivery of value, as seen by the customer or stake holders.

At the end each timebox recognisable (by the customer) value must be delivered; feedback and learning are core to the dynamic realisation of customer value. At the end of the project the customer has received what they by then realise are their dynamically prioritised value deliveries, rather than what the supplier and they would have originally identified under traditional processes. The structure of APM value delivery is shown at Figure 2. This contrasts starkly with the traditional approach of value residing with the developer/ contractor until the customer is prepared to accept the phase/ project as complete.

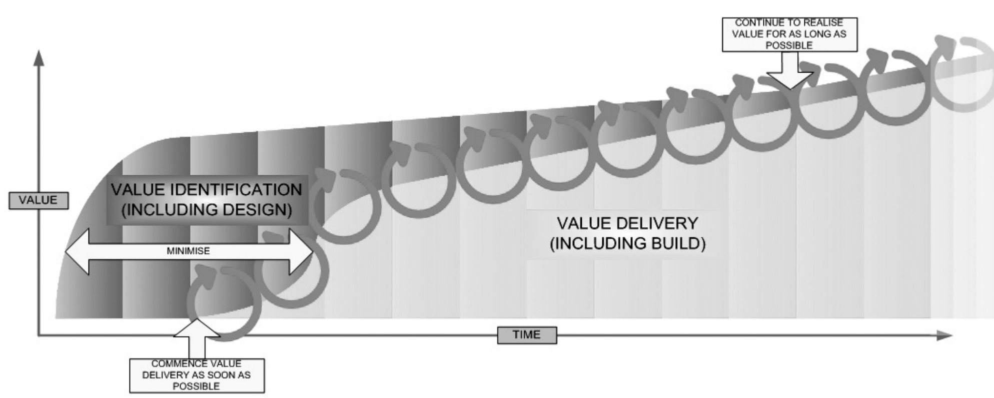

Figure 2: APM Value Delivery

Control and Learning

APM offers the possibility of process improvements in the use of metrics for project control. However, the area of organisational learning offers even greater potential, both during the project and in the medium and long term.

Project metrics

Whilst measurement is never waste if it enhances value or learning, excessive measurement can interfere with work and metrics should both be meaningful and have context. Excessive emphasis on data collection (Armour, 2006) not only adds waste to the production process but also can lead to information overload to such an extent that analysis paralysis is reached and derived information therefore becomes stale and obsolete before it is available.

On the other hand, APM relies on minimal, accurate and up-to-date metrics, displayed as 'big visible pictures', to facilitate project control at a glance. An exemplary example of this is the Toyota product development environment, Oobeya (big room in Japanese) (Tanaka, 2005) which consolidates meaningful metrics for control and involves every functional area in one place.

Attitude to learning

Traditional project management employs Model 1 single loop learning which *'make(s) organizational assumptions and behavioural routines self-reinforcing – inhibiting "detection and correction of error" and giving rise to mistrust, defensiveness and self-fulfilling prophecy'* (Edmondson and Moingeon, 1999)

On the other hand, Model 2 learning organizations have governing values which include: valid information, free and informed choice and internal commitment. Model 2 strategies are: sharing control, and participation in design and implementation of action. Model 2 learning organisations are rare, though they foster double loop learning, as shown in Figure 3. (Argyris and Schön, 1996)

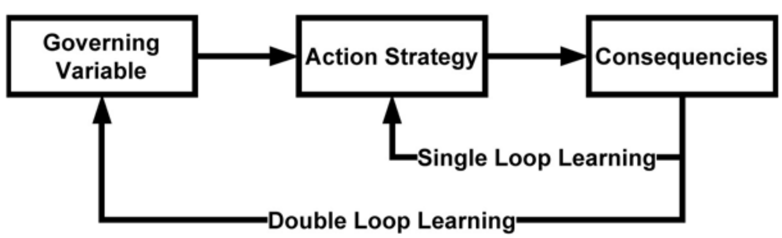

Figure 3: Single & Double Loop Learning

Agile project management has emerged from double loop learning (Model 2), i.e. by questioning the governing variables such as methodologies. Double loop learning continues throughout the agile project through the formal use of iterative development and through the informal learning inherent in small interactive multi-disciplinary teams. Any Model 2 organisation relies on the sharing of control, design and implementation of action, using

minimally defensive relationships and is in direct contrast to the traditional command and control management system and waterfall development methodologies.
As with the Toyota Production System (Liker, 2004), it is essential for an agile workforce and their employers to have long-term bi-lateral commitment and for the workforce to be encouraged and trained in the application of Model 2 learning.

Since the 1970s, particularly in the construction industry, main contractors have employed less labour to give them more flexibility and to offset risk (Pietroforte, 1997). Employees generally no longer benefit from the in-depth training and industrial fidelity inculcated by traditional apprenticeships. This mobility and de-skilling of the workforce is an obvious impediment to agile learning.

POTENTIAL AREAS FOR IMPROVED AGILITY WITHIN CONSTRUCTION

Within the construction industry, it is possible to consider the pre-design, design and actual construction phases separately. These have been mapped against the APM analysis, above, in order to assess the degree to which APM might be useful to the industry.

Pre-design Phase

In the pre-design phase of a construction project, the three prime issues are: concept development; planning covering procurement strategy, time and cost; and the preparation of a brief (Best and de Valence, 1999). The contents, organization and management principles used in the pre-design phase vary considerably across projects and client organizations, even if (especially larger) clients have created standard procedures for this phase. There is often considerable complexity in the pre-design phase (Pennanen and Koskela, 2005). This phase being a basis for subsequent phases, the output of pre-design should be comprehensive and integrated (Morris, 1991), as well as consistent.

The key findings in prior literature on the pre-design phase suggest that, in practice, the approach in pre-design tends to be either too programmatic or too chaotic (following the adhocracy prescription of Mintzberg (1983). This results in incomplete, inconsistent or otherwise suboptimal guidance for the subsequent phases of the project.

Whether agile principles are applicable in the pre-design phase is discussed based on three criteria, presented in diminishing order of validity:

- Agile principles have successfully been used, implicitly or explicitly.
- Problems have been identified in prior literature, to which agile principles arguably provide a solution.
- Agile principles can be argued to be applicable, based on general knowledge related to the pre-design phase.

In the following, the application of a number of agile principles to the pre-design phase is analysed, based on the fore-mentioned principles. The starkly contextual nature of any statement and advice should be noted.

Philosophy. In the pre-design phase, a considerable number of issues are in a flux, and the whole process is emergent. Thus, process metaphysics can advantageously be used as a basis for conceptualizing this phase.

Attitude to Chaordic change. New opportunities constantly emerge (Blomberg, 1998) and new risks are constantly identified; thus the situation is characterized by chaordic change.

Management style/work group structure. It is advisable to organize through an empowered team any large and complex pre-design effort, with frequent mutual communication. Hierarchical decision making has been found to cause problems, for example in the pre-design phase of primary healthcare facilities (Tzortzopoulos et al., 2006).

Customer involvement. As requirements capture is a central task in the pre-design phase, customer involvement is clearly highly recommended, if not essential.

Nature of planning. Due to the complexities and uncertainties involved in the pre-design phase, anything other than lightweight planning is probably nugatory. Indeed, Blomberg (1998) finds very little formal planning in the early phases of successful projects.

Development approach. Due to the needs for integration and customer involvement, an iterative and incremental development approach can be – and is often recommended for the pre-design phase.

Requirements capture. The distinction between stable requirements (to be captured up-front), volatile requirements (for which options need to be kept open) and evolving requirements (for which learning is to be cultivated) is highly relevant in construction projects. Consequences of failures to categorize requirements in this way and reliance on immature requirements are reported by Tzortzopoulos, et al. (2006).

Arguably, agile principles and methods promise the potential of an improved approach for the pre-design phase, being simultaneously appropriately structured but also flexible enough to allow opportunities to be seized and creative solutions to be devised.

Design

Design is the intermediate phase where the concept generated during the pre-design phase will be developed and transformed into solutions (specifications and prescriptions) to guide construction, operation and maintenance of the building (Kagioglou et al., 1998). As such, two main issues emerge: the integration between design and production, and the dynamic process of requirements capture.

Despite the possibility of generalizing the main phases of the design process, the content developed during this phase varies from project to project, and is also varied through iteration inherent to designing. It is to these two key issues that it is believed that APM can contribute value.

Philosophy. In the design phase, contemporary methods and approaches, such as Concurrent Engineering and Last Planner are essentially based in delivering value throughout the process (Kamara et al, 1997); (Codinhoto, 2003). Issues regarding the identification of trade-offs, processes of analysis and synthesis, and also decision-making are in flux. Therefore, process metaphysics is the appropriate basis for conceptualizing this phase (Koskela; Kagioglou, 2005).

Organisational Attitudes and Practices. The construction industry, in general is characterized by the establishment of a new team of companies for each new project. Therefore, the design team varies from project to project and the categories Y, X and Z can not easily be applied in construction. However, it is possible to say that some Type Z characteristics e.g. collective decision making and improved employee-employer relationships can be observed in some long-term partnerships (Kamara; et al, 1997); also observed in the Heathrow airport Terminal 5 project (College, 2005).

Regarding iterative and incremental development of value, it seems that this is a natural process in the design phase. However, to delay decisions to the 'last responsible moment' would prove problematic in the construction setting, as currently structured with its discrete phases. Such an attitude might also imply difficulties in product development coordination (Clark and Fujimoto, 1991). The design process is highly interactive and before any change the design team should consider the impact of the change on the product, and also on the design process itself (Crawford and Benedetto, 2000).

Planning. Design planning has been considerably investigated in manufacturing and in construction. Approaches, methods and tools vary greatly. Therefore, there is a range of solutions that fit into one of the two categories "light" and "heavyweight". On the one hand, Design Structure Matrix (DSM) and Analytical Design Plan Technique (ADePT) (Austin et al., 2000) constitute examples of heavyweight planning. On the other hand Last Planner (Ballard, 2000) can be considered lightweight.

Regarding the client requirements capture in the design phase, it seems that a considerable number of methods, e.g. Quality Function Deployment (QFD) are focused in detailing the requirements exhaustively and at the beginning. Studies as presented (Miron and Formoso, 2003) show that there is still a gap regarding the process of requirements capture during the whole design phase, indeed, research shows that, as late as the start of construction, significant uncertainty remains as to what is to be constructed (Howell et al., 1993).

Finally, the use of work breakdown structures is the current basis of work package structures in construction. The division of the tasks according to products and sub-products to be delivered is a common practice in construction. The process protocol developed by Salford University (Kagioglou et al., 1998) is one example.

Execution. Regarding the approach to development, the design phase can be either sequential or iterative. The adoption of one or another will vary according to the project as discussed by Kamara et al (1997). On the one hand, the adoption of iterative approaches will result in frequent value delivery for clients. On the other hand, sequential approaches are characterized by product delivery at the end; as a consequence errors and corrections are frequent (Prasad, 1996). Also quality is delivered considering both the perception of value by the customer and other stake holders, and defect reduction (e.g. Design for Manufacturing and constructability analysis). Client involvement during the design phase is common practice in construction.

Control and Learning. The construction design is constantly measured according to different types of metrics, for instance, cost, maintainability and sustainability of solutions. However, the relations between different metrics are not completely understood. Regarding attitude to learning, the process will vary within each new project. Therefore, it is substantially based on change management within the temporary organisation, with knowledge retained largely at the individual, rather than wider organisational level.

In conclusion, the adoption of APM principles in the design phase is very appropriate to the challenges that face the construction industry, for instance, the development of high quality and complex products at lowest possible cost. However, its adoption will vary according with the complexity and uncertainty related to the project; it would be particularly appropriate where solutions to requirements evolve or are likely to change through the project. Therefore, the projects that will gain more benefit from APM are projects in which a considerable number of clients are involved, requirements are conflicting and constantly generate trade-offs, and early delivery of value is a priority.

Construction

The construction phase differs from design in some relevant ways; these will be pinpointed to analyze the applicability of APM in construction. Firstly, we have to be aware that the construction phase utilises a wider disparity of employers and employees, this workforce is also one of the most poorly prepared in terms of professional qualifications and have amongst the lowest comparative salaries (Koch, 2005). Thus, trying to apply new management methodologies in construction, we are confronted by a large culture problem which must change in order to enable training and learning to achieve multi-skilled and self-managing teams, as proposed by APM philosophy. Furthermore, construction is usually characterized by having a great number of sub-contractor and casual workforces; this is a significant impediment to inculcating strong loyalty from workers (Howell and Koskela, 2000). Despite all these construction culture problems, the authors believe that there is room for use of APM in construction on the site level, at least for planning, when managers can respond quickly to any change that might occur in the scope of the project.

However, construction shows considerable inertia towards cultural evolution. Therefore, at the lower levels of execution, an APM implementation is likely to be harder because the consequences of changes can cause big impacts and their cost can be too high for this non-coherent workforce to assume. But, as mentioned previously, APM applicability will also depend on the scale of the project and the organisation type. Construction has started to move forward with a positive change in philosophy by taking into consideration more human aspects within some production management methods (e.g. the Last Planner System (Ballard, 2000)).

The APM approach relies on up-front value definition, and early and continuous delivery of value to customers. In design APM fits perfectly, but in the execution phase it is more complicated to achieve as there are many more interdependent activities. In brief, the authors believe in the APM concepts and think that it could be a powerful tool for construction managers, mainly for planning in the production phase of construction. However, for managing construction execution, a great amount of effort would be needed, beginning with a culture change within the sector.

CONCLUSIONS

APM revolves around the embracing of change as an opportunity for improved, early and sustained value delivery; it requires organisations to be more proactive than lean organisations. To achieve this, stake holders, including the client/customer utilise the power of organisational learning. However, for the organisation to learn organically it is vital to employ a highly trained and team-based workforce to use their swarm intelligence; bi-directional loyalty and mutual long-term commitment are necessary for such learning.

There seems to be considerable potential for gains to be made from the adoption of APM in the pre-design and design phases of construction; iterative and incremental development can facilitate creative solutions, particularly to complex and uncertain requirements. However, the fractured and temporary nature of the actual construction organisation is likely to impede the desirable continuation of these practices through to construction and support.

A construction industry restructured to embrace a more highly trained and motivated work force should yield an improvement in customer-perceived value delivery, forming the basis of long-term trust networks. The bid-to-win ratios of construction companies would then be improved; reducing the feast and famine nature of each company's own contracts, and forming the basis of an iterative and incremental improvement of fortunes for such innovators.

Whether or not it is adopted within construction, APM acknowledges that change is inevitable. Agile Project Management delivers real benefits to those organisations which thrive on change, and which foster a culture where workers can contribute to organisational learning (and hence, profitability).

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