“AgiLean PM”
– A UNIFIYING STRATEGIC FRAMEWORK TO MANAGE CONSTRUCTION PROJECTS

SELIM TUGRA DEMIR

A thesis submitted in partial fulfilment of the requirements of Liverpool John Moores University for the degree of Doctor of Philosophy

December 2013
Acknowledgements

I thank my supervisor Prof. Dr. David James Bryde for all his great support through these years of PhD study.

Thanks to Ibijoke Idowu who is a specialist in chemistry. Her feedback was of great interest when translating the nuclear physics approach to a project management context.

Thanks to the GPM Deutsche Gesellschaft für Projektmanagement (German Project Management Association) for showing great interest on my research and collaboration.

Finally, I would like to express my gratitude to my parents for their continuous love and moral support. They were always there for me when I needed them.
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Summary of research findings

Gann (1996) and Crowley (1998) argue that the construction industry can learn from other industries. This is not a new idea. But if one considers the high complexity and the uncertainties which construction projects are facing,

“[...] it might well be that management techniques that improve performance in other industries are not readily transferable to this context, if construction follows a different logic then it might even be a mistake to try to adopt management techniques applied in other contexts” (Dubois and Gadde, 2002, p 622).

AgiLean Project Management is the result of a synthesis between Project Management [PM], Lean and Agile. It is derived from leading paradigms of other industries, but it is tailored for construction. The term “AgiLean PM” has been for the first time coined by the researcher of this work and his first supervisor. The following sections will give an overview about the research context, problem, and the main conclusions drawn.

Problem statement and research question

Tah et al. (1993) and Nassar et al. (2005) as well as Meng (2012) argue that poor performance in terms of time and cost overruns is a common issue in construction projects. Corfe (2011) explains further that there is a need for performance improvement, because a construction project is exposed to different pressures by its environment. These pressures can be related to globalisation and competition, external market influences, risk and uncertainty, and the continuous desire of the clients to get more value for less money. Hence there is an increase in the level of the complexity of construction processes (Gidado, 1996). Construction projects face meanwhile new problems, which are more complex. Paradoxically, these problems are still managed with management methods, which are not up to date anymore. Therefore there is a need for new management practices, which will improve performance when planning and constructing the project (Pan et al., 2007).
In search for such new management practices, the industry got attracted to Lean construction. Because, early proponents of Lean argued that the result of Lean construction is a new delivery system which can be applied to any kind of construction - see, for example, Howell (1999). This would include complex projects with high degrees of uncertainty and time compressed schedules. However, the practical achievements of using Lean in construction do not always reflect those stated in theory. This can be related to the debate about the implementation of Lean construction, which is extremely one sided (Green, 1999a; Green, 1999b; Green and May, 2003). There are barriers and limits of using Lean in construction, which have been already identified in manufacturing outside of Japan and barriers which are unique for construction. Instead of changing the nature of Lean so that it is better aligned with construction, the Lean movement has focused on re-conceptualising the nature of construction, with the general approach being to make construction more like production (Latham, 1994; Egan, 1998; Wolstenholme, 2009).

Changes and uncertainty, or changes caused by uncertainty in the project life cycle create a dynamic environment in construction. Manufacturing, in turn, consists on a static environment and dynamic product. This has been realised by Ballard and Howell (1998) who stated that for construction projects Lean production is insufficient, as well as by Egan (1998, p. 18), who argued that the “[...] parallel is not with building cars on the production line; it is with designing and planning the production of a new car model”. To keep the Guru-Hype alive Ballard and Howell (1998; 2004) argue that Lean construction differs from Lean production in a way that it is able to deal with the dynamic nature of construction projects, but complexity needs to be reduced (Ballard and Howell, 1997), changes are not welcomed (Gabriel, 1997) and the industry needs to be defragmented (Egan, 1988), all that just to push for Lean in construction.

An alternative approach may be to re-emphasize construction as projects. So a Lean management approach needs the ability to react to change and become more flexible. This is not currently the focus of Lean construction approaches, as it requires a stable platform where processes can be forecasted with a high degree of
certainty and hence can be optimised. Winch (2006) argues further that if Lean
construction has the requirement of viewing construction projects as temporary
production systems, then the core of this temporary production system should be
based on uncertainty management.

Lean construction, therefore, might be improved with the inclusion of Agile
paradigms. Agile PM methods focus on the team as an important expertise factor,
aiming to satisfy the client and react to uncertainty (Chin, 2004; Hunt, 2006; Dyba
and Dingsoyr, 2008).

As a result, the construction industry faces two ways to implement Lean. One is to
change the characteristics of the construction industry so that Lean is more
applicable. The other is to change Lean. The first approach is to reduce the
construction projects’ complexity and the second approach is to develop a method
to be able to deal with that. This study proposes the second approach. Dealing
with complexity is related to being more flexible, more Agile. Therefore Lean
needs to be more Agile if it wants to reach the same amount of acceptance in
practice as it has achieved in theory.

To do this there is a need for a method which is labelled as “AgiLean PM”. In this
sense the term “AgiLean” is carefully chosen, as preferable to other alternatives,
such as “Leagile”. “Leagile” uses Agile in the preconstruction phase and then has
a de-coupling point to switch to Lean in the execution phase (Naim and Barlow,
2003). The notion of “AgiLean” is that the foundation is Lean, but that in some
situations, including through the execution phase, Lean needs to be “agiteted” i.e.
become more irregular, rapid and agile – hence “AgiLean”.

By undertaking a synthesis of PM, Lean and Agile, the research question is as
follows:

*How can a universal and unifying strategic framework based on PM, Lean and
Agile be generated?*
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The combination of PM, Lean and Agile which is conceptualised in this research project as “AgiLean PM” eliminates waste in the processes and is able to react to change. This new innovative management method could be the best way of dealing with the complexity in construction projects in order to achieve maximum performance in future. Figure 1 gives an overview of the proposed new management method.

![Figure 1 synthesis of AgiLean PM](image)

AgiLean PM is underpinned by universal PM methodologies, such as those from the International Project Management Association [IPMA] or Project Management Institute [PMI] on the strategic level. At the operational level it synthesises modern management paradigms, such as Agile and Lean. This ensures that the whole project view is taken. It enables the right paradigm to be chosen depending on the requirements of the project. The outcome is the management of project uncertainty in an effective and efficient manner.

**Research aim and objectives**

The aim of this research project is to develop a unifying strategic framework for managing construction projects, which is conceptualised as “AgiLean PM”. To achieve this aim the following objectives have been derived:
The relationships between the objectives can be illustrated through the following figure.

As illustrated in Figure 2, objective one is the underpinning objective of this research. The assessment will tell if further considerations in objective two and consequently three should be on Agile manufacturing or Agile IT. The first objective will be achieved through reviewing the literature. The columns of this research are the objectives two, three and four. Objective two will focus on
identifying the strengths and weaknesses of the different management paradigms. This will be facilitated through the literature review and through the collection of qualitative interview data from the practitioners in the fields of PM, Lean and Agile. Qualitative data, however, is criticised that it is unstructured and unreliable (Denzin and Lincoln, 2005). To validate the transferability of the qualitative data collected a quantitative survey will be conducted in objective three, which is based on the interview findings. PM, Lean and Agile have been reported in a more general manner. There has been little research specifically focused on comparing the perceptions about PM, Lean and Agile in a country context and between the parties involved in construction, i.e. is Lean perceived the same in Europe as it is in North America, or is Agile perceived by the architects in the same way as it is by the contractors, and so forth. This gap will be addressed in objective four with the questionnaire. The outcome of objective four will give an indication about the universality of the AgiLean PM framework. Finally objective five will synthesise PM, Lean and Agile and enable answering the research question. This will be achieved through the translation of the nuclear fission and nuclear fusion approaches.

**Research scope**

The scope of this research is primarily on developing the concepts and principles of the AgiLean PM framework. This research does not provide methods for implementation, but rather wants to keep the AgiLean PM framework more universal and generic. A “construction project” means different things to different individuals (Ritz, 1994). Therefore there are many ways of categorising or classifying construction projects. However, within the scope of this research, the focus will be on dynamic projects. According to Collyer and Warren (2009) dynamic projects are characterised by their uncertainties, which exceed the known factors. Hence the more unknown factors a project consists of, the more dynamic it is. AgiLean PM is made to be a strategic framework. If this research needs to be associated with any party involved in construction (client’s side, designer’s side, and contractor’s side), then is this research associated with the client’s side, as the
parties there are more related to the strategic level and have a holistic view about the project life cycle.

**Meeting the objectives**

The following sections will re-state the objectives and the drawn conclusions.

**To assess the suitability of Agile manufacturing and Agile IT paradigms to construction.**

The applicability of Agile concepts to construction have been analysed by several researchers (e.g. Owen and Koskela, 2006a; Owen and Koskela, 2006b; Owen et al.; 2006), with the conclusion being that it is more applicable to the design phase than to the execution phase. Ribeiro and Fernandes (2010) argue in turn that Agile methods show high potential for implementation for managing the whole project, when applied by medium and small sized companies. However, these studies did not make a formal distinction between Agile manufacturing and Agile IT, as the conclusion drawn considered concepts of both paradigms. A synthesis of the comprehensive literature review is provided in the following table.
As shown in the above table, both paradigms have different elements, but the core concept is the same, namely that static project planning, where the requirements need to be determined in advance, cannot cope with dynamic project environments, which are characterised by uncertainty and change. The concept of Agile manufacturing is related to strategic entrepreneurial issues, as it is also called Agile enterprise (Ross, 1994). Therefore Agile manufacturing might be used for construction business strategy research. However, this research is focused on deriving a management paradigm which will improve performance on the project. Agile manufacturing cannot fulfil this need, because it is more appropriate for setting up a business strategy to penetrate new market segmentations.

Agile IT on the other hand provides new solutions with a high degree of customer satisfaction through iterative project planning (Wysocki, 2006), which leads to project success. So, considering that the IT environment is project-based in a similar fashion to construction and Agile developments are presenting practices, which do improve performance, leads to the conclusion that Agile IT is more appropriate for construction PM than Agile manufacturing. The more dynamic the project environment, the more Agile IT suits the project. The highest dynamics
are during early project stages, consequently it has been identified that Agile IT or Agile PM is best suited to these stages.

**To identify the strengths and weaknesses of traditional PM, Lean and Agile in relation to the management of complex construction projects.**

The findings of this research stressed that a construction project is in between different project typologies, if viewed holistically. This can be illustrated through the following figure.

![Figure 3 the nature of construction projects (adapted from Wysocki (2006))](image)

It seems not feasible to locate a construction project to a particular typology in Figure 3. A construction project is adaptive at the initial stages. Workshops and meetings have to be conducted to articulate the vision of the client to the project participants. During the design stages the project shifts between being iterative and incremental, because the customer wishes change more frequently at early design stages. The more the construction project progresses, the more linear becomes the project, because the number of uncertainties will decrease, too.

Lean has been explored from four different perspectives, namely the topicality, industry, labour and culture, as well as management. Those four perspectives
helped in grounding the problem in theory, where different weaknesses have been identified. The results can be illustrated with the following fishbone diagram.

Figure 4 weaknesses of Lean construction

The above Figure shows that weaknesses of Lean construction have been brought back to the project dynamics. Lean construction is more associated with the execution and operation phase, because the project uncertainties and consequently the project dynamics decrease. This weakness has been realised by the Lean advocates. The action undertaken was to re-conceptualise the construction industry to a model which exists in manufacturing. However, recommendations made in landmark reports (Latham, 1994; Egan, 1998) have not been particularly successful (Wolstenholme, 2009).

PM has an integrative character. It has been found out that PM is good in managing the interfaces between the phases, but has difficulties in mitigating the interfaces between the trades. Hence the strengths of PM can be related to the strategic level, but difficulties exist in dealing with the operative level.

This could lead to the conclusion that the Leagile decoupling point model should be applied i.e. the design phase is managed with Agile values and the execution with Lean. PM would still exist with its tools and methods, but would operate more on the strategic level. The Lean and Agile approaches would complement the strategic PM by focusing on the operational level. This has not so far been applied to construction, but seems like a good approach, in theory.
The design phase of construction is characterised by changing requirements and non-routine working, which fits to the conditions for the application of Agile. In a construction project, however, there are also different contributors from different companies, caused by the fragmented nature of the industry. Therefore it cannot be generalised that the design phase could always apply Agile principles, because it depends on the project type, size and number of contributors. The execution phase of a construction project starts with diverse complex tasks, and as time progresses these tasks become more routine and repetition can eventually be identified. This contrasting mix of activities during the execution phase creates a need for Lean, but with Agile values. Therefore Lean needs to be complemented by Agile, i.e. it needs to be “AgiLean”.

When there is a phase, activity or a task in which a separation between Lean and Agile is not possible the Leagile decoupling point model is of limited use. It is not possible to define where to start with Lean and where to continue with Agile, or vice versa. This is the starting point at which Lean needs to become more flexible, where it needs to be agitated and become more Agile, i.e. AgiLean.

To explore the perceptions of traditional PM, Lean and Agile among industry practitioners.

Semi structured interviews have been utilised to enable the exploration of perceptions about traditional PM, Lean and Agile among industry practitioners. To validate the transferability of the collected data a quantitative survey have been conducted with 213 useful responses. The survey was developed out of the interview findings. Central tendency tests have been performed to investigate the transferability of the interview findings to a wider population. The result is that 64 items out of 67 can be transferred to a wider population and are not just the opinion of the interviewees. Hence the central tendency tests helped in refining the interview data to create a solid basis of primary data for developing the AgiLean PM framework.
To analyse the influence of moderating variables, such as country context and party involved on the perceptions of traditional PM, Lean and Agile.

The assumption made for the interview findings is that construction PM, Lean construction, and Agile PM are universal. This means for example that Lean construction in Europe is principally the same as it is in Asia. To this point, there is little research undertaken which has addressed this issue. To close this gap the following hypotheses were derived:

- **H1**: There is no relationship between a respondent’s attitudes towards the construction environment and the project context in which they work.
- **H2**: There is no relationship between a respondent’s attitudes towards PM and the project context in which they work.
- **H3**: There is no relationship between a respondent’s attitudes towards Lean construction and the project context in which they work.
- **H4**: There is no relationship between a respondent’s attitudes towards Agile PM and the project context in which they work.

H1, H2, H4 have been confirmed. H3 has been rejected (because of three items) in the case of North America. The findings indicate that the perceptions about Lean construction concepts and principles are in general everywhere the same, but differ for the Lean philosophy. Given that the AgiLean PM framework aimed to develop concepts and principles, the results confirmed that the interview findings are universal in their nature, i.e. it does not depend on the country. This leads to the conclusion that if the primary data collected is universal, then the AgiLean PM framework is universal, too.

Another assumption of the interview findings was that the perceptions about PM, Lean and Agile do not depend on the occupational background, i.e. for instance is Lean construction perceived the same by the architects as it is by the contractors. There is little research about this issue, too. To address this issue, the following hypotheses have been derived:
H5: There is no relationship between a respondent’s attitude towards the construction environment and their involvement in construction.

H6: There is no relationship between a respondent’s attitude towards PM and their involvement in construction.

H7: There is no relationship between a respondent’s attitude towards Lean construction and their involvement in construction.

H8: There is no relationship between a respondent’s attitude towards Agile PM and their involvement in construction.

H5 has been confirmed. H6, H7, and H8 have been rejected. The perception about the construction environment is for all parties the same. However, the perception about PM, Lean or Agile depend on the occupational background. The result is that the questionnaire indicated that the interview findings are more associated with the parties, who are acting on the client’s side. Hence, the AgiLean PM model is universal, but not applicable for the parties involved in construction, which are acting primarily on the designer’s or contractor’s side.

To develop a framework for the management of complex construction projects based on PM, Lean and Agile principles.

The assumption that the introduction of a new management paradigm, such as Lean and Agile, means that former approaches need to be rejected is not shared by this study. It is proposed that as well as developing new management paradigms, universal PM methods have to be an essential element of construction PM. However, such methods should focus at the strategic rather than at the operative level. The concept of Leagile suggests combining Agile with Lean, through using the Decoupling Point Model. It is argued that the phase-based implementation of those modern management methods might be too complex. Hence, it is suggested that the management style should be iterative, in order to be able to cope with the project dynamics, caused through changes over the project lifecycle. However, PM, Lean and Agile are completely different in their nature. They have been derived to solve different problems and have different concepts and principles. Therefore a new approach was required, which enables the synthesis of those
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paradigms with each other. A novel approach for this has been derived out of nuclear physics. The nuclear fission and fusion approaches have been translated to a PM context. This approach allowed a transparent syntheses of PM, Lean and Agile, resulting in AgiLean PM.

The final objective of this research, is to synthesise PM, Lean and Agile to develop a management framework, which is based on the principle of these paradigms. Hence, this objective can be considered as the overarching objective, which will answer the research question:

*How can a universal and unifying strategic framework based on PM, Lean and Agile be generated?*

PM, Lean and Agile have been synthesised through using the nuclear physics approaches of fission and fusion. For each management paradigm, a paradigm atom has been derived, which consisted of concepts, principles, strengths and weaknesses. Through the application of the nuclear fission approach, the nuclei have been split into their fragments. The application of the fusion approach afterwards, enabled that the weakness of a paradigms principle could be eliminated through the strength(s) of another. The last step was the usage of the re-fusion approach where the principles have been refined.

The outcome is conceptualised as “AgiLean PM”. AgiLean PM is defined as a unifying strategic framework which is based on construction PM, Lean construction and Agile PM. AgiLean PM believes that reality is based on subjectivist and objectivist ontological considerations. AgiLean PM in the context of this thesis is a framework, which comprises concepts, principles and characteristics. It consists of four generic concepts, five principles and 27 characteristics, which are related to the principles. The AgiLean PM framework is illustrated in the following figure.
Figure 5 shows the elements of the AgiLean PM framework. The framework has been derived through a bottom up approach, where first the principles and then the concepts have been derived. The four concepts are generic, i.e. they are in line with each principle. Hence, a principle is AgiLean PM when it fulfils the AgiLean PM concepts.
Limitations of this study

Each research project has limitations, because it has to be conducted in a predefined time period and with a limited set of resources. This is also true for this research. Two main limitations of this study have been identified.

The first limitation is related to the number of survey respondents for creating transferability of the findings. Even if the number of 213 useful responses seemed high, it is not sufficient enough to claim a generalisability of the findings. In the case of this research it was not possible to define a population. Hence a convenient sampling technique has been utilised. However, even if it is not possible to generalise out of a convenient sampling technique, Bryman (2012) found out that after a set of 1000 useful responses, the tendencies are clearer and further responses will have only a low impact on the survey findings. Hence one limitation of this study is that the survey findings do not lead to generalisations, but they reinforce the qualitative interview findings. A set of 1000 useful responses could not be reached, because of the limited time framework.

The second limitation of this study is related to framework validation. The data has been validated, which leads to the conclusion that the data is true and if the data is true then the framework will be true, too. The framework has been brought in relation with the current good practice of Lean construction (Last Planner System) and Agile PM (Scrum), where it has been indicated that those practices are in line with the concepts and principles of the AgiLean PM framework. However, the finalised framework has been verified, but not been validated. It has not been tested or presented to a different set of experts. The quality of the framework could have been increased through validating it with five case studies (Eisenhardt, 1989) or with five focus group sessions (Bryman, 2012). Nevertheless, the validation of this framework can be interpreted as a new research project.
Author’s biographie

Dr. Selim Tugra Demir is a Project Engineer for Innovations Management, Research and Development at Ed. Züblin AG - Zentrale Technik in Stuttgart (Germany). His role covers among other things the identification of future trends in the construction sector, the implementation and introduction of new management methodologies, technologies and materials, and the implementation of a cooperate wide innovation management approach. He is also a visiting lecturer at the University of Applied Sciences in Stuttgart and teaches there Research Methods to Master Students. Tugra has an academic background in Civil Engineering (Bachelors Degree), International Project Management (Masters Degree) and Executive Leadership (MBA with Distinction). He obtained also a PhD from the BEST-Research Institute at Liverpool John Moores University. The topic of his PhD Thesis was "AgiLean PM - a unifying strategic framework to manage construction projects". Tugra has work experience in the fields of Project Management and Construction Management in Germany, the UAE, the UK, and Turkey.