Advantages of Implantmentation of Agile Management in Construction

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ABSTRACT

In any construction projects the project durations are elongated which usually includes changes form the initial project idea to the end of the design phase, requirements and expectations of the project tends to change. There are many reasons for this, viz. new or more meticulous disclaimer from the client, or perhaps, changed factors in the surrounding. A problem is that changes have penalty in terms of extra costs, extensive time and transformed scope. Hence, unwanted changes often mean that the resources are used in an disorganized way since re-work has to be done. This often affects the client satisfaction pessimistically since, as earlier mentioned, costs might increase, time might be extended or scope could have to be changed. The plan to work proficiently in the design phase of construction projects lays the foundation for this report. More specifically, agile methodologies can make the course and system-stages, of a construction project, more efficient and thereby increase the client contentment. agile methodologies could be described as “the ability to revolutionize quick retort”. In a few words this paper summarizes the advantages of the implementation of the agile management over strategic management. The implementation of strategic management may cause delayed project durations which automatically increases the cost. This may result into customer dissatisfaction agile project management methodologies can help to improve the productivity and to serve to customer satisfaction.

Key words: Agile project management, project duration, design phase, project cost, customer satisfaction.

1. INTRODUCTION

Generally, agile is more applied to the execution phase of a construction project, as there still has to be some practically solemn upfront planning. Major changes late in a construction project are generally hard to do efficiently. Also, the key principle of incremental deliverance of value in the form of working software does not translate well to construction. Conversely, agile concepts such as client collaboration and receptiveness to change have a place in a construction project. Lean methods applied to construction are beneficial in regards to creating material and information flows, maximizing value cohort, and the use of plan-execute-and-control paradigms Once the overall design and master schedule for the project has been shaped, then a method known as the Last Planner System can take that master schedule and provide a process for contravention work down into smaller units that can be executed more iteratively[1]:
1.1 Construction Management In India-
In India construction management is still done strategically. This scenario is not only in India but also many countries have the same phenomenon of management in construction. The traditional philosophy of management in construction, both in academia and in industry, places has great prominence on the ability to plan and execute projects. In contrast, a similar prominence on strategic management has established less consideration in the construction industry. Although the pressures of project recital can often be incomprehensible the broader social, economic, and professional context in which strategic management is undertaken, it is these wide-ranging contextual areas that make strategic management an essential issue for construction organizations. Hastily varying social and technological issues are creating a proficient environment that will look very singular in the coming decades from that experienced in today's organizations [2]. Strategic management of construction organization has to take place within the context of fortunes of the construction industry. As many researchers have documented one of the enduring characteristics of the construction industry is its variability in demand. Taking the snapshot of the construction industry in 1998 the order received by contractors were 6% higher than in 1997. The DETR recorded that between 1990 & 1997 the industrial workload declined by 23% yet the years 1999-1998 showed a growth in the same market of 18%. Looking at the same years in the commercial market the same volatility can be observed. Between 1990 & 1993 the volume of work in the commercial market fell by 68% and in the period 1995-1998 it had grown by 43%.

1.2 Agile Management-
Over the last few years agile methodologies have been developed and are now widely used in different types of projects. Agile methodologies have numerous advantages over the classical methods used in project management and the implementation of these methodologies in projects of different areas and scopes is very interesting. Typically, this type of methodology is used in software development projects, which by their nature makes a perfect match with the principles introduced by agile methodologies. However, projects in other areas such as civil engineering, less flexible and with more physical constraints, have been trying to apply these methodologies. The agile methodologies are suited for projects with high intricacy and improbability. It is also suitable to work in agile ways when a project has unclear specifications, changing situations, complex project goals and results needs to be achieved incessantly or early in the project process. Agile methodologies introduce significant changes in relation to classical methods; the most significant change is to develop projects in an iterative cyclic way. Iterations divide the work to be performed by several stages, making deliveries to the customer at the end of each stage. In most cases the duration of the iterations is set at the beginning of the project and should only be changed in an extreme case. The maximum duration of iterations is typically a month. This is, as stated above, one of the main particularities of agile methodologies. Besides the advantage from the iterative operation – the progressive delivery of the product rather than just at the end of the project cycle - these methodologies allow a better participation of the client and an effective monitoring of the progress of the project, allowing the project manager to know whether the project is ahead or behind of predictions. Regular meetings between the people involved in the project allow better control of the project progress, as well as more efficient management of all resources involved in the project. [3].

2. PROJECT MANAGEMENT IN CONSTRUCTION INDUSTRY-
Construction planning is a elementary and exigent activity in the management and execution of construction projects. It involves the selection of technology, the characterization of work tasks, the estimation of the required resources and durations for entity tasks, and the identification of any interactions among the different work tasks. A good construction plan is the foundation for mounting the budget and the schedule
for work. Developing the construction plan is a decisive task in the management of construction, even if the plan is not written or otherwise formally recorded. In addition to these technical aspects of construction scheduling, it may also be indispensable to make executive decisions regarding the relationships between project participants and even which organizations to include in a project. For example, the degree to which sub-contractors will be used on a project is often determined throughout construction planning.

Philosophy To form a construction plan is a highly exigent task. As Sherlock Holmes noted: Most people, if you describe a tutor of proceedings to them, will tell you what the result would be. They can put those events together in their minds, and squabble from them that something will come to outdo. There are few people, however, who, if you told them a result, would be able to evolve from their own inner perception what the steps were which led up to that result. This power is what I mean when I talk of reasoning backward[5]. Like a detective, a conspirator begins with a product (i.e. a facility design) and must synthesize the steps required to acquiesce this result. Indispensable aspects of construction planning include the generation of required activities, investigation of the implications of these tricks, and choice among the various alternative means of performing activities. In disparity to a detective discovering a single train of events, however, construction planners also face the normative predicament of choosing the best among numerous alternative plans. Moreover, a detective is faced with an observable result, whereas a conniver must imagine the ultimate competence as described in the plans and specifications. In mounting a construction plan, it is widespread to adopt a prime prominence on either cost control or on schedule control. Some projects are primarily divided into disbursement categories with associated costs. In these cases, construction planning is cost or expense slanting. Within the categories of disbursement, a peculiarity is made between costs incurred directly in the performance of an activity and indirectly for the triumph of the project. For example, borrowing expenses for project financing and transparency items are commonly treated as indirect costs. For other projects, scheduling of work actions over time is decisive and is emphasized in the planning process. In this case, the planner insures that the proper precedence among activities are maintained and that competent scheduling of the accessible resources prevails. Traditional scheduling procedures emphasize the maintenance of task precedence (resulting in critical path scheduling procedures) or ingenious use of resources over time (resulting in job shop scheduling procedures). Finally, most multipart projects necessitate consideration of both cost and scheduling over time, so that planning, monitoring and record keeping must consider both magnitude. In these cases, the integration of schedule and budget information is a major concept. The reason for focusing on the design phase is that the possibility to influence a project is largest in the beginning of the project, and the possibility decreases as the project proceeds, see Figure 2.

![Cost Influence Curve](image)

**Figure 2**: The possibility to influence the project is large early in the project, the cost of making changes increases with time (Rocque, 2013).

2.1 Phases of Construction

A construction project consists of several different phases. In the book Construction Project Management the authors explain that a construction project starts off with a feasibility analysis (Gould & Joyce, 2009). This phase is an investigation on an economic basis. The aspects that are most important to analyse is the
cost, the time schedule, the budget and the market demand. If the feasibility analysis then show that the project will generate return, a decision to proceed with the project is made. The search for financial means begins and a procurement process for the design of the project is initiated. The design of the project can be procured with different contract forms, for instance the entire responsibility can be handed to one company or the different disciplines can be procured from different companies.

2.2 Design Phase

Gould and Joyce (2009) explain that the design phase can be divided into four different stages. The first is programming, the second schematic, the third design development and the last construction documents. In the first stage a program is created. This is a document where the requirement of the building is stated. It describes for instance the functions of the building, what particular spaces are needed and so on. The complexity of the project is also an important factor to consider (Gould & Joyce, 2009). The more complex a project is the more time and resources need to be dedicated to the project in order to make sure that the program becomes as accurate and descriptive as possible. At the end of the programming stage there should be a detailed program and usually an estimate and a time schedule. With this information the owner then decides whether to proceed with the project or cancel it. The next stage is the schematic design (Gould & Joyce, 2009). At this point the actual design of the project begins. Usually a team of architects develop several different designs that more or less fulfil the requirements stated in the program in order to find the best solution for the project. The final stage in the design phase, according to Gould and Joyce (2009), is the production of construction documents. These documents are what the bid for the construction is based upon. These are the documents that the contractor will follow and build according to. So if they are disagreeing with the program criteria or the design agreed upon in the schematic phase it could lead to problems during the construction phase and may cost the owner a lot of money and time.

2.3 Method

Once the overall design and master schedule for the project has been created, then a method known as the Last Planner System can take that master schedule and provide a process for breaking work down into smaller units that can be executed more iteratively:

Source: Agile and Lean Applied to Construction

At a more tactical level, here is one way that typical Agile terms could be translated for use in Construction:
In his post, “An Agile Construction Project,” Chris Klein has some ideas on how agile roles would be represented on a construction site. For instance, the Superintendent could be the Scrum Master, as s/he would be responsible for running the various meetings and coordinating work on the site. The Project Engineer or Project Manager could fulfill the Product Owner role, as s/he would be responsible for maintaining various project artifacts, make decisions on various questions around interpreting design specifications, and could represent other stakeholders to the project team similar to a Scrum Product Owner or Product Manager.

As Agile Construction is based on 7 principles or pillars:
- Labor productivity and measurement
- Job scheduling and planning
- Procurement management
- Prefabrication (components or parts already assembled by the supplier, reducing time and complexity of the task)
- Reduction of labor composite rate (the cost of the worker to the company per unit of time)
- Estimation accuracy and improvement
- Project financial management

Agile Construction improves the contractor's ability to rapidly adapt to job site changes, minimizing the time between when a risk is detected and corrected. This requires a better mechanism to capture these changes and a better infrastructure for addressing them. Agile project management applied for construction can also make gains in pre-design and design phases of construction, and with a more highly trained and motivated work deliver a better consumer value. Agile Construction is a way of doing business adapted to construction jobsites and overall project delivery, born from agile manufacturing and project management, mostly used in manufacturing production, automotive and software developing teams. It is the application of the Toyota Production System to construction, with two parallel paths: measuring (ASTM E2691) and improving productivity, and segregating and externalizing work through prefabrication and supply chain management. Like the Toyota Production System, Agile construction is a system that relies on input from the source of the work information, both up front for planning the project, as well as throughout the life of a project for real-time feedback. The real-time input produces real-time measurements of productivity. It is an iterative and incremental method of managing the design and build activities. This means that each time the process is repeated some changes are made to make the process better. Changes for the better are kept and for the worse are discarded.
2.4 Management Style
Traditional hierarchical organization relies on the largely unidirectional flow of communication, thus denying opportunities for observation which are afforded through APM (Boehm and Turner, 2003). The ‘command and control’ style of management used in numerous industries and projects inhibits trust and hence reliability, whereas APM provides, together with facilitating leadership, an effectual managerial motive force and fosters creativity.

2.5 Organization 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 organizations. Ouchi’s theory Z (Ouchi, 1981) attempts to merge the best of theory Y into modern western organizations, 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 organization itself. Therefore, although theory Z ‘pragmatic oriental’ practices of collective decision making, employee-employer relationships and long-term employment organizations 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.

2.6 Work Group Structure
In APM the employ of small, empowered, multi-skilled teams is a common trait. These teams rely on tacit knowledge and intense communications to create innovative solutions through swarm intelligence (Bonabeau and Meyer, 2001) and are typically self-managing; the task manager provides leadership and facilitates progress. It can be argued that spontaneous, self-organizing groups would prove even more productive (Anderson and McMillan, 2003). APM relies on a flatter, team-based construction rather than traditional close, hierarchical management. The removal of tiered management effectively removes communications code of behavior overheads, as well as reducing unnecessary systems noise and the probability of compounding errors.

2.7 Approach to Risk
For palpable pragmatic reasons, organizations are often ‘risk averse’. As a consequence, financial, legal and indemnity frameworks have evolved to guarantee that risk is passed as far down the contractual food chain as possible (Pietroforte, 1997), resulting in companies divesting themselves of innate expertise, as in much of the construction industry. Such risk distribution and supervision mechanisms are obviously causal in the development of adversarial business relationships. Written verification 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 new party to work to mitigate that risk, is doomed to failure’. The alternative and agile approach is that risk is agreed to whichever actor is most capable of resolving it, irrespective of initial contractual relationships. In further words, risk is apportioned from a total value maximization viewpoint, rather than a(n apparent) local financial risk management perspective. Such actions typify the network of trust which is necessary for true teamwork.

2.8 Planning
Most project managers will make out the need to following a well-prepared arrangement, and the consequent fight to get back on plan when things go mistaken. However, this is not the APM way. Nature of planning Traditional project management tools expect a sequential arrangement to be primed in detail for the whole project, and then to be rigidly followed. Divergence 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 intensity that is both practical for the planners to act on in the petite term in order to deliver early value, and to diminish risk for the entire project.
Where achievable, decisions are delayed awaiting the ‘last responsible moment’. Requirements capture APM recognizes that change is inevitable during a project and therefore clinch 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 visualize, and: ‘We cannot completely specify an interactive structure.’ - Wegner’s Lemma (Wegner, 1995) However, numerous construction projects could also be categorised as interactive structures and research shows that significant uncertainty lingers as to what is to be constructed, as late as the initiate of construction. (Howell et al.,1993). Traditional obligations capture can be shown to be less than optimal: ‘The definition and dissemination of preliminary objectives was not significantly related to the success or failure of a project’; and: ‘Successful projects were able, added their lifetime, to stead fasten the initial uncertainty associated with their technical and commercial goals and objectives.’ (Baker et al., 1986) APM recognizes that changes throughout the project force scope control to be an ongoing task: project compass should only be defined as far as we are currently truly able to comprehend and prioritise it, from the perspectives of value realization and risk mitigation. We can then use project team (including the customer) learning for organize and rapid feedback. Work package structure Instead of the traditional task-based WBS being used to realise the project plan, APM utilizes its dynamic work backlogs. Typically, ‘stories’ are first developed to describe the wider business worth priorities, facilitate rough estimation and showing how value will be validated. Each value generation or peril mitigation task is structured and sized in such a way that its package can be delivered within a regular and sustainable instant(boxed) time (30 days for some APM methods) (this can be considered as analogous to Take time in the Toyota Production System (Liker, 2004)).

2.9 Execution
Agile project administration can be seen as ‘management as systematize’ (Koskela and Howell, 2002b), indeed, an agile project manager is very much seen as a catalyst who enables small, self-organizing multi-disciplinary teams to decide for themselves how they satisfy their important goals. Development approaches. Conventionally requirements incarcerate methods generally discourage further adaptation once the plan is running. After the requirements are described they are wrecked down and recompiled into logical groups, often to create delivery milestones. It is obviously in the developers’ interest to struggle to meet these milestones as payment is usually attached to them; revolutionize is seen as adding menace. APM relies on incremental and iterative development with continuous learning being essential to the evolution of the finest value (to the customer) within the constraints of time and cost. Thus, the ‘iron triangle’ of traditional project management is twisted on its head, as shown in Figure 3 (after Cockburn, 2003).

![Figure 3: Traditional versus APM](image-url)
3. QUALITY APPROACH
Compared with structured chronological (Royce, 1970) or ‘waterfall’ PM, APM was reported as delivering defect rate upgrading 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 causes for enhancement in both defect rates and professed quality are not fully understood; however, it is plausible that defects are caught and corrected much earlier because of the scenery of APM teams, work structures and comment mechanisms. APM also concentrates on embryonic purchaser discernments, rather than conformance to an near the beginning plan.

3.1 Customer Involvement
Every project administrator must see customer association as imperative at the requirements collection and requirement juncture, and the majority would lug this through to the design phase. In the author’s personal familiarity, many managers of sequential development projects act as if patron contribution at anon stages of construction is a obligatory but irritating obstruction to proficient achievement of the plan; such participation must be managed and minimized. However, APM emphasizes that customer involvement right through the project is key to the organizational learning required to iteratively and incrementally generate the best possible value yielded through Type 2 learning. The result of such change must be reflect in the reported 83% enhancement in business satisfaction from using APM (Shine, 2003).

3.2 Value delivery
A major spotlight of APM is the early and sustained delivery of value, as seen by the customer or stake holders. At the end each time-box recognizable (by the customer) value must be delivered; feedback and learning are core to the dynamic realization of customer value. At the end of the project the customer has received what they by then realize are their dynamically prioritized value deliveries, rather than what the supplier and they would have originally identified under traditional processes. 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.

4. POTENTIAL AREAS FOR IMPROVED AGILITY WITHIN CONSTRUCTION
Within the edifice diligence, it is promising to mull over the pre-design, design and actual construction phases separately. These have been mapped alongside the APM analysis, above, in order to assess the degree to which APM might be valuable to the industry.

4.1 Pre-Design Phase
In the pre-design stage of a construction project, the three major issues are: notion maturity; development casing; procurement tactic, time and cost; and the preparation of a pithy (Best and de Valence, 1999). The contents, organization and administration principles used in the pre-design phase diverge considerably across projects and patron organizations, even if (especially larger) clients have shaped typical procedures for this phase. There is often extensive complexity in the pre-design stage (Pennanen and Koskela, 2005). This phase being a basis for subsequent phases, the output of pre-design should be wide-ranging and integrated (Morris, 1991), as well as unswerving.

The key pronouncements in aforementioned literature on the pre-design phase suggest that, in practice, the loom in pre-design be liable to be either too programmatic or too muddled (following the adhocracy prescription of Mintzberg (1983). This results in curtailed, inconsistent or otherwise sub finest guidance for the subsequent phases of the project. Whether agile principles are pertinent in the pre-design phase is discussed based on three criteria, presented in diminishing array of validity:

Agile principles have successfully been used, unreservedly or explicitly.
Problems have been identified in aforementioned literature, to which agile principles debatably provide a solution. Agile principles can be argued to be germane, based on general knowledge related to the pre-design phase. In the following, the application of a number of agile doctrines to the pre-design phase is analysed, based on the fore-revealed principles. The harshly related nature of any statement and advice should be noted.

**Philosophy.** In the pre-design phase, a substantial number of concerns are in a flux, and the whole process is embryonic. Thus, procedure metaphysics can advantageously be used as a source for conceptualizing this phase.

**Approach to Chaordic change.** New opportunities continuously materialize (Blomberg, 1998) and new perils are unvaryingly identified; thus the circumstances is characterized by chaordic amend. Administration technique/work cluster structure. It is advisable to organize through an sanctioned squad any hefty and multifarious pre-design effort, with frequent mutual communication. Hierarchical pronouncement making has been found to reason problems, for example in the pre-design phase of crucial healthcare facilities (Tzortzopoulos et al., 2006).

**Customer involvement.** As requirements incarcerate is a essential task in the pre-design phase, patron involvement is clearly highly counseled, if not essential.

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

**Development Loom.** Due to the necessitates for amalgamation and customer participation, an iterative and incremental development approach can be – and is often urged for the pre-design phase. Requirements capture. The distinction between steady requirements (to be captured upfront), unpredictable requirements (for which options need to be kept open) and evolving requirements (for which learning is to be nurtured) is highly relevant in construction projects.

Corollaries of failures to categorize requirements in this way and reliance on immature requirements are reported by Tzortzopoulos, et al. (2006). Arguably, agile attitudes and methods promise the potential of an improved approach for the pre-design phase, being synchronized properly structured but also flexible enough to allow opportunities to be seized and creative solutions to be devised.

### 4.2 Design

Design is the transitional phase where the notion generated during the pre-design phase will be urbanized and malformed into elucidations (specifications and prescriptions) to channel construction, maneuver and safeguarding of the building (Kagioglou et al., 1998). As such, two main issues materialize: the amalgamation amid design and fabrication, and the energetic route of obligations incarcerate. Regardless of the leeway of generalizing the main phases of the design process, the contented developed throughout this phase varies from project to project, and is also varied through iteration intrinsic to deceitful. It is to these two input issues that it is alleged that APM can throw in value.

**Philosophy.** In the design phase, modern methods and approaches, such as Synchronized Engineering and Last Planner are fundamentally based in delivering value throughout the progression (Kamara et al, 1997); (Codinhoto, 2003). Issues regarding the identification of trade-offs, processes of examination and amalgamation, and also decision-making are in flux. Therefore, process metaphysics is the pertinent root for conceptualizing this phase (Koskela; Kagioglou, 2005).

**Managerial Approaches and Practices.** The construction industry, in wide-ranging is differentiated by the establishment of a new team of groups for each new project. Therefore, the design team varies from project to project and the categories Y, X and Z can’t easily be applied in construction. However, it is possible to say that some Type Z attributes e.g. collective decision making and improved employee-employer liaisons can be observed in some long-term partnerships (Kamara; et al, 1997); also experiential in the Heathrow
airport Terminal 5 project (College, 2005). Concerning iterative and incremental maturity of value, it seems that this is an innate procedure in the design phase. However, to delay pronouncements to the ‘last responsible moment’ would attest challenging in the construction scenery, as currently structured with its isolated phases. Such a stance might also entail difficulties in product development coordination (Clark and Fujimoto, 1991). The design progression 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 progression itself (Crawford and Benedetto, 2000).

Planning. Design planning is to be considerably investigated in industrialized and in construction. Looms, methods and tools diverge greatly. Therefore, there is a assortment of solutions that robust into one of the two consortium “light” and “heavyweight”. On the one dispense, Design formation Matrix (DSM) and Analytical Design Plan Technique (ADePT) (Austin et al., 2000) comprise examples of hardwearing planning. On the other hand Last Planner (Ballard, 2000) can be considered frivolous. Concerning the client requirements incarcerate in the design phase, it seems that a considerable number of methods, e.g. Eminence Function Deployment (QFD) are paying attention in detailing the obligations comprehensively and at the beginning. Studies as accessible (Miron and Formoso, 2003) show that there is still a gap concerning the progression of supplies incarcerate throughout the whole design phase, undeniably, research shows that, as late as the start of construction, momentous improbability remains as to what is to be constructed (Howell et al., 1993). Finally, the employ of work breakdown structures is the existing basis of work parcel structures in construction. The division of the assignments according to products and sub-products to be delivered is a widespread practice in construction. The progression modus operandi urbanized by Salford University (Kagioglou et al., 1998) is one example.

Execution. Regarding the approach to progress, the design phase can be either chronological or iterative. The adoption of one or another will fluctuate according to the project as discussed by Kamara et al (1997). On the one hand, the adoption of iterative approaches will result in recurrent value delivery for clients. On the other hand, chronological approaches are characterized by merchandise delivery at the end; as a corollary errors and corrections are recurrent (Prasad, 1996). Also eminence is delivered considering both the discernment of value by the client and other venture holders, and imperfection diminution (e.g. Design for Manufacturing and constructability investigation). Client contribution during the design phase is widespread observe in construction. Control and Learning. The construction design is constantly deliberate according to different types of metrics, for illustration, cost, maintainability and sustainability of solutions. However, the relations between diverse metrics are not entirely understood. A propos stance to erudition, the route will fluctuate contained by each new project. As a result, it is significantly based on revolutionize management within the impermanent organization, with comprehension retained chiefly at the individual, rather than wider organizational echelon. In wrapping up, the espousal of APM principles in the design phase is very appropriate to the challenges that visage the edifice engineering, for instance, the enlargement of soaring quality and complex products at lowest possible cost. However, its implementation will vary according with the intricacy and ambiguity related to the project; it would be particularly correct where solutions to requirements progress or are likely to change through the project. Therefore, the projects that will gain more profit from APM are projects in which a considerable number of clients are implicated, requirements are contradictory and constantly generate trade-offs, and early liberation of value is a precedence.

5. CONCLUSION

In this paper, we asked whether project management is a restraint that is chiefly characterised by a hard, instrumental loom and whether there are improvements headed for a more human- or culture-oriented approach. We realise that this paper does not endow with any ultimate answers to this question, as the scope is too wide-ranging and the subject is too new-fangled. We then examined the literature on the subject and
presented two studies. In today's milieu of development projects with multidisciplinary lineups, such as the large enterprises or multi-agent intricate projects: hydroelectric power plants, refineries, ports, airports and industrial complex, technical issues are very imperative for members to influence engineering design. However, with more compact development time, the need for speed at the interfaces activities between the various areas becomes mandatory for making decisions assertions. Based on this perception, this study has suggested that firms should consider concomitantly to the traditional project management in complex implantation, manners of improving the interface management process based on the necessities of the operational level of engineering design to the deliverables of EPC projects. To check this possibility empirically this paper has utilized a theoretical framework related with agile practices to develop a questionnaire and verify the perception on the standpoints of an civil engineering group of complex projects design.

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