

LEAN AND AGILE METHODS ARE SET TO REVOLUTIONISE PROJECT PLANNING AND SCHEDULING: A CRITICAL REVIEW

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ABSTRACT

This paper reviews the proposition that lean and agile methods are set to revolutionise project planning and scheduling. The concepts of lean and agile methods were critically reviewed from relevant literature. The results indicate support for the proposition that lean and agile methods are set to revolutionise project planning and scheduling. This is in line with the dynamics of globalisation which have brought about intense competition in many industries necessitating project organisations to pursue revolutionary changes to conventional approaches of project planning and scheduling in order to remain competitive in today's global market.

KEYWORDS: Lean, Agile, Planning, Scheduling, Project.

INTRODUCTION

This paper discusses two important concepts: lean and agile methods and their impacts in project planning and scheduling. Research in this work has shown that Lean and agile principles have been widely applied in the manufacturing industry, supply chain, and software development. Further applications are also found in the construction industry, project management and other industries as part of strategic measures by organisations to respond to the rapidly changing and competitive global market environments. The concept of lean thinking [1] emerged after the 2nd world war when the Japanese industries, in particular Toyota were re-building. Taiichi Ohno, then Toyota Assembly Shop Manager introduced the concept to get the best out of limited investment. It emphasizes building only what is needed and eliminating waste. This became common in Japan in the 1950s, but started in Western (Europe and Americas) industries in the 1980s in manufacturing, logistics and distribution. Womack et al were reported as early researchers who advocated (in their book: the machine that changed the world) transformation from mass production to lean manufacturing by western companies [1-2].

On the other hand, agile concept in manufacturing and project management started in 1990 [3]. According to them, agile manufacturing deals with production, focussing on how to respond to constant changes in an unpredictable environment, in the information system industry, focussing on efficient software development to satisfy customer requirements based on human collaboration. It is today applied to most other industries. Explanations of these paradigms are presented later in this work based on literature review. Also, evidences are drawn from previous research to support the use of these principles to revolutionise project planning and scheduling.

Definition of the terms Lean and Agile

A number of definitions have been given by researchers on the meaning of the terms lean and agile. [4] attempts to distinguish between these two related terms to avoid perceived misconception by reviewing definitions given by up to seven different groups of researchers. They analysed leanness and agility from two perspectives of 'manufacturing paradigms' and 'performance capabilities', and concluded with the following definitions:

"Production is lean if it is accomplished with minimal waste due to unneeded operations, inefficient operations, or excessive buffering in operations".

Similarly, *"production is agile if it efficiently changes operating states in response to uncertain and changing demands placed upon it".*

However, the generally accepted definitions are given by Naylor et al [5]. According to them, *"Leanness means developing a value stream to eliminate all waste, including time, to ensure a level schedule"*, while *"agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place"*.

These definitions have been supported by different researchers including [6-7]. It can be seen that lean and agile principles are both strategies to remain competitive by improving effectiveness and performance of work processes in an organisation. There exhibit similarities such as knowledge of market, value stream and lead time compression. However, while lean principle is based on a level or smooth schedule, agile is suited to a rapidly changing schedule. Also, lean will require the elimination of all waste, while agile require elimination of waste as much as possible. This implies the difference between the two concepts may also lie in cost.

The five principles of lean which underpin manufacturing are as follow:

- i. Specify what creates value from the customers perspective
- ii. Identify all the steps along the process chain
- iii. Make those processes flow
- iv. Make only what is pulled by the customer
- v. Strive for perfection by continually removing wastes [8].

The above principles are in line with Womack and Jones' 5 principles of lean [1].

On the other hand, [9] provide agile principles from software development background as follow:

- i. Different projects need different processes
- ii. In methodology, "less is more"
- iii. Deliver working software frequently and establish feedback loops
- iv. Enhance iteration and communication
- v. Empower individuals to make decisions
- vi. Learn by doing

The above relate to the agile manifestoes [10]. Two main agile methods have been identified by [3] as follow: Dynamic System Development Method (DSDM) and Scrum. DSDM uses iterative development and incremental approach for software systems development. This is similar to Extreme Programming (XP) which [11] describe as principles and practices aimed at achieving successful software development despite vague or constantly changing requirements in small and medium size teams.

Scrum is an agile method for project management which encourages the practice of adopting small, cross-functional teams, emphasising communication flows within the teams. The limitation of these methods is that there originated from software development and may not apply to other industries such as construction Lean and agile concepts have been applied concurrently to supply chain resulting in the concept of 'leagile'. According to [7] lean usually precedes agile in supply chain. This is supported by [6] who also argue that lean supply chains are under pressure to become agile. According to them, in leagile principle, lean focuses on efficient supply upstream, while agile focuses on effective supply downstream linked by a de-coupling point to bring together the best of both paradigms.

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Lean and agile methods versus project planning and scheduling

This section provides evidence from literature to support the statement that lean and agile methods are set to revolutionise project planning and scheduling. Jobs (in manufacturing, software development, supply chains, etc) are usually subject to precedence constraints and a given job can only start with its processing when all its predecessors have been completed. Hence, the objective of project planning and scheduling is to minimise the makespan of jobs while adhering to precedence constraints. The problems associated with this when resource (or work force) is constrained are complex [12].

Hence, in the present competitive global market, applying lean and agile principles which seek to eliminate or minimise waste as discussed above [1, 3, 5, 6] can transform project planning and scheduling to bring about deliverables in the most efficient and effective manner while satisfying customer values. Some researchers have developed methods and models based on the lean and agile principles aimed at revolutionising project planning and scheduling. [13] showed how an Australian furnishing firm increased capacity by 30% to become competitive through using a new scheduling system which supported use of lean manufacturing principles. He developed and used a Production Efficiency Program (PEP) which according to him, revealed the need to apply both lean and agile principles to IT development.

[14] suggests that applying lean principles in planning and scheduling techniques could help in construction and will work better if practitioners can shift from traditional task-based approaches to location-based scheduling. According to him, identifying workflow in a production system with discrete activities in critical path planning and execution is the main difficulty associated with applying lean thinking. [15] argues that the traditional project planner software packages (eg. MS project) used in scheduling take relatively long time. Conversely, agile approaches require rapid response to a given situation using iteration scheduling "based on intuitive human judgements, whose inherent discrepancies are resolved during team's daily and iteration review meetings". He developed a method and an information model which is claimed based on simulations; to significantly improve load balancing of resources, give higher quality and lower-risk feasible schedule and better decisions to agile teams.

Also [16] argue that the assumption of conventional project planning and scheduling that the defined set of related activities as found in a work break down structure and activity network is sufficient to attain desired goal does not hold because of the unique nature of projects. According to them, non-traditional approaches such as lean and agile have responded positively to the realities of process and goal uncertainty, ambiguity and instability in projects, although with some limitations for complex projects. They propose an adaptive product development process (APDP) model to improve complex project planning and control.

[17] demonstrated the relevance of using combined lean and agile (leagile) principles and outsourcing to optimise an integrated process planning and scheduling model. According to them, by changing planning and scheduling strategies with modern approaches, enterprises can satisfy their customer requirements more efficiently. They propose a new hybrid enhanced swift converging simulated annealing (ECSA) algorithm to solve complex scheduling problems. [3] believe that the inclusion of interface management into lean and agile principles can improve productivity in the construction industry. According to them, agile project management, which includes planning and scheduling, should have decentralised planning with emphasis on management-as-organising; among small, interactive multi-disciplinary teams with effective communication. They supported [18] that incorporating a functional work break down structure (WBS) into an agile project can provide visibility and control for the project manager and customer team.

[18] claims that agile project captures two views of work on software project, namely: the developers view and the business view which rely on "reality-based planning, constant monitoring and frequent verification and validation". [11] conducted a survey of more than 80 projects and concluded that project failures are due more to people and project management issues than technical issues. Hence, using agile methods which they describe as human-centred approach to software development may change this trend. Complex Adaptive Systems (CAS) based on agile project management principles such as XP have been

proposed by [19] to achieve projects delivery on schedule and within budget while also satisfying customer requirements.

[20] argues that agile manufacturing scheduling systems contribute to face dynamic realities in industries. He proposed a model based on agile principles to tackle high-level of heterogeneity in a multi-agent scheduling system. In agreement with the above, agile methods have been said to be ideal for projects that exhibit high variability in tasks due to changes in requirements [21].

CONCLUSION

The concepts of lean and agile have been defined and explained. Though there both are closely related, there are some differences. Lean is Japanese concept and is based on level schedule, while agile is a western concept which shares some lean attributes but suited to rapidly changing demand. A number of evidences from previous researches have been captured in this work to support the statement that lean and agile methods are set to revolutionise project planning and scheduling. However, it is found that researches in literature supporting this proposition tend to be based more on agile principles than the lean principles. This may be due to the fact that agile principles are built on lean concepts and most researchers tend to use the terms interchangeably.

Furthermore, most of these researches were based on the manufacturing industries and software development. There is little research on the application of lean principles to construction, while there appears to be a dearth of research into the application of agile principles in construction. This may be due to the nature of construction, which exhibits low variability in tasks, contrary to agile projects which exhibit high variability in tasks due to changes in requirements.

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