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Modelling The Influence Of Production Planning And Production Scheduling On Business Performance In The Manufacturing Industry Of South Africa

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Abstract

It is apparent that for manufacturing companies to succeed, it is crucial to consider the factors that will contribute positively to the performance of the business. The issues related to production planning and production scheduling on business performance have been neglected. Production planning and production scheduling be adopted as factors manufacturing companies could consider improving their business performance. There has been little research done to prove that production planning and production scheduling can lead to improving the overall business performance of the manufacturing industry. Therefore, this study seeks to fill this lacuna by investigating the influence of production planning and production scheduling on business performance in manufacturing industries. A quantitative approach was adopted for this study, and a questionnaire was distributed physically and electronically. Three hundred and six (306) respondents participated in the study. Data obtained were analysed using SPSS 28.0 and AMOS 28.0. The results of the study proved that production planning and production scheduling have a positive impact on business performance. Production planning and scheduling have proved to deliver a competitive advantage and improved customer satisfaction in the manufacturing industry.

Keywords

Production planning; Production scheduling; Business performance; Manufacturing industry

1. Introduction

The issues related to production planning have been neglected. Production planning is equally important as it is the core function in the manufacturing environment. Production scheduling and first to market can be adopted as factors manufacturing companies could consider to improve their business performance [1]. Arguably, although little research has been done to prove that production scheduling, and first to market influence the performance of a business, little has been done to demonstrate that production planning, scheduling and first to market can be adopted by a manufacturing company as strategic risk management techniques to oversee operations and the advantages that come with it. There has been little research done to prove the benefits of production planning, production scheduling and first to market for the organisation, as well as how to improve the overall business performance. Therefore, this study seeks to fill this lacuna by investigating the influence of production planning, production scheduling and first to market on business performance in manufacturing industries. It has been observed that problems with some manufacturing industries in the country seem to be a lack of skills set to carry out activities such as production planning. There seems to be a lack of understanding of what production planning is with

regards to how to use it to the advantage of the organisation and how to use this strategy to counter future production issues which may occur, such as late deliveries and poor-quality products.

Conceptual framework and hypotheses development

This model consists of two predictor variables which are production planning, production scheduling and business performance as the outcome variable.

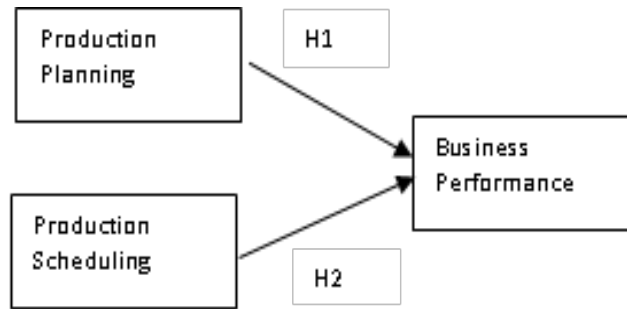


Figure 1: Conceptual framework

H1: Production planning positively influences business performance within the manufacturing industry.

H2: There is a positive relationship between production scheduling and business performance.

2. Literature review

The theory applies to this study, and the explanation of constructs is done under the literature review.

2.1 Production theory

Production theory was introduced by [2]. Production theory is the study of production or the economic process of converting inputs into outputs. The progressive refinement during the years in the measurement of the volume of physical production in manufacturing companies suggests the possibility of the following: firstly, to measure the changes in the amount of labour and capital, which have been used to turn out this volume of goods and secondly, to determine what relationships exist between the three factors of labour, capital and product. It is important to understand that the production theory is at the heart of business operations and discussions regarding economic organisations in manufacturing processes [3]. In 1928, Cob and Douglas developed a neoclassic production function which they referred to as the C-D production. The function was tested empirically by various authors and showed positive results [3]. [4] and [5] argued that, based on the research they had done, the relationship between production planning and business performance is either positive or negative. Production uses resources to create a product or service that is suitable for use, gift-giving in a gift economy or exchange in a market economy [6]. This can include manufacturing, construction, storing, shipping and packaging. The theory of production acts as an economic method used by manufacturing organisations to determine how much of the products should be produced as well as how much of each of the raw materials will be acquired to meet the production requirements.

2.2 Production planning

Production planning correlates with complexities in production. It has subsets that consist of process planning and machinery capacity, delivery lead time and layout [7]. Production planning is a process that

links together the performance of functions, such as job size, machine load and requested delivery as one process [8]. The main concerns of production planning are to produce defect free products and to satisfy customers by delivering jobs on time. The production planning process uses a material requisition plan, along with job size, safety stock and planned lead time [9]. The principles of productive relations that correlate between production factors and products or goods can positively assist with the vital task of production planning if these factors are cleared up from the grounds of production considerations. The main objective of production planning is to draw the gross requirement of the manufacturing facility and transform this into production orders and material purchases through the use of methods such as Economic Order Quantity (EOQ) and Material Requirement Plan (MRP). These methods can determine the expected lead time [10]. The process of production planning identifies activities that need to be performed for the manufacturing plant to efficiently execute the production plan, namely identifying the production programme, selecting the production procedure and identifying the potential productivity of the manufacturing plant, as well as understanding process planning [11].

A manufacturing plant usually produces a variety of products to satisfy a certain demand, depending on the target market. This encourages organisations to determine which product to produce by putting together the production factors at hand. The organisation must decide on the product type as well as the required quantities to make good profits for the established planning period [3]. Poor production planning consequently results in poor business performance within the manufacturing industry [12]. Firm and production strategies must conform to one another and reflect the performance and environment of the firm [13]. Theoretically, manufacturing firms are expected to adopt best practices directly related to production planning. These often include production planning and production scheduling in the environment of demand uncertainty.

2.3 Production scheduling

Production scheduling looks at aligning the allocated job sequence problems, job production size, machine capacity and order size requested. It pertains to establishing the timing of the use of specific resources in a firm [14]. The main difference between production planning and production scheduling is that planning takes the material requisition plan, customer orders and material production into consideration to draw up a production plan that will ensure customers' orders will be ready on time. Production scheduling focuses on implementing the production plan and converting work orders once they have an execution tie period allocated to them [15]. This relates to the overall production scheduling plan for the production process within some given period to give an idea to management as to what quantity of materials and other resources are to be procured and when, so that the total cost of operations of the organisation is kept to the minimum over the period [16]. Scheduling is an important aspect of operations control in both manufacturing and service firms with increased emphasis on output levels and lead time in meeting demand and in satisfying the customer [17]. Production scheduling has been found to influence business performance in manufacturing firms [18]. Production scheduling focuses on executing the production plan and converting work orders once they have an execution tie period allocated to them. Its function is to boost production planning and control for improved performance [19]. Scheduling can be identified as the process of allocating jobs to various machinery while adhering to specific time frames and ensuring control over the movement of products and material components throughout the manufacturing plant. Labour must be coordinated as well at all assembly points for production to take place.

Production scheduling looks at aligning the allocated job sequence problems, job production size, machine capacity and order size requested. It also pertains to establishing the timing of the use of specific resources in a firm [20]. This relates to the overall production scheduling plan for the production process within some given period to give an idea to management as to what quantity of materials and other resources are to be procured and when, so that the total cost of operations of the organisation is kept to the minimum

over the period [21]. Scheduling is an important aspect of operations control in both manufacturing and service firms with increased emphasis on output levels, lead time in meeting demand and satisfying the customer [22]. Production scheduling has been found to positively influence business performance in manufacturing firms, which, in turn, means production scheduling is a dimension of production planning and an antecedent of business performance.

2.4 The notion of business performance

If businesses can consistently provide their customers with the desired quality and quantity of the products demanded at an acceptable price, this may assist them in gaining a competitive advantage over their competitors [23]. For a business to be successful over a long period, the business must have an internal foundation and management over its operations for inbound and outbound movement to run smoothly [24]. One of the manager's toughest and most important responsibilities is to evaluate the performance of their business, and this is done through performance appraisal [25]. The selection of a suitable strategy cannot bring the desired results by itself [13]. In particular, the enhancement of the manufactured product quality, a direct response to market demands, the minimal delay on the firm's behalf and, of course, the minimal production cost, have been emphasised [13]. Businesses that want to grow have to adapt to the rapidly changing environment through continuous innovation to develop new products to reach new customers [23]. Customer perceived value is a function of quality and price. It enhances repurchase intention and discourages switching behaviour. Some customers equate value with price, and this is usually the case when goods are perceived to have uniform or homogenous levels of output, the cheapest goods are seen as the most valuable [26]. The role played by the perceived value on business performance directly results in an assessment of whether a seller's price can be reasonably justified and a price paid higher than other customers is likely to be perceived as less fair [27], [28]. Thus, customer perceived value is a dimension of business performance.

It is important to fully understand the competencies of each unit and their strengths, weaknesses, expectations and values to build productive and positive relationships amongst organisations, making relationship building an antecedent of business performance [14]. Collaboration takes place when people from different units work together in cross unit teams on a common task to provide significant help to each other for a better output. This factor also serves as an antecedent of business performance. Collaboration within business units leads to better innovation which happens because people from different areas, business units, divisions, technology centres and sales offices come together to create new ideas through these interactions and go on to develop exciting products.

If businesses can consistently provide their customers with the desired quality and quantity of the products demanded at an acceptable price, this may assist the business in gaining competitive advantage over their competitors [23], [29], [30]. [12] state that one of a manager's toughest and most important responsibilities is to evaluate the performance of their business, and this is done through performance appraisal. The selection of a suitable strategy cannot bring the desired results by itself [31]. Firm and production strategies must conform to one another and reflect the performance and environment of the firm. In the past few years, a vast number of approaches-theories have been developed regarding the improvement of the firm's operational performance. In particular, the enhancement of the manufactured product quality, a direct response to market demands, minimal delay on the firm's behalf and, of course, minimal production cost has been emphasised [32].

3. Methodology

Convenience sampling was used as a sampling technique in this study. Reliability and validity of a measurement is the degree to which the measurement instrument employed has no error, and the approach to assessing reliability includes using Cronbach’s alpha coefficient and alternative forms.

Table 1: Accuracy analysis statistics

Research Constructs		Descriptive Statistics		Cronbach's Test		CR	AVE	Factor Loading
		Mean	SD	Item-total	α Value			
Production Planning	PP1	4.662	0.636	0.479	0.767	0.881	0.650	0.761
	PP2			0.702				0.919
	PP3			0.607				0.796
	PP4			0.520				0.738
Production Scheduling	PS1	4.570	0.593	0.459	0.704	0.803	0.513	0.519
	PS2			0.494				0.661
	PS3			0.446				0.770
	PS4			0.570				0.866
Business Performance	BM1	4.492	0.654	0.608	0.846	0.887	0.663	0.802
	BM2			0.757				0.873
	BM3			0.731				0.875
	BM4			0.677				0.824

Significant Level <0.05 *; significant level <0.01 ***; significant level <0.001 **, BP= Business Performance; PP = Production Planning; PS = Production Scheduling

Cronbach’s alpha was used in this study to measure the reliability of all constructs; the reliability of the constructs is determined by a higher level of Cronbach’s coefficient alpha. Reliability of a construct must be above 0.7 to enhance the internal consistency of the construct. Based on table 1, PP, PS, and BM Cronbach alpha are above the threshold of 0.7 and therefore reliable. The item to the total value observed from table 1 ranges from 0.479 to 0.757 specifically between PP, PS, and BM, which showed valid results and are above the required cut off point of 0.3. A composite reliability index value that is higher than 0.7 proves the adequacy of the internal consistency of the research construct. An analysis of data from table 1 illustrates that all research constructs are above 0.7, which affirms the existence of internal validity of all constructs measured is reliable. The average value extracted (AVE) should be greater than 0.5. Based on data in table 1, all average values extracted range between 0.5 and 0.6 adhere to the required acceptability value, thus all constructs met the required degree of acceptability.

3.1 Discriminant validity

This refers to the extent to which scores from a measure are distinct and do not correlate to other measures. Discriminate validity was measured in this study by observing the correlation matrix as well as the average variance extracted result.

Table 2: Correlation matrix

Research Variable	BP	PP	PS
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	BP	1.000		
	PP	.681***	1.000	
	PS	.429***	.675***	1.000

Significant Level <0.05 *; significant level <0.01 ***; significant level <0.001

**, BP= Business Performance; PP = Production Planning; PS = Production Scheduling

As indicated in table 2, there is a positive correlation across all constructs, and they are all below the required level l of 1.0, which proves there is discriminant validity in the measurement scale.

3.2 Hypothesis testing results

Once the reliability and validity of the research constructs and measurement instruments have been proved and confirmed, the researchers tested the hypothesis of the study. Smart PLS software was used to test and verify the relation of the hypothesis.

Table 3: Results of hypothesis testing

Path Coefficients	Hypothesis	Path Coefficient	P value	T-Statistics	Decision
Production Planning -> Business Performance	H1	0.628	***	8.006	Significant and supported
Production Scheduling -> Business Performance	H2	0.989	***	19.910	Significant and supported

Significant Level <0.05 *; significant level <0.01 ***; significant level <0.001 **, BP= Business Performance; PP = Production Planning; PS = Production Scheduling

Table 3 above focuses on the P value and T-statistics. T-statistics should be above 1.96, and all the above values are above the recommended threshold, which shows a strong and significant relationship between the variables.

4. Discussion of results

The results acquired from testing hypothesis one confirms the correlation between production planning and business performance. The hypothesis proves that there is a significant relationship between production planning and business performance, and the relationship is supported. The results obtained from this study are supported by [6], [9], [34] who regards production planning as a strategic function in the manufacturing process and that it is closely related to business performance. [10] and [35] affirm that production scheduling cannot be successfully executed without the function of production planning. Based on the results obtained, it can be concluded that when organisations align planning and scheduling strategically, it becomes highly likely that they can effectively execute lean manufacturing and boost production.

The results of this study prove that the relationship between production scheduling and business performance is significant and supported (H2). The $p < 0.001$ and the path coefficient is $\beta = 0.989$. Furthermore, the t-statistic value is observed at 19.910. This illustrates that production scheduling in the manufacturing organisation influences business performance in a very significant way than production planning. The literature has supported the significance of the scheduling function on business performance. This is supported by [29] and [36] who state that production scheduling is a vital function in manufacturing as this heightens control in the factory, ensures continuous flow and prevents bottlenecks, thus improving overall business performance. It can be concluded that production scheduling is critical to the success and overall performance of the business. This function plays an important role in gaining business market share and potentially being the market leader. This function requires more focus from manufacturing companies to reap the full rewards.

5. Limitations and implications for future research

The electronically sent questionnaires had very few respondents and so many errors when returned. The sample size was only limited to Gauteng thus results could be more meaningful and robust if more provinces were included or rather do a comparison of two provinces to get different results. Also, the researchers could have received more participants if this study was across more than one province. The results and findings in this study proved to be very insightful into the organisations in the manufacturing industry, specifically general managers, and production/operations practitioners. This study used a quantitative method for data collection thus future researchers can consider using a mixed method approach. This can allow the researcher(s) to get further constructive details from the respondents. This study drew three hypotheses' statements though there was potential to use more, thus, future studies can expand the field of research by looking into other contributing variables.

6. Conclusion

This study has presented vital information relating to best operational practices that should be implemented in manufacturing industries. It has proved that variables such as production planning, production scheduling and first to market can positively improve the performance of manufacturing industries. This study has also briefly highlighted other factors, which can be considered by management to drive efficiencies throughout the production plan. The findings confirm that production planning can be used as a risk avoidance technique by ensuring production is carried out efficiently by minimising waste and costs related to production job changeovers. This study can contribute to increasing literature on lean manufacturing and production excellence. These recommendations are of value to production planners, production managers, general managers, and supply chain practitioners in the manufacturing space. This study also enlightens managers in this industry in identifying areas for improvement in their production process, scheduling process and first to market techniques and applying beneficial strategies for production improvement.

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Biography

Professor Elizabeth Chinomona is a 50-year-old black female senior lecturer at Vaal University of Technology in South Africa. She has been an assistant and part time lecturer in Zimbabwe and Taiwan. She has successfully supervised and graduated more than 5000 Bachelor of Technology (Honours) students, 20 Masters students, and 8 PhD students. To date, she has published more than 100 papers in peer-reviewed accredited journals. She sits on numerous Academic Journals Editorial Boards.

Mamonare Minky Kgaogelo Mogano is a 29-year-old black female who has soared to exceptional heights in the logistics and supply chain industry. With her fervent passion for supply chain, she has achieved significant milestones in her academic and professional journey. She earned her Master's degree in Supply Chain Management from the Vaal University of Technology in 2022, this has been a testament to her dedication.