Jurnal Informatika: Jurnal pengembangan IT

Vol. 10, No. 2, 2025
ISSN : 2477-5126, DOI:10.30591/jpit.v10i2.8248

A Systematic Review: Aggregation Methods for Production Processes In Supply Chain Management

Yudha Herlambang Cahya Pratama [1], Keysa Naristi [2], Clariza Arifianti [3]
Information System, Faculty of Engineering and Design, Hayam Wuruk Perbanas University, Surabaya
Jl. Wonorejo Utara No. 16 Rungkut, Surabaya, Indonesia

Info Artikel

Riwayat Artikel:

Received 2025-01-10
Revised 2025-04-22
Accepted 2025-05-07

Abstract *– In the modern era, technology has changed the way businesses operate significantly, leading to the need for faster and more efficient processes. One strategy for implementing technology is through aggregate planning that involves planning the entire production process and operational planning. This approach helps companies optimize resources, reduce costs, and increase efficiency. This study aims to explore the implementation of Aggregate Planning consisting of Chase Strategy, Level Strategy and Mixed Strategy in companies that implement Supply Chain Management. These three methods will be identified as suitable for implementation in what types of industries and under what conditions in order to achieve productivity and efficiency of business processes. This study will use a systematic review method to obtain results from the exploration of several journals that have been successfully collected. Of the 10 journals analyzed,6 journals were found to use Chase Strategy, 3 journals discussed Level Strategy, and 1 journal discussed Mixed Strategy. From the results of the analysis, it was found that the most widely used Aggregate Planning method in Indonesia is Chase Strategy. Chase Strategy is the right choice for production planning at the MSME business unit level. Information technology integration has proven to be important in increasing the efficiency of aggregate planning, although the challenge of interdepartmental coordination is a major obstacle. Therefore, it is necessary to implement centralized information technology such as ERP applications that are able to unite the needs of each department to achieve efficiency and effectiveness of the overall business process.*

Keywords: *Supply Chain Management; Systematic Review; Agregat Planning; Chase Strategy; Level Strategy; Mixed Strategy.*

Corresponding Author:

Yudha Herlambang Cahya Pratama

Email:

yudha.herlambang@perbanas.ac.id

Abstrak *– Di era modern, teknologi telah mengubah cara bisnis beroperasi secara signifikan, yang mengarah pada kebutuhan akan proses yang lebih cepat dan lebih efisien. Salah satu strategi untuk menerapkan teknologi adalah melalui perencanaan agregat yang melibatkan perencanaan seluruh proses produksi dan perencanaan operasional. Pendekatan ini membantu perusahaan mengoptimalkan sumber daya, mengurangi biaya, dan meningkatkan efisiensi. Penelitian ini bertujuan untuk mengeksplorasi implementasi Perencanaan Agregat yang terdiri dari Chase Strategy, Level Strategy dan Mixed Strategy pada perusahaan yang menerapkan Supply Chain Management. Ketiga metode ini akan diidentifikasi cocok diimplementasikan pada jenis industri seperti apa dan dalam kondisi yang bagaimana guna untuk mencapai produktifitas dan efisiensi proses bisnis. Pada penelitian ini akan menggunakan metode tinjauan sistematis atau literature review untuk memperoleh hasil dari eksplorasi beberapa jurnal yang berhasil dikumpulkan. Berdasarkan 10 jurnal yang dianalisis, ditemukan 6 jurnal yang menggunakan Chase Strategy, 3 jurnal yang membahas Level Strategy, dan 1 jurnal yang membahas Mixed Strategy. Dari hasil analisis, ditemukan bahwa metode Aggregate Planning yang paling banyak digunakan di Indonesia adalah Chase Strategy. Strategi Chase merupakan pilihan yang tepat untuk perencanaan produksi di tingkat unit bisnis UMKM. Integrasi teknologi informasi terbukti penting dalam meningkatkan efisiensi perencanaan agregat, meskipun tantangan koordinasi antardepartemen merupakan kendala utama. Oleh karena itu, perlu diterapkan teknologi informasi terpusat seperti aplikasi ERP yang mampu menyatukan kebutuhan masing-masing departemen untuk mencapai efisiensi dan efektivitas proses bisnis secara keseluruhan.*

Kata Kunci*: Supply Chain Management, Systematic Review, Perencanaan Agregat, Chase Strategy, Level Strategy, dan Mixed Strategy.*

I. INTRODUCTION

In the era of modernization, rapid technological developments have significantly changed the way companies operate [1]. Technological developments make digital transformation a necessity for companies from various sectors. This change is driven by the demand for faster and more efficient processes, which requires the adoption of new technologies such as automation, artificial intelligence, and cloud computing. These advances enable organizations to streamline operations, improve customer experience, and remain competitive in an ever-evolving market [2]. Therefore, adapting to technological changes is no longer an option, but a strategic necessity for companies that want to succeed in today's dynamic environment.

One of the applications of technology to support corporate strategy is through ideal generation arrangements [3]. Aggregate arrangements, or total planning, can be used as a strategy in strategic planning. This planning includes long-term strategic planning and short-term operational planning [4]. This operational

planning includes capacity, inventory, and workforce arrangements. Manufacturing companies generally use these strategies more because they have better control to organize strategies from the raw material procurement process to finished products ready to be marketed [2].

Production planning is a process that aims to produce goods according to the requirements agreed between the producer and buyer companies [5]. This planning is part of general generation management, which involves cooperation between top management and production divisions, and is arranged based on market demand and the availability of company resources. Generation planning in a company is divided into three levels based on its time period, namely long term, medium term, and short term [6]. Aggregate planning aims to optimize available resources, such as raw materials, labor, and machines, so that a balance is achieved between demand and production capacity. In other words, aggregate planning helps companies respond to changes in market demand efficiently and effectively, reduce production costs, and maximize profits [7].

In the context of business process management, aggregate planning plays an important role in integrating various business functions, such as marketing, production, and finance, to achieve overall corporate goals [8]. Although the benefits of aggregate planning have been widely recognized, its implementation in practice often faces various challenges. One of the main challenges is the uncertainty of market demand, which can cause fluctuations in production volume [9]. Despite its significant benefits, the implementation of aggregate planning still often encounters obstacles due to this uncertainty, which makes production volume management more difficult.

In the context of business expansion, coordination between various divisions within the company, such as marketing, production, and finance, is often a challenge in implementing aggregate planning [10]. Therefore, it is very important for companies to develop systems and processes that support integration and collaboration between departments. This will enable the company to achieve holistic and comprehensive planning, so that all functions can be aligned in realizing strategic goals as a whole [11]. In business expansion, coordination between various divisions within the company, such as marketing, production, and finance, is often a challenge in implementing aggregate planning [9]. Therefore, it is very important for companies to develop systems and processes that support integration and collaboration between departments. This will enable the company to achieve holistic and comprehensive planning, so that all functions can be aligned in realizing strategic goals as a whole [12].

Several important terms used in this study are presented to complement the understanding of the existing journal synthesis process. Some terms from several literatures are as follows. The main job in material flow is to plan and manage production so that production is completed within the specified time so that the production process can meet market demand and production capacity [13], [14]. Aggregate planning is an effort to create a production plan so that an organization can effectively utilize its resources to meet consumer or customer demand [14]. Level Strategy is an overall plan where the production level remains constant from period to period throughout the planning period [15]. Chase Strategy is a strategy that seeks to achieve a production level in any period to meet the estimated demand during the period [13]. Mixed Strategy is a production plan that combines demand-following strategies and average strategies, taking into account overtime costs and adjusting production volume to the average quarterly demand [14]. Supply Chain Management is the management and supervision of the cycle chain that includes raw materials or goods, payments, and information from suppliers to producers, wholesalers, retailers, to consumers [16].

The main problem in this study is the application of which aggregate planning method is appropriate to be applied to a particular type of industry. So in this study, several aggregate planning methods will be observed that are appropriate to be implemented in a particular type of industry. This study aims to explore the implementation of aggregate planning in the context of business process management in the manufacturing industry. The focus of the study is on the impact of technological advances on the efficiency and effectiveness of production planning [8]. Through the analysis of various methods and approaches in aggregate planning, this study will identify best practices and challenges faced in its implementation. This study was compiled using the Systematic Literature Review (SLR) method which is used to systematically identify, evaluate, and synthesize various studies relevant to the topic of the role of the aggregation method. This SLR (Systematic Literature Review) method was chosen because it is able to collect evidence from various previous studies. This method helps ensure that research findings cover various perspectives, identify best practices, and understand the challenges faced, thus producing significant contributions to the existing literature. The limitation of the research in this article is the implementation of the aggregation method in manufacturing companies in Indonesia.

II. METHOD

The method used in this literature review research is Systematic Literature Review (SLR). The first stage in SLR is to search for journals in online databases. The journals searched are journals on the application of aggregation methods in manufacturing companies in Indonesia. Places to search for previous research journals,

the databases used are Google Scholar (https://scholar.google.com/) and (Garuda) Indonesia's Digital Reference Guard (https://garuda.kemdikbud.go.id/).

The second stage is to identify the database. Searching online databases is done using relevant keywords to ensure that the results obtained are in accordance with the research topic [17]. The journals found are then filtered based on predetermined inclusion and exclusion criteria, such as year of publication, type of research, and relevance to the focus of the study. This systematic approach is expected to collect comprehensive and quality information to analyze how the application of moderation methods in manufacturing companies for efficient use of information technology.

The literature search stage is carried out by searching based on keywords in the journal title column, abstract and year of publication of the journal. The keywords used in the literature search in the online database are as follows.

a. In Google Sholar database online, the search process uses the keywords “perencanaan produksi”, “metode agregat”, “perusahaan manufaktur” and “SCM”.
b. In the Garuda database, the search process uses the keywords "perencanaan produksi", "metode agregat", "perusahaan manufaktur" and "SCM" by activating the year and abstract filters.

Next, after searching the online database by entering the keywords explained above. A selection of literature is carried out that is in accordance with the various stages of the process. The results of the search using the keywords above can be seen in table 1 below.

TABLE 1
SEARCH RESULTS ON ONLINE DATABASE

No	Criteria	Online Database	
		Google Scholar	Garuda
1	According to The Keywords Entered	93.900	72
2	Publication Year Between 2019 - 2024	18.700	33
3	Keywords According to The Abstract	137	9
4	Abstract in Accordance With The Research Problem Formulation	63	3
5	Journal used	8	2

The next process is to assess the quality of the review journal and select several journals that will be used as references. The next process is to assess the quality of the review journal and select several journals to be used as references. This process is called journal synthesis. The journal synthesis process consists of several stages. The stages in this journal synthesis can be seen in Figure 1 below.

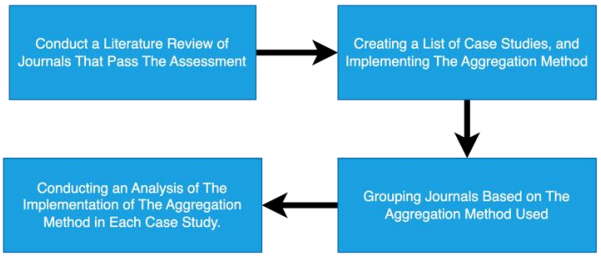

Figure 1. Journal Synthesis Stages

Based on the results of the journal synthesis stage, 66 journals were found that met the criteria. Not all journals were analyzed and grouped, but only 10 journals. The journals came from 8 Google Scholar and 2 from Garuda. Furthermore, the journals were analyzed, grouped and described the results of the aggregation method used.

III. RESULTS AND DISCUSSION

Based on the results of the analysis and synthesis of journals that meet the criteria, this study uses 10 journals as a literature review. The journals use case studies with various implementations of the aggregation method in production process planning in industry. Several companies or industries have implemented this aggregation method. Based on 10 journals that passed the selection, this study obtained data on the strategies used for production process planning as in table 2 below.

TABLE 2
JOURNAL ANALYSIS RESULTS

No	Journal Title	Journal Year	Agregate Metode	Objective	Findings
1	Aggregate Production	2024	Chase Strategy	This study aims to determine the	Data analysis techniques are carried out by forecasting

No	Journal Title	Journal Year	Agregate Metode	Objective	Findings
	Planning Analysis at CV. Pelangi Rex's in Denpasar [18]			aggregate production planning strategy that has the lowest cost at CV. Pelangi Rex's.	demand using the Moving Average and Exponential Smoothing Methods, and the aggregate planning methods used are Chase Strategy, Level Strategy, and Mixed Strategy. The aggregate production planning strategy that has the lowest total cost for Croissants and White Bread is Chase Strategy.
2	Production Planning Using Fuzzy Time Series Average Algorithm Method - Based, Aggregate Planning Strategy and Transportation Method [19]	2023	Chase Strategy	This research can aim to provide solutions for companies in maximizing profits and minimizing losses by knowing the level of future demand and minimizing prediction errors.	The forecasting results obtained using the Fuzzy Time Series Averge - Based Algorithm method produce a Mean Absolute Percentage Error (MAPE) value of 10.6% and state that the results are classified as Good. The Chase strategy aggregate planning strategy is the best method that can be used to meet production demand by minimizing production costs.
3	Semedang Tofu Production Planning at UMKM X [20]	2024	Chase Trategy	This research aims to provide alternative solutions related to production planning and propose appropriate production costs for each production.	Based on the results and discussions, it can be concluded in this study that the alternative aggregate planning solution is with a chase strategy. This is because the chase strategy has no storage so that the cost can be cheaper.
4	Application of Aggregate Planning to Minimize Production Costs (Study on CV. X) [21]	2019	Chase Strategy	This study aims to apply aggregate planning to CV. X with the main focus on efforts to minimize production costs. This study explores various aggregate planning strategies that can be used to achieve operational efficiency and cost savings.	This study concludes that by choosing the right aggregate planning strategy with a chase strategy, CV. X can achieve significant cost savings and improve overall operational efficiency.
5	Aggregate Production Planning CV XYZ with a Fixed Number of Workers [22]	2020	Chase Strategy	This study aims to develop aggregate production planning at CV XYZ while maintaining a fixed number of workers.	Based on a comparison of production planning strategies, the chase strategy is a strategy that can be used as a reference for production planning for the next 12 months, because the production costs generated are

No	Journal Title	Journal Year	Agregate Metode	Objective	Findings
					the lowest among other strategies.
6	Aggregate Planning Analysis to Minimize Production Costs on Bajigur Packaging Products at CV. Cihanjuang Inti Teknik (Cintek) [23]	2019	Level Strategy	This study aims to calculate and compare production costs using the aggregate planning method with the aim of minimizing production costs at CV. Cihanjuang Inti Teknik (CINTEK).	The results of the study show that of the three methods used, the Level Workforce Strategy method produces the lowest total production cost, which is Rp. 2,712,004,710.
7	Analysis of Aggregate Planning Method for Minimizing Costs at UMKM Makmur Jaya - Jakarta [24]	2022	Level Strategy	This study aims to analyze the aggregate planning method that can be used to minimize production costs at Makmur Jaya MSMEs in Jakarta.	The results of the study indicate that the Seasonal Additive forecasting method with the smallest Mean Absolute Percentage Error (MAPE) value of 0.2057 is the best for demand forecasting. Of the three aggregate planning methods tested, the Level Strategy method produces the lowest total production cost, which is Rp. 80,916,600.00.
8	Application of Aggregate Planning Forecasting for Freezer Production at PT Dies [25]	2021	Mixed Strategy	This study aims to apply forecasting and aggregate planning methods to minimize production costs on freezer products at PT. DIES	After applying various aggregate planning methods, it was found that the Mixed Strategy method between overtime control and inventory control resulted in the lowest total production cost, which was Rp. 1,010,130,720.
9	Aggregate Planning Analysis Using Chase Strategy Method, Workforce Level and Mix Strategy to Minimize Jersey Product Production Costs (Case Study on CV. Ceksport) [26]	2019	Chase Strategy	This study aims to analyze and compare three aggregate planning methods Chase Strategy, Level Workforce, and Mixed Strategy - to minimize the production cost of jersey products at CV. Ceksport.	The results of the study showed that of the three methods tested, the Mixed Strategy method produced the lowest total production cost. This method combines the use of subcontractors and overtime when demand is high, which has proven to be more efficient in reducing production costs compared to the Chase Strategy and Level Workforce methods.
10	Evaluating the performanc e of aggregate production planning strategies under uncertainty in soft drink industry [4]	2019	Level Strategy	This study aims to compare two aggregate production planning strategies, namely Level Strategy and Chase Strategy.	Level Strategy tends to be more stable and reduces labor fluctuations, but can result in higher inventory costs. In contrast, Chase Strategy is more flexible in adjusting production to demand, but can increase labor costs and reduce employee morale due to frequent fluctuati

From the 10 journals analyzed, it was revealed that methods such as Chase Strategy, Level Strategy, and Mixed Strategy are used with various implementations in different industries. Each method has advantages and disadvantages that depend on the context and specific needs of the company. Of the 10 journals analyzed, it was found that 6 journals used Chase Strategy. There were 3 journals that discussed Level Strategy. Finally, out of 10 journals, 1 journal was found that discussed Mixed Strategy. The mapping of journal findings based on the method used can be seen in Figure 2 below.

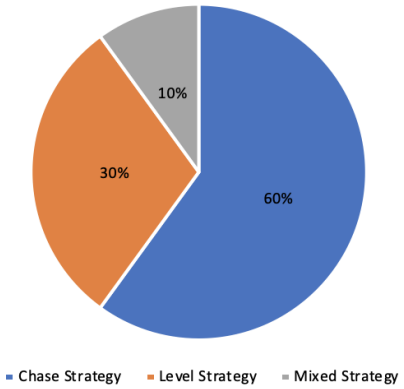

Figure 2. Mapping of Journal Finding

From the results of the analysis, it was found that the most widely used Aggregate Planning method in Indonesia is Chase Strategy. Furthermore, it was also analyzed how the method is implemented in the type of industry that is the case study. For example, Chase Strategy is often chosen because of its flexibility in adjusting production to demand, although it can cause high labor fluctuations. Conversely, Level Workforce Strategy is more stable and reduces labor fluctuations, but can cause higher inventory costs. Mixed Strategy combines elements of several approaches to achieve a balance between cost and efficiency, but its implementation requires more complex management.

Based on the analysis of ten journals reviewed, it can be concluded that the Chase Strategy method is the most widely used, with a total of seven journals employing this approach. The prevalence of this method is closely related to the fact that most of the case studies focus on the MSME sector. Chase Strategy is considered more flexible in adjusting production volumes according to demand, making it highly suitable for MSMEs, which generally operate on a small to medium scale. In this context, production planning becomes a crucial aspect at the MSME business unit level, and Chase Strategy has proven to be the most appropriate choice. On the other hand, the Mixed Strategy method is less favored by MSMEs. This is due to the management complexity required to implement the method, which often poses significant challenges for MSMEs with limited resources and management structures. Conversely, this method is more suitable for companies with large-scale production and more complex management systems.

The journal analysis process also revealed variations in the implementation of information technology as a business process support tool across the publications. Some studies emphasize the importance of integrating information technology to enhance the efficiency and effectiveness of aggregate planning. However, challenges in inter-departmental coordination often become a major obstacle to implementation. To address these challenges, the implementation of centralized information technology is needed to align the needs of various departments within a company. This step is expected to create greater efficiency and effectiveness in overall business processes. Based on the findings above, it is necessary for an organization to implement an ERP application in order to be able to organize and supervise all activities in a company, starting from production planning, management to product sales.

IV. CONCLUSION

Based on the analysis of ten reviewed journals, it is known that aggregate planning strategies such as Chase Strategy, Level Strategy, and Mixed Strategy have their own advantages and disadvantages that can be adjusted to the needs and contexts of different industries. In the context of MSMEs, Chase Strategy is more appropriate because of its flexibility in adjusting production to fluctuating demand. In addition, information technology integration has proven to be important for improving aggregate planning efficiency, although the challenge of inter-departmental coordination is a major obstacle. Therefore, it is necessary to implement centralized information technology, such as ERP applications, which are able to integrate the needs of each department to improve the efficiency and effectiveness of the overall business process. The development of ERP applications itself is part of the field of Information Technology.

For further research, it is recommended to conduct a more in-depth comparative analysis of the implementation of aggregate planning strategies in various types of industries, including a comparison between MSMEs and large companies. In addition, it can also be done by increasing the number of journals analyzed, for example with 20 journals to better describe the findings. Research can also explore the application of cloud-based information technology to support more integrated and adaptive aggregate planning to changes in market demand. Studies on the development of a more effective inter-departmental coordination management model in the implementation of information technology can also make an important contribution to improving the efficiency of Aggregate Planning.

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