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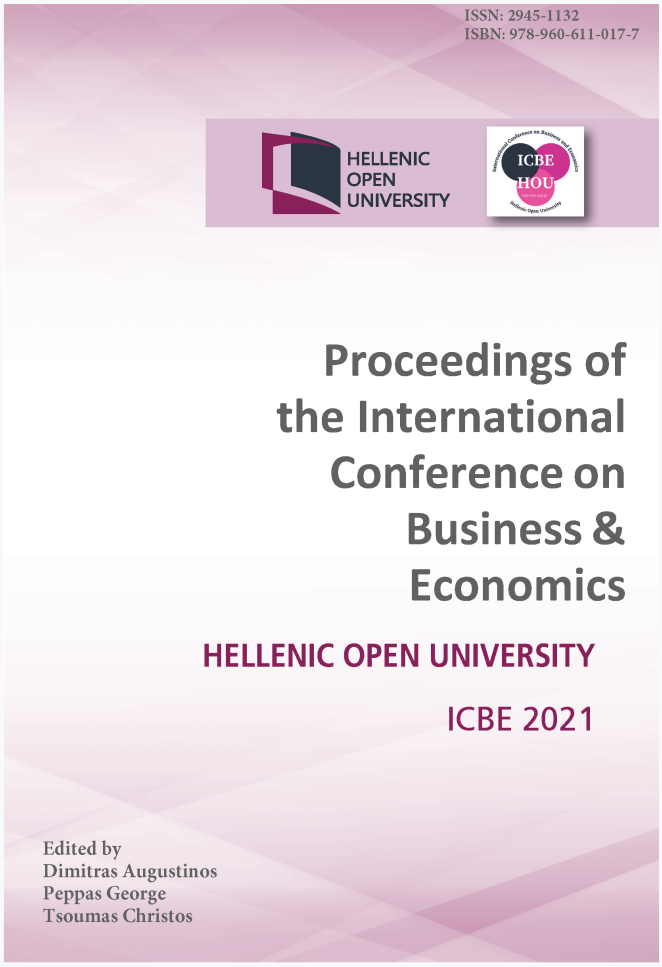

Project management: Lean vs. Agile methodology

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Project management: Lean vs. Agile methodology

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Abstract

The past decades there has been a large discussion on the suitability of the lean and the agile methodologies for an effective project management. This paper aims at providing an answer to this question. Both theoretical facts and practical case studies are going to be examined in order to be able to reach a result. It seems that both methodologies might be good, depending on the problem under consideration.

The two methodologies have some differences both on their starting point (LEAN was initially used in the manufacturing sector, while AGILE was initially used by the software development sector) and on their general concept (LEAN being more holistic and long-term, while AGILE is a better tool when quick decisions are needed).

Aspects such as reliability of the methodologies and their challenges including reasons that might lead to failure are going to be discussed.

EL Classifications: M10 General, M11 Production Management, M19 Other

Keywords: LEAN methodology, AGILE methodology, Project management, effectiveness, efficiency

1. Introduction

The realm of project management (PM) is characterized by two main methodologies: lean PM and agile PM.

During the 1940's, the Toyota Production system invented the lean PM methodology for use on Toyota's factory floors. It was deemed to be so successful that it was quickly adopted by other functions and business units of the company. The main idea behind lean PM is to get rid of all tasks that are not generating value, so as to be able to focus more on the matters that do generate value and consequently, are more meaningful for potential clients.

Fifty years later, during the 90's, the agile PM methodology was introduced, which adds flexibility to the planning and execution of a project (de Raedmaecker et al., 2020). Nowadays, there are actually efforts to combine the two methodologies into a lean-agile approach. (www.scaledagileframework.com, 2021)

The paper is going to be developed in the following sections: (a) presentation of the lean methodology, (b) presentation of the agile methodology, (c) comparison of the two methodologies, (d) presentation of the new mixed methodologies and finally (e) presentation of the outcomes and the results

2. Lean methodology

The driving principle of the lean PM methodology is to eliminate what does not add value. This means that meetings, tasks and documentation should be eliminated to the absolutely necessary ones. In addition, since it is a more systemic methodology, it also emphasizes the various ways that the whole team may perform better (TWOPROJECT STUFF, 2018). Over time, a number of key principles have been proposed, accepted and already applied across a variety of projects:

- Production should be based on demand and not on supply. The idea is to do something when someone wants it and orders it, rather than producing it, hoping that it will be sold;
- Small lots lead to a more efficient production exploiting economies of scale;
- Taking the time to focus on quality also increases production and efficiency;
- It is employees', rather than managers' responsibility to define their method of working;
- Continual improvement of the workers' way of working (the so-called "Kaizen"). is preferred to the execution of predefined tasks over and over again

2.1 Lean manufacturing Techniques

As seen in (www.planview.com, 2021), there are various lean techniques, which might be summarized as follows:

Continuous Improvement (Kaizen), where anyone participating in the value stream is encouraged to search for ways that will lead to the improvement of the quality of work and reduce waste.

Error-Proofing (Poka-Yoke), which seeks to eliminate waste because of human errors, through the use of visual signals, tools, and other similar systems. Some examples of the Poka-Yoke technique are: a) the standardized containers in the workstation eliminates the need for workers to weigh or count the contents on their own; b) accidents are prevented with the use of power guards on machines with moving parts, which do not allow opening before the parts are completely stopped; c) injury to machine operators is prevented with the use of safety mats which automatically stop the machine once stepped on; d) the blue colour can be easily spot on food, so workers in the food company wear blue gloves and clothes.

5S, which seeks to be organize and prepare workstations for the tasks at hand, eliminating waste. The 5S are: a) **S**ort (remove unnecessary tools from the workspace; b) **S**et-in-order (where the tools required are organized in a manner that makes it easy to find them); c) **S**hine (which means that the workplace is being kept need and tidy); d) **S**tandardize (when guidelines/requirements that should be met by all items are established); e) **S**ustain (where the maintenance of the standards previously determined leads to waste minimization).

Kanban Visual Management, which, being a workflow management tool, helps visualize and manage all works, and supports the reinforcement of some key elements, such as: a) limitation of work in process (WIP); b) use of a pull system; c) management of capacity so as the flow is improved; d) visualize the work

Just-in-Time, where manufacturers do not overproduce or hold any excess inventory, since the main idea is to purchase raw materials and produce the final products just in time to meet the demand

Stop the Line (Jidoka), where the production is paused in order to allow a root-cause analysis take place exactly the moment of the occurrence of any error

Takt Time, is the quotient of the available time divided by the required output, leading to a balanced production with no inventory or shortages

Production Leveling (Heijunka), which ensures an efficient flow of production while the potential fluctuations in the demand are also calculated and offers: a) predictability (calculation of the demand fluctuations); b) flexibility (decrease of the changeover time) and c) stability (ensure the balance between the volume and the type of the production)

2.2 Lean examples

There have been several best practices (Hanstedt, 2019) of the lean methodology, which can be summed up as follows:

- Waste elimination
- Continuous improvement
- Organisation according to five main principles - a) Sort, b) Set in Order, c) Shine, d) Standardize, e) Sustain
- Safety
- Track Metrics

Some really good real-time examples of lean manufacturing are the following (Crawford, 2020): a) cable manufacturing, b) truck manufacturing, c) printing industry, d) automotive parts manufacturing, e) warehouse management, f) customer service, g) heating air conditioning manufacturing

3. Agile methodology

The agile methodology was introduced in the 1990's and was more formalized in the early 00's. It was initially meant to facilitate software development. Soon, it did find acceptance in all business aspects and departments. The basic principles of the Agile methodology are described in detail in the Agile Manifesto (Beck et. al, 2001).

3.1 Agile Manifesto

The agile Manifesto is based on 12 principles:

i. The highest priority is the satisfaction of the customer, achieved through early and continuous delivery of valuable software.
ii. Agile processes harness change for the customer's competitive advantage, making changing requirements to be welcome even if they are late in development
iii. Frequent (from a couple of weeks to a couple of months, with a preference to the shorter timescale) delivery of working software.
iv. Business people and developers must work together daily throughout the project.
v. Projects are built around motivated individuals, who are given the environment and support they need, and are trusted to get the job done.
vi. Face-to-face conversation is considered as the most efficient and effective method of conveying information to and within a development team.
vii. The primary measure of progress is working software.
viii. Agile processes promote sustainable development. That means that sponsors, developers, and users should be able to maintain a constant pace indefinitely.
ix. Agility is enhanced by continuous attention to technical excellence and good.
x. Simplicity (i.e., maximizing the amount of work not done) is essential.
xi. Self-organizing teams usually result to the best architectures, requirements, and designs.
xii. At regular intervals, the team reflects on how to become more effective and tunes and adjusts its behavior accordingly.

3.2 Agile Techniques

In Altavater (2017), we see that several techniques have been developed following the Agile methodology:

i. **SCRUM**, which is based on the organization of software developers as a team in order to reach the common goal, i.e., the creation of a marketable product

ii. **eXtreme Programming**, which is mainly based on the frequent updated releases, which are a consequence of the short development cycles and the frequent communication with the customer

3.3 Agile examples

As seen in Aghina et al., (2018) there are quite a few best practices of the agile methodology:

i. **North Star embodied across the organization**: where we can see the manufacturing of modular products; agile supply chains in distribution; distributed energy grids in power; and platform businesses like Uber, Airbnb, and Upwork, where both stability and unprecedented variety and customization are enabled. Some examples of companies which put stakeholder focus at the heart of their North Star and, in turn, at the heart of the way they create value are Amazon, Gore, Patagonia, and Virgin, while companies like Google, Haier, Tesla, and Whole Foods constantly scan the environment.

ii. **Network of empowered teams**: where we have the case of an agile organization comprising a dense network of empowered teams operating with high standards of alignment, accountability, expertise, transparency, and collaboration. An additional characteristic of such companies is the stable ecosystem ensuring that these teams are able to operate effectively. Some examples are Gore, ING, and Spotify focus on several elements: (a)Implementing *clear, flat structures* that reflect and support the way in which the organization creates value. For example, teams can be clustered into focused performance groups (for example, “tribes,” or a “lattice”) that share a common mission. These groups vary in size, typically with a maximum of 150 people. This number reflects both practical experience and Dunbar’s research on the number of people with whom one can maintain personal relationships and effectively collaborate. The number of teams within each group can be adapted or scaled to meet changing needs. (b)Ensure *clear, accountable roles* so that people can interact across the organization and focus on getting work done, rather than lose time and energy because of unclear or duplicated roles, or the need to wait for manager approvals. Here, people proactively and immediately address any lack of clarity about roles with one another and treat roles and people as separate entities; in other words, roles can be shared and people can have multiple roles. (c)Foster *hands-on governance* where cross-team performance management and decision rights are pushed to the edge of boundaries. It is at this interaction point that decisions are made as close to relevant teams as

possible, in highly-productive, limited-membership coordinating forums. This frees senior leaders to focus on overall system design and provide guidance and support to responsible, empowered teams that focus on day-to-day activities. (d)Evolve functions to become *robust communities of knowledge and practice* as professional "homes" for people, with responsibilities for attracting and developing talent, sharing knowledge and experience, and providing stability and continuity overtime as people rotate between different operating teams. (e) Create *active partnerships and an ecosystem* that extends internal networks and creates meaningful relationships with an extensive external network so the organization can access the best talent and ideas, generate insights, and co-develop new products, services, and/or solutions.

iii. **Rapid decision and learning cycles**: where organizations focus on *rapid iteration and experimentation*, with the production of a minimal viable product or deliverable very quickly. During these short activity bursts, the team holds frequent, often daily, check-ins to share progress, solve problems, and ensure alignment. Between sprints, team members meet to review and plan, to discuss progress to date, and to set the goal for the next sprint. Agile organizations leverage *standardized ways of working* to facilitate interaction and communication between teams, including the use of common language, processes, meeting formats, social-networking or digital technologies, and dedicated, in-person time, where teams work together for all or part of each week in the sprint. For example, under General Stanley McChrystal, the US military deployed a series of standardized ways of working between teams including joint leadership calls, daily all-hands briefings, collective online databases, and short-term deployments and co-location of people from different units. This approach enables rapid iteration, input, and creativity in a way that fragmented and segmented working does not. Agile organizations are *performance-oriented* by nature. Working in rapid cycles requires that agile organizations insist on full *transparency of information.* Agile organizations seek to make *continuous learning* an ongoing, constant part of their DNA. Agile organizations emphasize *quick, efficient by* having insight into the types of decisions they are making and who should be involved in those decisions. They do not seek consensus decisions; all team members provide input (in advance if they will be absent), the perspectives of team members with the deepest topical expertise are given greater weight, and other team members, including leaders, learn to "disagree and commit" to enable the team to move forward.

iv. **Dynamic people model that ignites passion**: where organizations have invested in leadership which empowers and develops its people, a strong community which supports and grows the culture, and the underlying people processes which foster the entrepreneurship and skill building needed for agility to occur. Leadership in agile organizations serves the people in the organization, empowering and developing them. Leaders perform *shared and servant leadership* and become visionaries, architects, and coaches, serving as catalysts that motivate people to act in team-oriented ways, and to become involved in making the strategic and organizational decisions that will affect them and their work. The community is *cohesive* with a common culture. A good example is Zappos, the online shoe retailer acquired by Amazon changed its recruiting to support the selection of people that fit its culture. Employees in agile organizations exhibit *entrepreneurial drive*, taking ownership of team goals, decisions, and performance. Agile organizations attract people who are motivated by intrinsic passion for their work and who aim for excellence. Agile organizations allow and expect *role mobility*, where employees move regularly (both horizontally and vertically) between roles and teams, based on their personal-development goals.

v. **Next-generation enabling technology**: Agile organizations will need to provide products and services that can meet changing customer and competitive conditions. Traditional products and services will likely need to be digitized or digitally-enabled. Operating processes will also have to continually and rapidly evolve, which will require *evolving technology architecture, systems, and tools*. Organizations will need to begin by leveraging new, real-time communication and work-management tools. Technology should progressively incorporate new technical innovations like containers, micro-service architectures, and cloud-based storage and services. Extensive use of automated testing and deployment enables lean, seamless, and continuous software releases to the market (for example, every two weeks vs. every six months). Within IT, different disciplines work closely together (for example, IT development and operations teams collaborate on streamlined, handover-free DevOps practices).

Summarizing, we can see that becoming more agile is mainly driven by the environment. We are witnessing the emergence of a new organizational form based on the trademarks discussed and analysed above, in order to achieve a balanced and viable mix of stability and dynamism and thrive in an era of unprecedented opportunity.

4. Similarities and differences

Having analysed both methodologies, we can now seek for similarities and differences, leading to the following table 1 (educba.com, 2021):

Table 1

4: Table 1 The comparison of lean and agile methodologies

AGILE vs. LEAN	
AGILE	**LEAN**
DEFINITION	
Software development model, containing 6 different phases during the entire life cycle	Software development model deriving from the manufacturing sector

DEVELOPMENT	
Developed using different frameworks	Can be developed using the transition of manufacturing principles and processes
INTEGRATION WITH	
Capacity of delivering small and frequent parts of the products in order to develop and deliver the final product	Developed using the principles of the lean model
TIME	
Performs/delivers applications/products in a dynamic manner	Improvement of the speed and quality of the product
GENERALITY	
Six different phases in its life cycle	Seven principles in the development model
PRINCIPLES	
About scope/value of the product	About the speed and quality
BUILT-IN FACILITIES	
Can be used for any product development small or large	Can be used for building as small batches as possible
EASE OF USE	
Easier for dynamic requirement changes	Not flexible for dynamic changes
FLEXIBILITY	
Supports flexibility in the usage of different frameworks	Supports continuous inspection/adaption of the product

5. Towards a lean-agile methodology

There have been some approaches combining the two methodologies, such as SAFE which is based on ten principles (Scaled Agile, 2021):

i. Take an economic view
ii. Apply system's thinking
iii. Assume variability and preserve options
iv. Build incrementally with fast integrated learning cycles
v. Base milestones on objective evaluation of working systems

vi. Virtualise and limit Work-in-Progress (WIP), reduce batch sizes
vii. Apply cadence, synchronise with cross domain planning
viii. Unlock the intrinsic motivation of knowledge workers
ix. Decentralise decision making
x. Organise around value

We can also see the lean-agile coach (Sipberg, 2019), where we see a person helping teams and companies build better products in a sustainable way. The Lean part implies when applying Lean principles in order to improve *the way* products are built.

Finally, we can see **DevOps** which emerged to fill this gap and create synergy between the teams. This methodology grew out of a combination of Lean and Agile principles. (www.exin.com, 2021). It is actually a combination of cultural philosophies, practices, and tools that increases an organization's ability to deliver applications and services at high velocity. In other words, it is evolving and improving products at a faster pace than organizations using traditional software development and infrastructure management processes. The top 7 DevOps principles and best practices are shown below (perforce, 2018):

i. Version Control for All Production Artifacts
ii. Continuous Integration and Deployment
iii. Automated Acceptance Testing
iv. Peer Review of Production Changes
v. High-Trust Culture
vi. Proactive Monitoring of the Production Environment
vii. Win-Win Relationship (and Outcomes) Between Dev and Ops

5.1 The challenge of COVID-VACCINATION

The COVID-19 pandemic has raised very big challenges to both the scientific/pharmaceutical community that tried to find/produce a vaccine, (b) the logistics' society who had to transport the vaccine in time all over the globe.

The Effective Vaccine Management (EVM) initiative from the World Health Organization provides the necessary materials and tools to monitor and assess the supply chains for vaccines and to help countries improve the performance of their supply chains. The World Health Organization has set the following criteria for vaccines to be labeled and used at CTCs:

Vaccines must be used for special strategy or campaign scenarios. Currently, CTCs are not recommended for immunization under routine administration.

Vaccines should tolerate room temperatures of 40 ° C during a minimum of three days and must come with the four (4) critical factors for the logistics of the vaccine (Solistica, 2020)

i. Infrastructure logistics
ii. Transportation safety
iii. Product safety
iv. Product control system

It is obvious that the logistical planning involved will push any previously used modeling and supply channels to new limits. More than 12 billion total vaccine doses have been announced by all manufacturers for release in 2021, contingent upon all candidates succeeding in trials. In this ideal scenario, six billion to seven billion doses will be shipped in the first wave of pre-ordered vaccines, after which many countries are expected to reach the World Health Organization's minimum target of 20 percent immunization (Van Gogh, et. al, 2021).

We see the following matters impacting the distribution of the vaccine on a global plan. These are namely infrastructure, administration and the accessories to be in place when the vaccine arrives. In particular:

i. Storage refrigerators that will stock the vaccines once they arrive at the destination distribution or administration site.

   This means that the storage and distribution will be done according to the size and the frequency of the delivery and according to the particular storage instructions of each vaccine. The fact that the

prementioned issues are not common for all existing vaccines, makes the flexibility in storing an emergent necessity.

Obviously, the agile flexibility is needed at this point

ii. Keeping track of who got vaccinated, the vaccine they received and ensuring both and subsequent doses are from the same company will be a challenge.

This means that track on both the vaccine used and subsequently on the time the second dose should be received, if the vaccine initially used is supposed to have a second dose, is essential.

This is based more on lean principles

iii. The accessories needed around the administering of the vaccine including diagnostics and therapeutics will be six times the volume of the vaccine. (MAERSK, 2021)

This means that the supply of accessories should be scheduled according to the vaccination programme of each vaccination center

This could be a mixture of lean and agile principles

The deployment of COVID-19 vaccines will prove a challenge due to the volumes required, but also involving the intricacies of transportation and storage; testing the robustness of Global supply chains to the nth degree. (SEKO Logistics Knowledge Hub, 2021)

6. Discussion

The above analysis shows that both methodologies have good elements and makes it clear that a mixture of these good elements might lead to successful results and procedures' and processes' improvement.

Both agile and lean tools are powerful systems and there seems to be no need to choose one or another but combine them.

Companies should rather apply some **all-of-the-above approach**, by picking tools and applications which **suit** their case better.

The most recent example is the successful handling of the distribution channels of the Covid-19 pandemic vaccine that used both lean and agile techniques by applying adjustments according to:

i. the production and delivery plan of the existing vaccines
ii. the storing needs of each vaccine
iii. the vaccination programme/progress which affects the nee

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