JSTI
Jurnal Sistem Teknik Industri

Value Stream Mapping: Literature Review and Implications for Service Industry

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Abstract. Value Stream Mapping (VSM) is a technique used in the lean principle that helps analyze the flow of materials and information needed to bring a product or service to the customer. VSM has received a lot of attention in the industrial sector from both the manufacturing industry and the service industry. The development of VSM tools has grown rapidly. Much of the research using VSM tools is carried out in industry and universities. This literature review aims to provide an overview of the implementation of Value Stream Mapping in the service industry and to find out its implications. This paper involves a review study of 45 papers related to a case study of VSM implementation in the service industry. The study was conducted using the Google Scholar database, Researchgate, ProQuest, Elsevier. This paper provides an advantage for the service industry to find problems related to waiting times. This paper extends the knowledge and study of the application of VSM as an unexplored tool in several branches of industry. VSM can also serve as a complementary approach, capable of increasing outcomes in many areas other than services. This paper also provides benefits for future researchers to add insights and references for studies related to VSM in the service industry sector.

Keyword: Value Stream Mapping, Service Industry, Waste, Lead Time, Cycle Time

Abstrak. *Value Stream Mapping (VSM) adalah salah satu teknik yang digunakan dalam lean principle yang membantu menganalisis aliran material dan informasi yang diperlukan untuk membawa produk atau servis ke pelanggan. VSM telah mendapat banyak perhatian di sektor industri baik dari industri manufaktur dan industri jasa. Perkembangan alat VSM telah berkembang secara pesat. Banyak penelitian menggunakan alat VSM dilakukan di industri dan universitas. Tinjauan pustaka ini bertujuan untuk menyajikan gambaran umum tentang implementasi Value Stream Mapping di industri jasa dan untuk mengetahui implikasinya. Makalah ini melibatkan studi review dari 45 makalah yang terkait dengan studi kasus implementasi VSM di service industry. Studi dilakukan dengan menggunakan database Google Scholar, Researchgate, ProQuest, Elsevier. Makalah ini memberikan keuntungan bagi industri jasa untuk menemukan permasalahan terkait waktu tunggu. Makalah ini memperluas pengetahuan dan studi tentang penerapan VSM sebagai alat yang belum dieksplore di beberapa cabang industri. VSM juga dapat dijadikan sebagai pendekatan pelengkap, yang mampu meningkatkan hasil di banyak bidang selain jasa. Makalah ini juga memberikan manfaat bagi peneliti selanjutnya untuk menambah wawasan dan referensi untuk studi terkait VSM di sektor industri jasa.*

Kata Kunci: Value Stream Mapping, Industri Jasa, Pemborosan, Waktu Tunggu, Waktu Siklus

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1. Introduction

Currently, the service industry sector is experiencing a very rapid development in line with the needs of the community regarding various types of services in various fields of life. Therefore, the service industry will play an important role in the future. The rapid development of the service industry will have an impact on very sharp and fierce business competition in the domestic and international markets. The service industry is an industry with service as a parameter of its activities. To remain competitive in the global market, the service industry must be able to provide the best possible service to its customers. One of the best ways to win the competition in the global market is to create an effective and efficient work system. If the company cannot afford it, it will be very unable to compete with competitors. Every service must have a process that is not optimal. Therefore, it is necessary to make improvements. Improvements are identified at each stage. Improvements can be made to objects of wasted time, resources, methods, materials, information and others. The service industry's goal is to customer satisfaction with quality, fast, and right-price service in a short time. This can be achieved if the company can create and implement effective and efficient processes in each of its business lines. Based on these objectives, the lean method is used because lean focuses on the continuous improvement of the company. So that an effective and efficient future system of the company will be achieved [1]

Value Stream Mapping (VSM) is one of the powerful lean tools to identify waste in business process lines [2]. VSM describes the reengineering process mapped in a future state with the process steps and information flows being redesigned, simplified and made more concise. VSM is useful for eliminating and identifying or streamlining steps that have added value and eliminating steps that have no added value. There are many advantages for the company if implementing VSM, namely improving the flow of information that is not feasible, improving waiting times that are too long, the efficiency of the entire business process.

In recent years, VSM applications have expanded rapidly to many industrial sectors. This is due to the ease of adaptation and flexibility of VSM to various industries. At present and in the future, VSM is possible to apply it in solving various types of problems, especially those related to the reduction of waste. Based on a systematic approach, this paper covers the available literature published in reference journals, providing important information on the evolution, application and performance aspects of VSM as well as the implications of VSM particularly in the service sector. This paper aims to analyze, explore and explain the concept of implementing VSM in the service industry, which will have benefits for new research in the current field.

2. Literature Review

Taiichi Ohno is a developer of lean concepts, he developed the principles of lean production, found that in addition to minimizing waste, we also need to increase the flow of products and good quality. So, lean production emphasizes that a production process is a flow of raw materials or materials starting from the initial activity to the final activity until the material changes shape [2]. Lean is a strategy that is carried out on an ongoing basis to eliminate waste of activity within

the company and increase added value to products or services to provide satisfaction to customers. VSM is one of the powerful lean tools to identify waste in business process lines.

According to [3], value stream mapping is a method of mapping the flow of the production process or service and the overall flow of information to produce one type of product or service. Not only in each work area but at the overall level of production, as well as identifying value-added and non-value-added activities.

Value stream mapping in plain view is to describe or map the flow of material and information as a whole. The use of value stream mapping can identify and describe the presence of waste in a stream as a whole so that using this tool can help companies make decisions to reduce waste. The use of value stream mapping is necessary so that the improvements made can be more focused on the overall waste in the system [2].

3. Methods

This study aims to explore more deeply the implementation of Value Stream Mapping in the service industry. The study was conducted using the Google Scholar database, Researchgate, ProQuest and Elsevier. The database was chosen because it provides open access services and provides quality articles. Based on the objectives of this study, the keywords "Value Stream Mapping", "Lean Service" and "Service Industry" were used to search for articles. These keywords were selected based on the topic and purpose of this study. Search for articles is limited from 2015 to 2020 so that articles that are still new in research are obtained. A thorough search of the articles was carried out then the findings were collected and sorted into several categories regarding the implementation of Value Stream Mapping in the service industry. Articles from various sources are studied in various ways to understand how Value Stream Mapping is applied in the service sector, especially studying Value Stream Mapping analysis and the implications that companies get if they apply it.

The preparation of this paper follows the basic research steps, which include determining the research objectives; conduct a literature review on the development of Value Stream Mapping and the Service Industry; create a conceptual framework; conduct analysis and discussion related to Value Stream Mapping; and identification of gaps and suggestions for future research.

This paper has several systematic stages in its preparation. The systematic stages are as follows:

1. First step: Article search: Search for articles with keywords "Value Stream Mapping"; "Lean Service" and "Service Industry". A total of 158 articles related to Value Stream Mapping case studies in the service industry were collected and reviewed.

2. Second step: Screening: Articles that are not related to the research theme are removed. About 45 articles related to case studies of Value Stream Mapping applications in the service industry were considered.

3. Third step: Article summary: Summarize all relevant articles based on each service industry sector, including financial, transportation, health, repair and others. Then analyze the benefits of each sector.
4. Fourth step: The implications of each article: Identify the implications of each service industry
5. Fifth step Identify gaps in the article summary and suggestions for future research.

For more details on the literature review steps in this paper, see Figure 1.
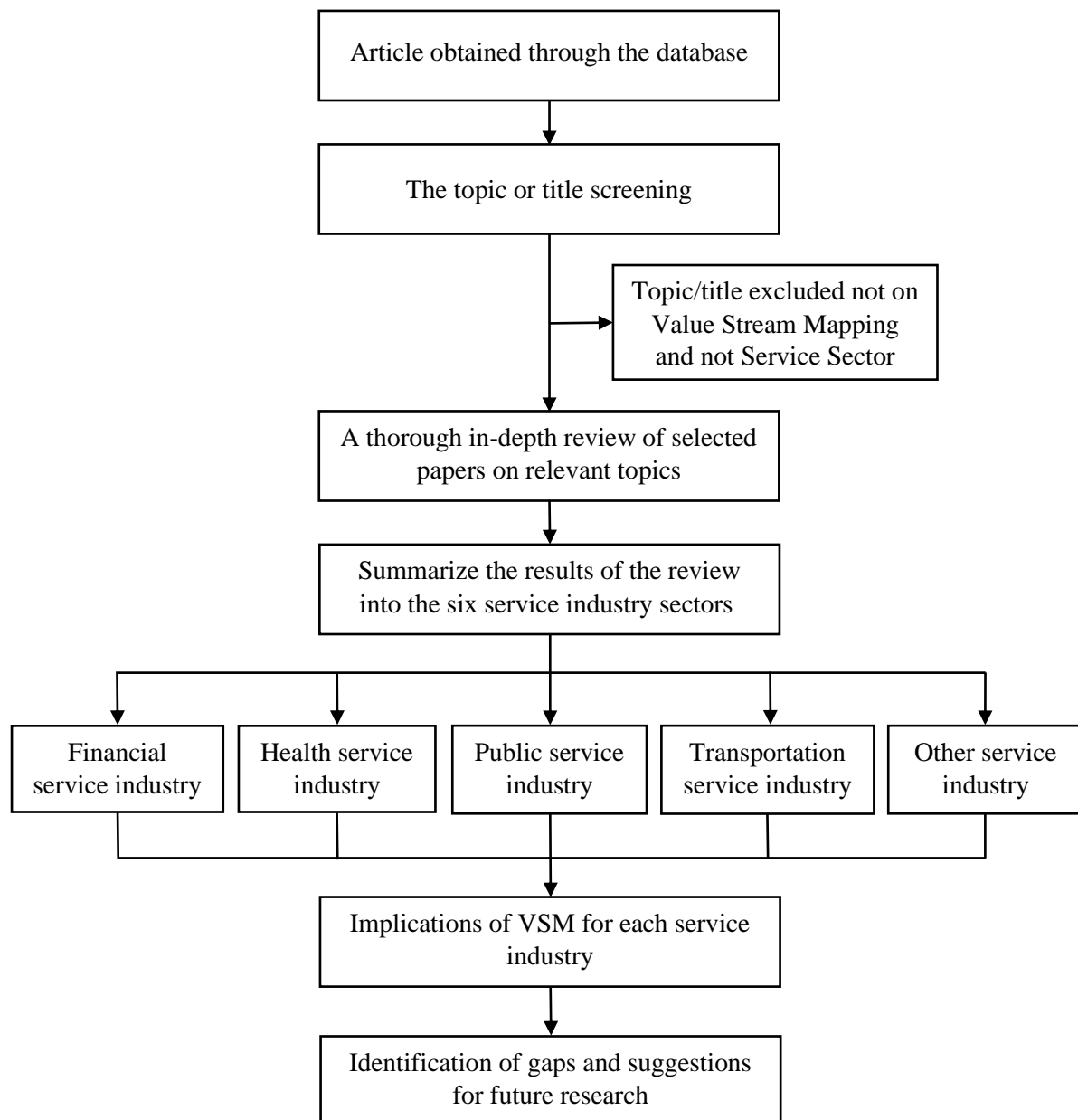
Figure 1 Literature Review Framework

4. Result and Discussion

4.1. Paper Classification

This paper identifies some of the attributes contained in the literature to offer comprehensive insights into the application, benefits and performance of VSM in the service industry. Articles were collected from 2015 to 2020 with specific topics related to VSM implementation in the service industry (Figure 2). Regarding the implementation of VSM in the context of the service industry, this paper finds that the Asian region is the region with a significant contribution. We note that the Asia region supplies a total of 25 articles. The European and American regions also grew in published proportions. These two areas have also made important contributions to the development of knowledge in this area, especially in recent years. The European Region shows contributions with 9 articles, followed by the Americas Region with 8 articles. The African and Australian regions showed little contribution with 3 articles and 1 article respectively. Article contributions by region can be seen in Figure 3.
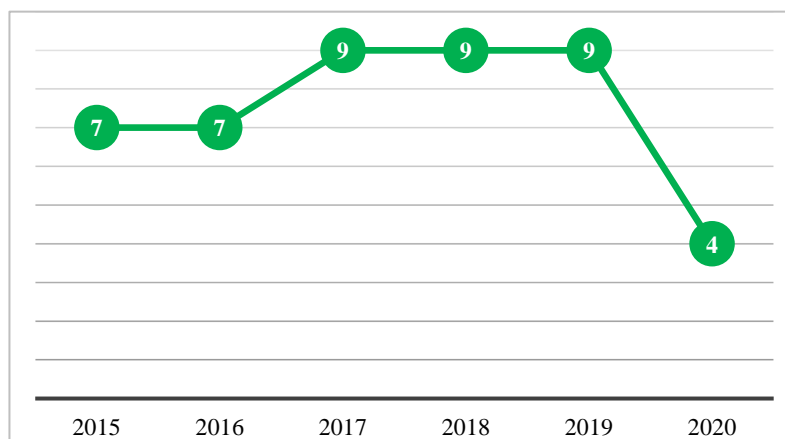
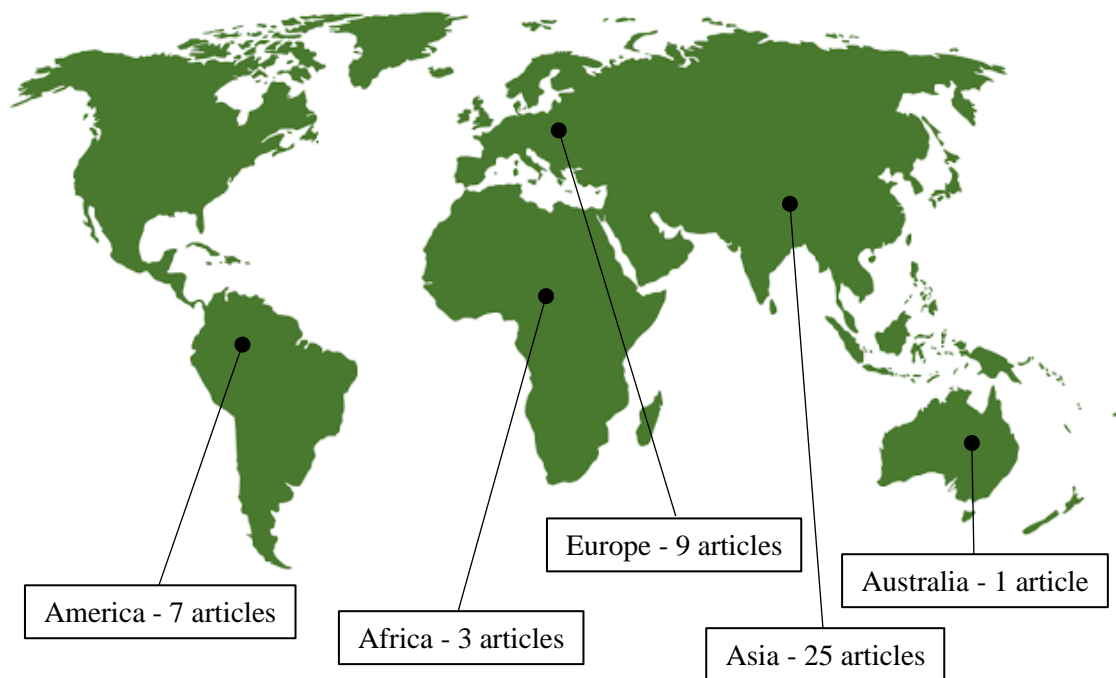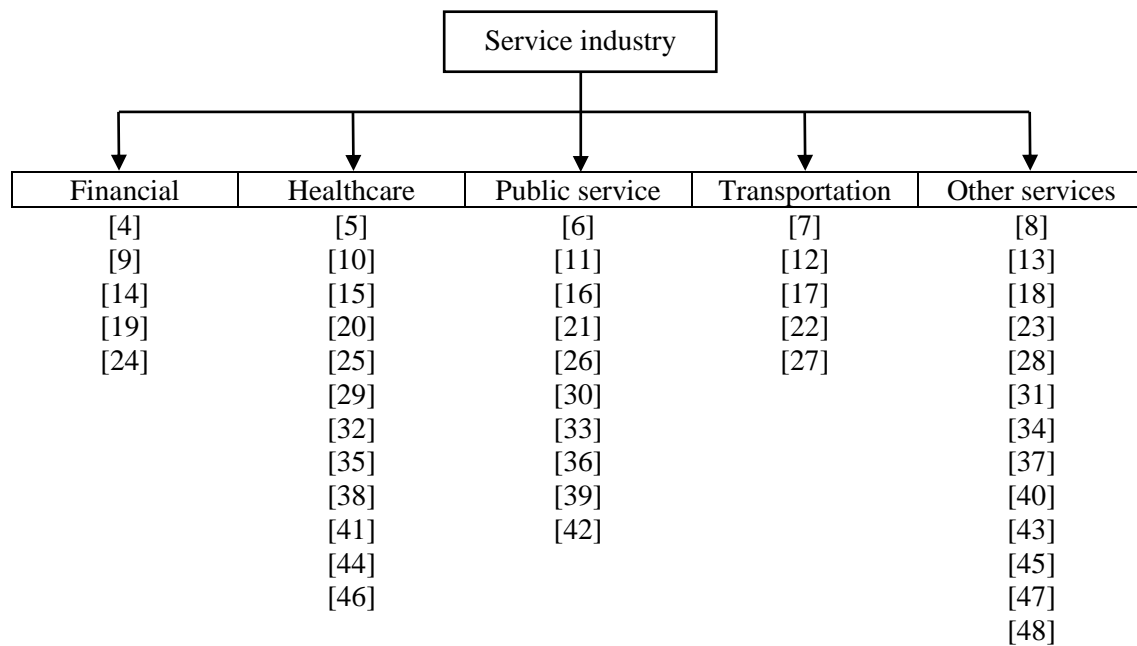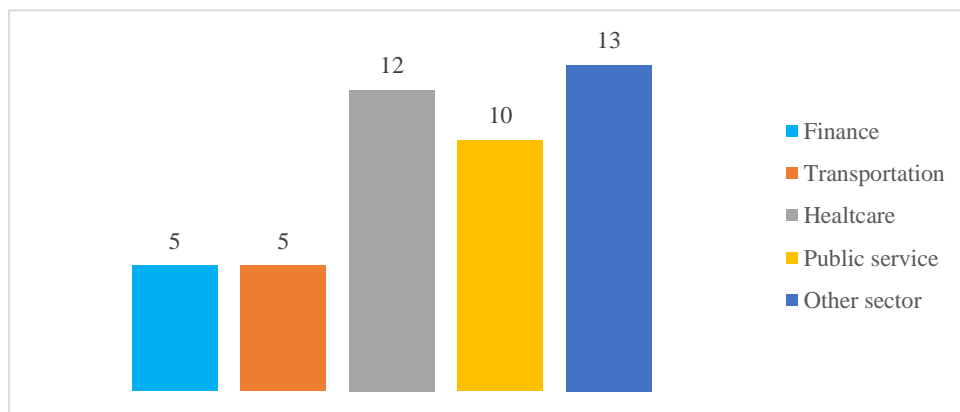**Figure 2** Publications by Year

Figure 3 Publications by Region

The methodology for analyzing value streams using the VSM approach explicitly states that it is necessary to draw a map of the actual and future state. However, some papers do not present a map of the future state. The analysis shows that only 68% of the articles focus on the use of VSM overall, while the rest are only present-day descriptions of VSM. The industries in which research is carried out are very different from one another, ranging from the financial sector, transportation, healthcare, public service, and others service industries. The available literature on VSM in service industries can be seen in Figure 4.

Service industry				
Financial	Healthcare	Public service	Transportation	Other services
[4]	[5]	[6]	[7]	[8]
[9]	[10]	[11]	[12]	[13]
[14]	[15]	[16]	[17]	[18]
[19]	[20]	[21]	[22]	[23]
[24]	[25]	[26]	[27]	[28]
	[29]	[30]		[31]
	[32]	[33]		[34]
	[35]	[36]		[37]
	[38]	[39]		[40]
	[41]	[42]		[43]
	[44]			[45]
	[46]			[47]
				[48]

**Figure 4** Available literature on VSM in service industries

In recent years, the implementation of VSM tools has increased significantly, especially in the service industry sector. This paper shows that the application of VSM in the industrial sector has been examined. The Healthcare industry sector with the most VSM implementations with 13 articles, the public service sector with 8 articles, the financial sector with 5 articles, the transportation sector with 5 articles and other service industry sectors with 15 articles. The contribution of articles based on the classification of the service industry sector can be seen in Figure 5.

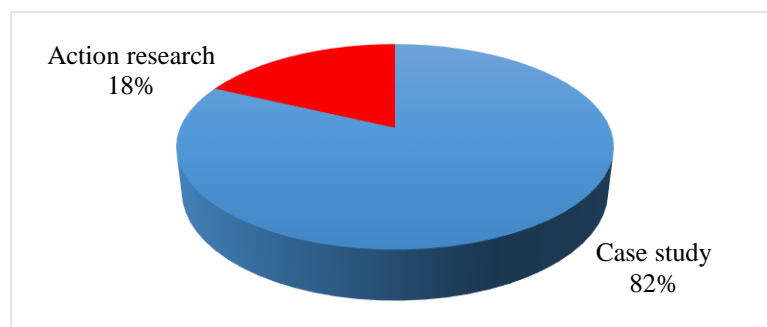**Figure 5** Publications by Service Industry Sector

Practitioners and researchers have integrated the use of this VSM tool with other methods. In its implementation, VSM is often integrated with various methods of improvement such as VSM with Activity Based Costing [34], VSM with Overall Equipment Effectiveness [17], VSM with Key Performance Indicators (KPIs) performance measurement [39], VSM with Kaizen [37]. VSM is often integrated with various methods of multicriteria decision making such as VSM with fuzzy AHP [43], VSM with DEMATEL [7]

This literature review identifies each article by grouping it into different objectives. The classification is based on the results of each case study article. The research objectives identified from each article were to eliminate the largest waste by 36%, then increase customer satisfaction by 28%, shorten cycle time by 18%, save costs and increase profits by 10% and improve service quality by 8%. Article contributions based on research objectives can be seen in Figure 6.
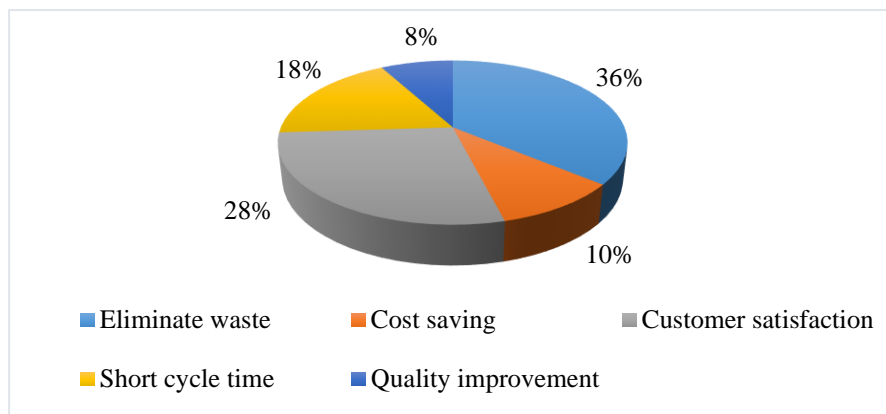
Figure 6 Publications by Research Objectives

This paper tries to identify the methodology aimed at each empirical study. Once identified, it was found that the most common methods used in this study were Case Studies and Action Research. Case study research articles were the most used articles among the identified articles, as shown in Figure 7.

Figure 7 Publications by Empirical Study

4.2.   Implications of VSM on the Service Industry

VSM has provided significant benefits to various sectors of the service industry. This is because the VSM tool can be a tool for improvement such as increasing customer satisfaction, shortening service cycle times, saving service costs and increasing profits, improving service quality,

creating an effective and efficient process and smoothing the flow of information. The following is an analysis of each implication of the VSM tool in each service industry sector.

A.   Financial Services

When implemented in financial services, VSM can reduce cycle time from 2 working days to 1 working day or reduced 50% [4]. Improvements to the lower customer waiting times and lower stress levels for employees and increased customer satisfaction [9]. Improved service quality and reduced waiting time [24]. Creating new business processes by reducing from 21 activities to 14 activities and reducing processing time from 8 days to 4 days [14]. Resulting in higher customer satisfaction due to reduced costs and improved quality [19].

B.   Health Services

When implemented in VSM health services, it can reduce waste identified in hospital services such as waiting times and administrative processes [5]. The reduction in drug storage costs was reduced by 47.22% or € 14,772 per year [29]. The amount of idle time increased by 51%, from 31,224 seconds reduced to only 15,232 seconds [44]. Shortening the ratio of the time the patient received services to the time spent waiting [20]. Large reduction in treatment time from 187 days to 60 days [46]. Reduction of waiting time for patients to be treated in the emergency department by 16.4% [15].

C.   Transportation Services

When implemented in transportation services, VSM can improve performance by decreasing the process lead time by 61.16% [7]. The reduction in total cycle time was significantly reduced by 69% [27]. Decrease in CO_2 6,050 KGs [17]. Improve the efficiency of service quality, performance, administration and operations [12].

D.   Public Service

When implemented in the public service, VSM can reduce the overall lead time for the annual uniform operational process by 80.15% [26]. Improved service to customers [39]. Improve the efficiency of its operations and increase customer satisfaction, such as shortening service delivery times or improving communication channels [30]. Creating an efficient and effective process in reducing service process time [11]. Reducing the total waiting time for the process to 50% [16].

E.   Other Service Industries

This paper identifies the implications of VSM on service industries divided into several sectors such as financial services, transportation services, healthcare services, public services. Many other service industries have used VSM tools for research and improvement. If implemented in maintenance services, it can improve the maintenance process and increase customer satisfaction [18]. If implemented in survey services, it can reduce the average processing time and reduce manpower [13]. If implemented in sales warehouse services, VSM can streamline warehouse operations and generate faster responses to customer requests [34]. If implemented in restaurant

services, VSM can increase performance by an average of 20% at the service stage [8]. If implemented in consultant services, VSM can reduce the time for activities that are not value-added, reducing by around 16.25% [23].

4.3. Development of VSM for Future Research

VSM has developed its application both in research and as a tool for improvement. Based on the focus of the VSM tool, the available literature suggests that lead-time reduction is a key performance indicator. This is what most of the researchers targeted in their paper. Initially, VSM has developed as a tool for eliminating waste in the manufacturing industry, which is better known as Lean Manufacturing. Along with the times, knowledge and demands for improvement, VSM has also been applied in the service industry as a tool to approach service time and increase customer satisfaction. This paper identifies the implementation of VSM in the service industry and its implications. Future research on the implementation of VSM tools can be carried out in the construction sector. As illustrated in Figure 8, in the future, VSM is more needed in the construction sector. It should be noted that in project work, the work time is uncertain. This can design the project work with VSM so that activities that are not value-added can be eliminated.
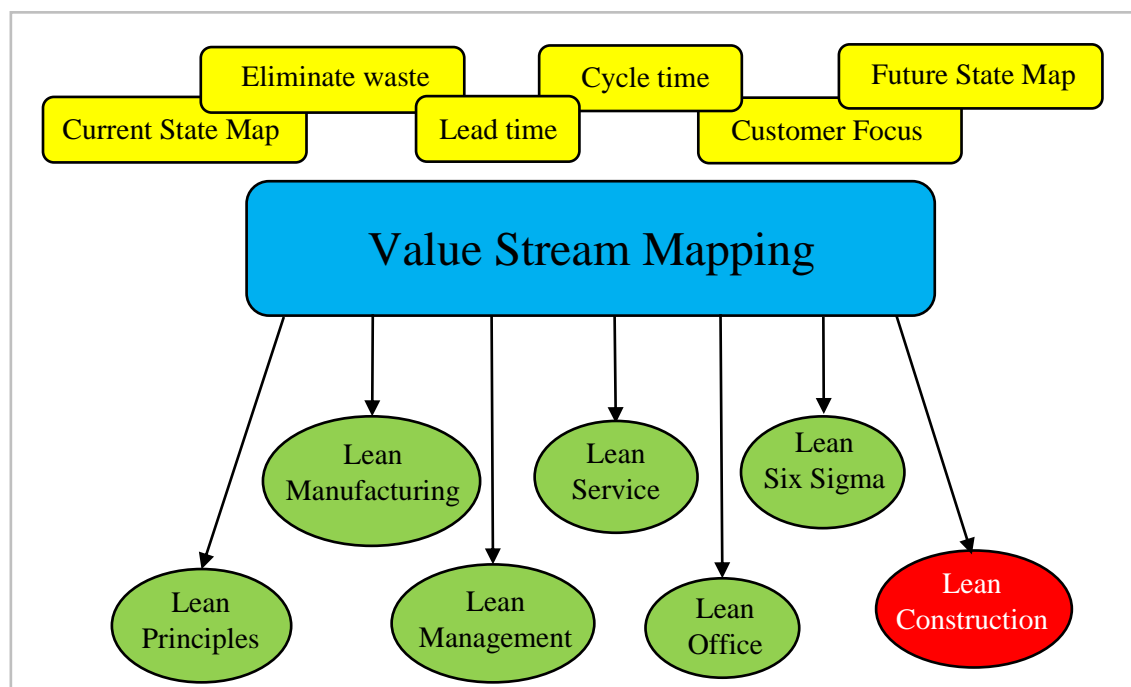
Figure 8 Development of VSM for future research

5. Conclusion

This paper has identified the implementation of VSM in the service industry. The main focus of VSM is to describe or map the overall flow of material and information. The advantages that can be obtained from implementing VSM are many and vary depending on different objectives. Some of the benefits obtained include increasing customer satisfaction, shortening service cycle times, saving service costs and increasing profits, gaining competitive advantages, improving service

quality and creating an effective and efficient process. This paper extends the knowledge and study of the application of VSM as an unexplored tool in several branches of industry. VSM can also serve as a complementary approach, capable of increasing outcomes in many areas other than services. VSM development in future research can be carried out in the construction sector using the lean construction approach to determine the effective time of project implementation.

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