BUNDLING THE FRAMEWORK FOR ALLYING THE VALUE ENGINEERING AND AGILE MANAGEMENT

Mohamed Said Meselhy [1]

[1] Associate Professor, Architectural department, Faculty of Engineering, Fayoum University, Fayoum, 63514, Egypt
* (dr.mohmeselhy@gmail.com).

Abstract

The construction projects especially the megaprojects need durations for the implementation as be determined before from the planners and the management teams. Otherwise, The changes of events at the recent times such as international wars and COVID-19 and the subsequent in all needs and different requirements. It became very clear on all levels as the social levels, the economic and the culture levels. These changes play in shifting concept and style for all requirements. This duration not compatible with the international and local changes speed. This case makes the projects styles and its functions not suitable for the shifting in all directions as society, technology and thought changes. It is effect directly on the investor's requirements at their projects. The main goal of the study is the integration between the value and agile to draw a new allying framework. It will be as a roadmap for megaprojects to be able to modify its paths according to any shifting. The study will present the value engineering methodology starting from the definitions then the value job plan based on the SAVE international organization. Then, it will present the philosophy concept for agile approach. The research will analyze the principles of agile management and its foundations. It appears with different weights according to the relation between each phase of value engineering to every principle of agile. Finally, it finalizes the research by drawing conclusions from all parts of study. It also offers recommendations for the current states and further research concerning the same issue.

Keywords

Value engineering; Agile management; Changes; Function; Shifting requirements

1. Introduction

The changes of events at the recent times such as international wars and COVID-19 and the subsequent in all needs and different requirements. It became very clear on all levels as the social levels, economic and the culture levels. These changes play in shifting concept and style for all requirements. It effected directly on the owners or investors visions to adapt or justify with modern innovations and technological developments.

The construction projects especially the megaprojects need durations for the implementation as be determined before from the planners and the management teams. This duration not compatible with the international and local changes speed. This case makes the projects styles and its functions not suitable for the shifting in all directions as society, technology and thought changes. It is effect directly on the investor's requirements at their projects. The requirements and expectations will constantly change during the development of the project. Time and resources are fixed and agreed upon as much as it is possible but the rest is evolving with the time.

The value engineering is a systematic process directed at defining and analyzing the function of systems for the purpose of achieving the essential functions at the lowest life cycle cost consistent with required performance. It is essentially a process which uses function analysis, teamwork and creativity to improve value. It still needs more adapt this methodology to modify itself if occur any shifting.

On the other hand, the Agile management approach is defined as: "Being agile is a declaration of prioritizing for project maneuverability with respect to shifting requirements, shifting technology, and a shifting understanding of the situation".

The main goal of the study is the integration between the value engineering and agile to draw a new allying framework. It will be as a roadmap for megaprojects to be able to modify its paths according to any shifting.

The study will present the value engineering methodology starting from the definitions then the value job plan based on the SAVE international organization. It will describe each phase and how we can apply it. Then, the study will present the philosophy concept for agile approach. The research will analyze the principles of agile management and its foundations. It will explain the purpose of each principle of agile. This explanation will be helpful to propose the allying with the all-different phases at the value engineering.

After that, the study will undertake a rearrangement for the value phase and the agile principles. It will propose the integration between value engineering and agile management. It will help to improve functionality benefit, increase the effectiveness of construction projects and/or reducing cost for the projects.

After the integration between VE phases and agile principles, the study summarizes and presents all these phases and principles. It appears with different weights according to the relation between each phase of value engineering to every principle of agile.

2. Materials and Methods

2.1. Value Engineering

Value Engineering (VE) is an organized/systematic approach directed at analyzing the function of systems, equipment, facilities, services, and supplies for the purpose of achieving their essential functions at the lowest life-cycle cost consistent with required performance, reliability, quality, and safety. Value engineering is essentially a process which uses function analysis, team- work and creativity to improve value (Chhabra, J. and Tripathi B. 2014).

2.2. Job Plan of Value Engineering

The VE study uses a systematic procedure called job plan. The job plan outlines specific techniques to effectively analyze a product or service in order to develop the maximum number of alternatives to achieve the products or services required functions. Adherence to the job plan will better assure maximum benefits while offering greater

flexibility. The VE study is consisting of five phases: information phase, creative phase, evaluation phase, development phase and recommendation phase. All phases and steps are performed sequentially (Arivazhagan O, Partheeban P, Guru V and Priya Rachel P. 2017)

For any certain project, the VE study is applied by a multidisciplinary team to improve its value. SAVE International sets 6 sequential phases for performing a successful VE study. The phases are distributed in 3 stages: pre-workshop stage, workshop stage, and post-workshop stage. The methodology of the SAVE International VE studies, including stages and phases, is shown in Figure 1. (Abdelghani M, Rahwan R, Abotaleb I, Fathy A and Al-Bughdadi A. 2015).
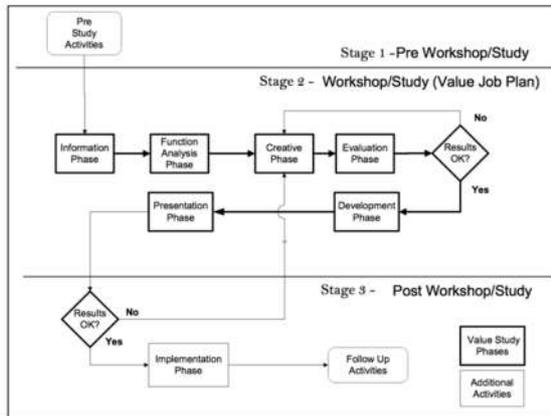

Figure 1. Illustrate Value Study Process Flow Diagram by SAVE International. (Source: Abdelghani M, Rahwan R, Abotaleb I, Fathy A and Al-Bughdadi A. 2015)

The workshop phase is structured around the job plan which consists of six job plan phases, as listed below:

Information phase: this brings all members of the team to a similar level of knowledge and provides a comprehensive understanding of the most significant aspects of the project. Important questions to be answered are: "What is it? What does it do? What must it do? What must it cost? What is the value performance of the primary function?" (Esezobor, E. 2016).

Function Analysis Phase: This is the most important phase of Value Methodology (VM) because it is here that VM started to be distinguished from other applications.

The purpose of this phase is to understand the project from a functional perspective, thus identifying the project intended functions. In this phase, the functions are identified and classified. Functions are to be in a certain format where only two words are used in the function; a verb and a noun (Abdelghani M, Rahwan R, Abotaleb I, Fathy A and Al-Bughdadi A. 2015).

Creativity Phase: The purpose of this phase is to present a number of ideas regarding other methods of actualizing functions. Techniques such as brain storming, Gordon technique, nominal and Therese techniques Then, the team develops a list of idea providing a wide range of possible alternatives to actualize functions with the purpose of improving construction projects value (RAD, K. and Yamini, O. 2016).

Evaluation phase: In this phase, the selected creative ideas are analyzed and the most appropriate is selected to achieve or meet the objectives of the project. Alternative ideas that are beneficial or risky are also evaluated in this phase (RAD, K. and Yamini, O. 2016).

Development Phase: The purpose of this phase is to more investigate and develop a short list of ideas and properly develop them to select alternative values. Some activities necessary to achieve the objective of this phase in construction projects (RAD, K. and Yamini, O. 2016).

Presentation phase: In this phase, the results of the development phase are presented to the decision makers to assist them get the best understanding of the different VE alternatives and their short-term and long-term benefits. In this phase as well, an anticipated implementation plan is outlined (Abdelghani M, Rahwan R, Abotaleb I, Fathy A and Al-Bughdadi A. 2015).

Implementation: The chosen ideas receive approval in this phase, while those that are not relevant are rejected. One of the key activities in the implementation phase is sharing information among stakeholders regarding the recommendations that have to be implemented in the construction project. The implementation phase also includes meetings that are with project members, after which the deliverables are submitted to the owner (Al-ketbi, S. 2020).

From the previous stages and phases of value methodology we can conclude Table (1).

Table 1. Purpose of each stage& phase of VM

| VE Stages & Phases		Description
Pre study		Identify customer attitudes, Identify goals and objectives
Study	Information phase	Collect and gathering data.
	Function phase	Define function
	Creative phase	Generate ideas
	Evaluation phase	Evaluate ideas
	Development phase	Develop Alternatives
	Presentation phase	Sell Ideas
Post study	Implementation phase	Obtain Results

3.1. Agile Management

Being agile is a declaration of prioritizing for project maneuverability with respect to shifting requirements, shifting technology, and a shifting understanding of the situation'. Other priorities that care of interest in agility include predictability, schedule, cost, the use of specific tools and process accreditation. However, in an agile approach, the customer requirements and expectations will constantly change during the development of the project. Time and resources are fixed and agreed upon as much as it is possible but the rest is evolving with the time. Figure (2) Gives an illustration of the traditional project and agile projects. In that illustration, it can be seen that features can be changed but resources and time are fixed (Carroll, J., and Morris, D. 2015).

3.2. Foundations and Principles of Agile Management

Agile originated from the creation of the agile manifesto

in 2001 by a group of software developers aiming to consolidate their best practices from experiences of iterative software development. Agile as a concept largely evolved from values defined in the manifesto.
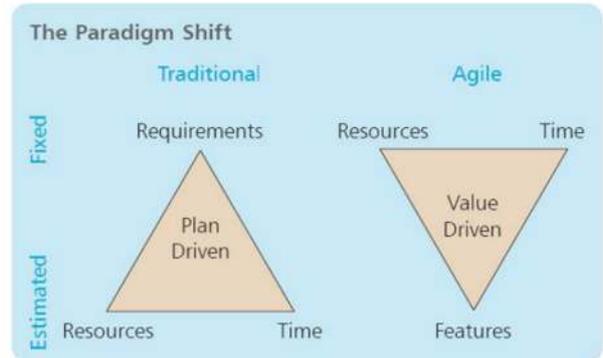
Figure 2. Difference between Traditional and Agile Projects (Source: Carroll, J., and Morris, D. 2015).

• Individuals and interactions over processes and tools
• Working software over comprehensive documentation
• Customer collaboration over contract negotiation
• Responding to change over following a plan (Storå, 2020).

Agile practices lie behind the agile manifesto which consist of twelve fundamental principles (Manifesto for Agile Software Development, 2001):

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale. (Malakar, S. 2021)
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. the sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity- the art of maximizing the amount of work not done-is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly (Aggarwal, S. and Kaldi, K. 2018).

From the previous values and principles of agile we can conclude Table (2).

Table 2. Purpose of each principle of Agile

NO.	Agile principles	Description
1	Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.	Obtain customer satisfaction early and continuous
2	Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.	Welcome Change
3	Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.	Division of work to the shorter timescale
4	Business people and developers must work together daily throughout the project.	Cooperation of team
5	Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.	Motivation and cooperation of team

NO.	Agile principles	Description
6	The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.	Direct communication
7	Working software is the primary measure of progress.	Obtain function and main goal
8	Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.	Continuous value delivery
9	Continuous attention to technical excellence and good design enhances agility.	Best Design
10	Simplicity-the art of maximizing the amount of work not done-is essential.	Achieve work with least and simplest way
11	The best architectures, requirements, and designs emerge from self-organizing teams.	Give team the right of innovation
12	At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.	Self-team performance assessment

4. Materials and Discussions

4.1. The integration between value engineering and agile

The integration between value engineering, agile helps to improve functionality benefit, increase the effectiveness of construction projects and/or reducing cost for the projects Table 3 shows the integration between phases and principles of VE and Agile.

Table 3. Integration between VE and Agile

VE Stages & Phases	Description		Agile principles		Description
Pre study	Identify customer attitudes, Identify goals and objectives		1.	Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.	Obtain customer satisfaction early and continuous
Study	Information phase	Collect and gathering data.	2.	Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.	Welcome Change
	Function phase	Define function	3.	Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.	Division of work to the shorter timescale
	Creative phase	Generate ideas	4.	Business people and developers must work together daily throughout the project.	Cooperation of team
	Evaluation phase	Evaluate ideas	5.	Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.	Motivation and cooperation of team
	Development phase	Develop Alternatives	6.	The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.	Direct communication
	Presentation phase	Sell Ideas	7.	Working software is the primary measure of progress.	Obtain function and main goal
Post study	Implementation phase	Obtain Results	8.	Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.	Continuous value delivery
			9.	Continuous attention to technical excellence and good design enhances agility.	Best Design
			10.	Simplicity-the art of maximizing the amount of work not done-is essential.	Achieve work with least and simplest way
			11.	The best architectures, requirements, and designs emerge from self-organizing teams.	Give team the right of innovation
			12.	At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.	Self-team performance assessment

4.2. The agile value matrix

After the integration between VE phases and agile principles, the study will create the agile value matrix to be able to determine weights for each phase. The creation process consists of five steps as follow:

1. The meeting preparation: This step aims to draw the meeting polices. The methodology started by an introduction which goals to introduce the matrix aims and the model generation.

2. A pilot meeting: It is presented with experts in value engineering in order to test the meeting protocol before starting an actual meeting. This step aims to justify the interview process. It was necessary to pilot the meeting process to ensure the paths are clear and comprehensive.

3. The selection interviewees: The level and category for interviewees consists of two categories of experts. The first one, Value members who's certified from the SAVE international origination. The second category, Consultants in the agile management.

4. Meeting experts: It will present the discussion with the expert as the outlines which are designed by the validation process.

5. The meeting outcomes: It will analysis their discussion according to the value methodology and agile principles. The outing outcomes summarizes and presents all these phases and principles as shown Table 4. It appears the relation between each phase of value engineering to every principle of agile.

Finally, The Study will present the estimated weights based on the above five steps. It will probably get slightly changes concern these weights according the selection of interviewees number, type and previous experiences. The changing weights does not make conflict at the study aim, as long as it is shown the same importance of the specific stage in every change that occurs.

Table 4. The Agile value matrix.

Agile Principles	Value Engineering Principles							
	Preparation phase	Information phase	Function analysis phase	Creative phase	Evaluation phase	Development phase	Presentation phase	Post study
Our highest priority is to satisfy the customer through early and continuous delivery of valuable software	√			√			√	√
Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.			√	√	√	√		√
Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.			√	√				
Business people and developers must work together daily throughout the project.	√	√	√	√		√		√
Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.	√	√		√		√		
The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.		√		√	√	√		
Working software is the primary measure of progress.	√	√	√	√	√	√	√	√
Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.			√	√	√	√		√
Continuous attention to technical excellence and good design enhances agility.						√		√

Simplicity the art of maximizing the amount of work not done is essential.			√	√				
The best architectures, requirements, and designs emerge from self-organizing teams.			√	√	√	√		
At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.							√	√
Weight by Authors	1	4	8	10	5	8	3	7
Total	46							

5. Conclusions and Recommendations

In this paper we explored the weights according to the relation between each phase of value engineering to every principle of agile as shown Table 5.

Table 5. Ratios between value phase and Agile principles

Value Engineering phases	*Applied Ratio in Agility*
Preparation phase	2.17%
Information phase	8.69%
Function analysis phase	17.39%
Creative phase	21.74%
Evaluation phase	10.70%
Development phase	17.39%
Presentation phase	6.59%
Post study	15.33%

The creative phase in value engineering is the most important according to agile principles as shown in the below chart. That means, the creativity idea presents the top value of achieving goals. Then as shown, the study ranked the rest of the important phases such as the function analysis phase, Development phase, and Evaluation.

It is very clear that the focus on the client satisfactions has achieved at the agile methodologies starting at the concept and approaches till to the global businesses. The Agile management not only limiting to the software and programming industry but also across other different fields especially at the construction industry. Thus, Value engineering is appropriate to create a framework by an allying with the agile principles.

On the other hand, the study enhances the applying of Agile Manifesto principles not only by productivity and client satisfaction. But also extended to the value approaches by increase the profitable and improve the quality irrespective of the changes and the shifting occurred. Finally, it is suitable time to get more productivity, profitable and quality by bundling the framework for allying the value engineering and agile management.

The further recommendation is at the research level, how to apply the framework for allying the value engineering and agile management at each phase of the construction projects. There are many phases starting with feasibility studies to the operation and maintenance phase. The study recommends researchers about apply the framework deeply at the different phase to be able to get more agility and align with any shifting.

References

Abdelghany M, Rahwan R, Abotaleb I, Fathy A and AlBughdadi A. (2015). Value engineering applications to improve value in residential projects. In: Proceedings, Annual Conference–Canadian Society for Civil Engineering. (pp. 27-

30).

Aggarwal, S. and Kaldi, K. (2018). "Agile project management for knowledge-based projects in manufacturing industry: case study: epiroc drilling tools, fagersta, sweden." Thesis, Uppsala University, Faculty of Science and Technology.

Alketbi, S. (2020) Effective implementation of value engineering in the housing construction programmes of the UAE. Ph.D. Thesis, University of Wolverhampton.

Arivazhagan O, Partheeban P, Guru V and Priya Rachel P. (2017) Application of value engineering in construction projects. International Journal of Engineering and Management Research (IJEMR), (Vol. 6 Issue 02), (pp. 25-29).

Carroll, J., and Morris, D. (2015). Agile Project Management in Easy Steps (second ed.). Publisher   In Easy Steps, Warwickshire, UK.

Chhabra, J. and Tripathi B. (2014). Value engineering: a vital tool for improving cost & productivity. International Journal of Industrial Engineering and Technology (IJIET), (Vol. 4, Issue 6), (pp. 1-10).

Esezobor, E. (2016) Sustainability and Construction: A Study of the Transition to Sustainable Construction Practices in Nigeria. Doctoral thesis, Birmingham City University.

Malakar, S. (2021). "AGILE in Practice: Practical Use-cases on Project Management Methods including Agile, Kanban and Scrum. " published by Manish Jain for BPB Publication, New Delhi.

Storå, (2020). "Towards Scaled Agility: A Case Study on Successfully Initiating Agile Transformations At Large Banks.", Thesis, KTH school of Industrial Engineering and Management, Stockholm, Sweden.

Rad, K. and Yamini, O. (2016). The Methodology of Using Value Engineering In Construction Projects Management. Civil Engineering Journal, (Vol. 2, No. 6), (pp. 262-269).