

Research Methods: Is Agile Different?

Elizaveta Gromova¹ and Eduardo Tomé²

¹E4 Conferences, Portugal

²Universidade Lusófona, Lisbon, Portugal

lizaveta-90@yandex.ru

Eduardo.tome@gmail.com

Abstract: The fourth industrial revolution was a radically new round in the evolution of many processes in society, including management processes. The digital revolution has provoked the development of new management models and concepts. Agile manufacturing is one of such managerial production concepts that meets modern challenges and requirements of the business environment. Literature review as a research method plays an important role in the studies. This paper presents a systematic literature review of the papers published in SCOPUS and Web of Science database about agile manufacturing since 2000. Specifically, we aim at analysing the research methods on this very popular topic on the economy and management. We believe that by defining the methods used in the agile field we may understand the nature of the research. It is well known that agile manufacturing methods are meant to be upfront in terms of efficiency, but in this paper we want to make a review on research methods to check how research has been made. Therefore, we believe this research is useful for scientists and practitioners.

Keywords: Agile manufacturing, Literature review, Research method, Fourth industrial revolution

1. Introduction

Nowadays the fourth industrial revolution development, dominated by digitalization and artificial intelligence (Schwab, 2017) agile manufacturing comes to the fore. Uncertainty and instability are the conductors of current business processes. In today's reality, an industrial enterprise faces a number of challenges. Along with those that have already become ordinary, which consists in achieving a high-quality indication and minimal costs, the following are becoming topical:

- reduction in time to market;
- wide variety of product range;
- increase in the rate of flow of production processes;
- accurate customer satisfaction;
- use of the latest technological advances.

So, a modern management model should satisfy these points. Agile is a strategy for achieving a sustainable development through adaptation to all challenges of the external environment.

Thus, it is very important to follow the research methods used by scientists on this very popular topic of economics and management in order to check how scientific research was conducted. That's why literature review is becoming particularly relevant.

2. Methods

Although changes and uncertainty in the market are not new challenges, over the past decades there has been an unprecedented acceleration of the changes taking place. Thus, the speed and frequency of the appearance of new things in the field of technology increases every year, doubling, by analogy with Moore's law, every five years. Because of this, it is difficult to keep up with the times and be at the forefront of research, as well as evaluate collective data in a particular area of business research.

So, literature review as a research method plays an important role in research papers.

A literature review is a document or section of a document that collects key sources on a topic and discusses those sources in conversation with each other. It is a comprehensive summary of previous research on a topic. And due to some researchers (Baumeister and Leary, 1997; Tranfield, Denyer and Smart, 2003) it can be described as a systematic way of collecting and synthesizing previous research. Well-conducted review as a research method creates a solid foundation for facilitating theory development and advancing knowledge (Webster and Watson, 2002). There are some guidelines for conducting literature reviews that propose different types of reviews, such as narrative or integrative (Wong, Greenhalgh, Westhorp, Buckingham, and Pawson, 2013), systematic and meta-analysis (Davis, Mengersen, Bennett, and Mazerolle, 2014; Moher, Liberati, Tetzlaff, and Altman, 2009) or integrative (Torraco, 2005). In general, there are different types of review methodologies:

systematic, semi-systematic and integrative approaches and argues that depending on purpose and the quality of execution, each type of approach has advantages.

So, systematic reviews are effective in synthesizing what the collection of studies are showing in a particular question and can provide evidence of effect that can inform policy and practice. However, systematic reviews are not always the best way. Instead, when wanting to study a broader topic that has been conceptualized differently and studied within diverse spheres, this can hinder a full systematic review process. Instead, a semi-systematic review approach could be a good strategy for example map theoretical approaches as well as identifying knowledge gaps within the literature. In some cases, a research question requires a more creative collection of data, in these cases; an integrative review approach can be effective when the purpose of the review is not to cover all articles ever published on the topic but rather to combine perspectives to create new theoretical models.

Table 1: Types of review methodologies (based on Snyder, 2019)

Approach	Systematic	Semi-systematic	Integrative
Typical purpose	Synthesize and compare evidence	Overview research area and track development over time	Critique and synthesize
Research questions	Specific	Broad	Narrow or broad
Search strategy	Systematic	May or may not be systematic	Usually not systematic
Sample characteristics	Quantitative articles	Research articles	Research articles, books, and other published texts
Analysis and evaluation	Quantitative	Qualitative/quantitative	Qualitative
Examples of contribution	Evidence of effect, inform policy and practice	Themes in literature, historical overview, research agenda, theoretical model	Taxonomy or classification, theoretical model or framework

Also, there are some attempts to develop guidelines specifically for business and management research. Thus, Tranfield, Denyer and Smart (2003) in their systematic review compare management and healthcare research, highlight the challenges of conducting a systematic review in management research and provide guidelines for conducting a systematic literature review in management. The main contributions of integrative review made by Torraco (2005) are definition the integrative literature review, providing guidelines and examples for integrative literature reviews and discussing contributions of an integrative literature review. Palmatier, Houston, and Hulland (2018) provide guidelines for publishing review papers in the sphere of marketing. It is noteworthy that Davis, Mengersen, Bennett, and Mazerolle (2014) provide guidelines for conducting a systematic review and meta-analysis in social sciences.

3. Results and Discussion

Different scientists describe the agile concept in different ways. Their studies have different approaches to literature review as a research method, but do not contradict each other. There is a tendency in view of the peculiarities of the concept of agile manufacturing, expressed in the fact that it is based on other fundamental, effective and well-proven concepts. The key to understanding the construction of a study on the agile concept is the content component of this concept.

The production system of the enterprise, which supports the principles of agile manufacturing, is based on the integration of organizations, highly qualified and knowledgeable people and advanced technologies into a coordinated system to achieve a qualitative leap forward in the competition by providing abilities that exceed those obtained from the current practice of the enterprise. Such an enterprise is a dynamically developing, flexible and reliable business unit capable of rapid reconfiguration in accordance with market opportunities. According to P. Kidd (1994), the fundamental resource for an agile enterprise is "knowledge". People should be united in dynamic teams formed around well-defined market opportunities so that each other's knowledge can be used. Through this process, knowledge is transformed into new products and services.

Production has undergone many evolutionary stages and paradigm shifts - from handicraft industry to mass production; then to lean production and, further, to agile manufacturing.

According to P. Kidd (2000), the manufacturing industry may well be on the verge of a serious paradigm shift. This shift is likely to take us away from mass production, far beyond lean production, into the world of agile manufacturing. K. Prahalad (2008) is also in solidarity - "we are moving towards a world in which value is determined through the experience of co—creation with the client at any given time." A. Gunasekaran (1999) suggests that agile manufacturing is a vision of production, which is a natural development of the original lean production concept. He believes that while lean production focuses on cost reduction, the requirement for organizations to become more agile and customer-oriented has led to the formation of the concept of agile manufacturing as a differentiation from lean production. A. Nambiar (2010) provides a taxonomic comparison of modern production concepts and comes to the conclusion that each of them, although contributing to the achievement of common goals - increasing profitability and customer satisfaction, is aimed at achieving specific objectives. Accordingly, the company must make a choice in favor of a particular concept by clearly defining its specific purpose. A. Harrison (1997) highlights the main discrepancy between lean production and modern market requirements in terms of the need to build a rigid supply chain, the development of which takes years, while agile manufacturing is characterized by a higher speed. A. Gunasekaran and Y. Yusuf (2002) define quick response manufacturing (QRM) as a characteristic of an agile enterprise. S. Goldman and R. Nagel (1993) argue that agile manufacturing assimilates the entire range of flexible manufacturing technologies, as well as lessons learned from Total Quality Management (TQM), the just-in-time model and lean production. Some scientists (Van Hoek, 2000; Mason-Jones, Naylor and Towill, 2000; Matawale, Datta, and Mahapatra, 2015) are discussing a combination of lean production and agile manufacturing within the supply chain, the so-called "Leagility" concept. In particular, the team of authors examines the similarities and differences between the characteristics of lean production and agile manufacturing and puts forward a judgment on the appropriateness of when and where they should be adopted from the point of view of the best customer satisfaction. Other authors (Greene, Ellis and Waller, 2008; Prince and Kay, 2003) consider a combination of these concepts in order to help companies reduce operating costs by responding to customer requests in a timely manner. According to Luzin (2013), the main difference between the concepts of agile manufacturing, quick response manufacturing, lean production lies in the "strategic, target orientation", but at the same time they do not contradict each other, but, complementing, strengthen. The authors (Powell and Strandhagen, 2012) support combining elements of the three production concepts in a logical progression - the transition from lean production, through quick response manufacturing to agile manufacturing. This leads us to reinforce the assumption that the principles of all three paradigms should be considered by an industrial enterprise striving for operational excellence and competitive advantage in the turbulent global markets of our time. According to Oleson (1998), agile manufacturing serves as a structure that combines the principles of lean production with mass customization. Sharp and colleagues (1999) presented a theoretical model in which lean production and quick response manufacturing are uniquely identified as agile manufacturing instruments. Yanzer Cabral, Ribeiro and Noll (2014) identify and discuss the gap between knowledge management and agile methodologies. Andriyani (2017) considers knowledge management as an important aspect of one of the agile techniques – retrospective.

Developing reflections on an effective production model of modernity, it is possible to schematically present the following (fig. 1).

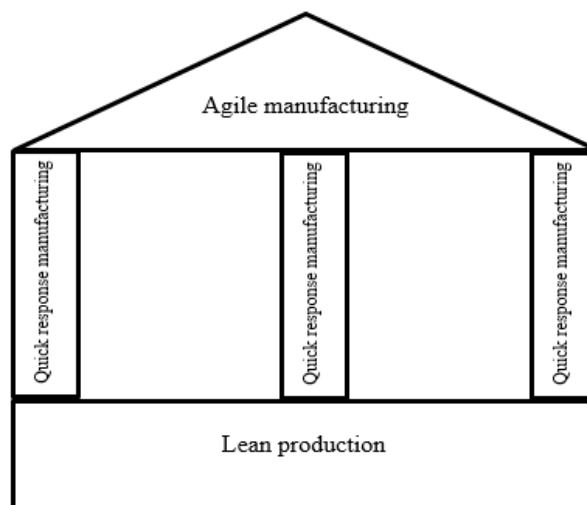


Figure 1: The model of agile manufacturing (developed by the authors)

The role of agile manufacturing (Booth, 1996; Goldman, Nagel and Preiss, 1995; Gunasekaran, 1998; Larman, 2004; Sutherland, 2014; Highsmith, 2000; Cohn and Schwaber, 2003; Schwaber, 2007; Goodpasture, 2010; Hass, 2007) is fundamental, the achievement of organizational agility serves as the main strategic guideline for the active production model, and the models of modern resource management (mainly lean production) are the foundation on which the action of active production is based – the principle of continuous improvement and reduction of production losses. Among the losses, emphasis is placed on minimizing the time aspect, which reflects the main idea of the quick response manufacturing concept, which is considered as a kind of supports.

Summarizing from the point of view of the research methods used by scientists, attention is drawn to how different authors use different approaches: systematic, semi-systematic, integrative. Thus, this fact unites the nature and structure of research, it is quite traditional. But in view of the peculiarities of the concept of agile manufacturing, expressed in the fact that it is based on other fundamental, effective and well-proven concepts. In this regard, the integrative review approach is the most widely used in this kind of research on agile manufacturing. Researchers systematically study the theories on which the concepts that are the foundation for agile are based, also study agile within various fields of activity, try to link them to modern trends in the development of production. But at the same time, they apply creativity, for example, in data collection, combining different points of view to create a new theoretical model.

Of course, the emphasis in the achieved research result will depend on the choice of approach to literature review. As noted earlier, each approach has its own vulnerabilities and advantages. And researchers face different challenges every time. Thus, the authors' theories will highlight important aspects of the study for them. But the correct highlighting of the core features of agile is the key to the success of the researcher.

The methodologies used by scientists influence the theories proposed by them. But it is important that due to the specifics of the agile concept, the fundamental thoughts are similar among all authors of research on agile manufacturing. These fundamentals are shared with the concepts underlying agile.

The agile concept is modern, rapidly developing and therefore interesting for research by scientists. Their studies have different approaches to literature review as a research method, but do not contradict each other. And in general, these studies are an extensive and large-scale work for students, scientists and practitioners to study.

4. Conclusions

Agile is an extremely popular and certainly effective management model in the realities of the development of the fourth industrial revolution. Different scientists have identified and interpreted the meaning of this concept in different ways. But because of the agile manufacturing feature, which consists in the presence of the fundamentals of other popular production management concepts, such as lean production, and quick response manufacturing. A systematic study of these concepts, each separately, becomes justified. And further, using a creative integrative approach to literary reviews for agile manufacturing is a rational solution.

Summing up, we can highlight the following conclusions.

- Agile manufacturing is a concept of production organization based on foreseeing changes in the business environment and timely responding to rapidly changing market needs through the efficient use of internal and external resources. It is based on the principles of such fundamental and well-established models as lean production, and quick response manufacturing.
- Literature review as a research method plays a fundamental role in research papers. It can serve as a basis for knowledge development, provide evidence of an effect, create guidelines for policy and practice, and in case of success, you have the ability to generate new ideas and directions for a specific area.
- The choice of approach to the literary review is important and influences the further logic of the theoretical model construction. Scientists use different approaches to literature reviews: systematic, semi-systematic, integrative. Thus, this fact unites the nature and structure of research, it is quite traditional. But in view of the peculiarities of the concept of agile manufacturing, expressed in the fact that it is based on other fundamental, effective and well-proven concepts. In this regard, the integrative review approach is the most widely used in this kind of research on agile manufacturing.

A possible continuation of this study consists in a presentation comparing the depth and quality of agile research conducted by three approaches to literature reviews.

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