An Empirical Study on Supply Chain Management Dilemmas and Countermeasures of Intelligent Manufacturing Enterprises in the Post-plague Era ---- Taking Dongguan BG Technology Co. as an Example

Fei Lei[1, a], Wenhao Luo[2, b], Yangyang Yan[1, *], Chun Feng[3, c], Lei Chen[4], Shixing Lei[4, d], Baihe Lei[4, d], Decai lv[4, d]

[1]School of Finance and Economics, Guangdong University of Science and Technology, Dongguan, China

[2]Guangdong University of Science and Technology Dongguan, China

[3]School of Economics and Trade, Guangzhou Xinhua University, Guangzhou, China

[4]Management Consulting Division, Dongguan Jiuxing Enterprise Management Consulting Co., Dongguan, China

[a]2745776452@qq.com, [b]1209370434@qq.com

*Corresponding author: 1782869374@qq.com

[c]2747567916qq.com, [d]2068899136@qq.com

Abstract. In the post-epidemic era, rapid changes in the international situation have led to a more competitive market, and the supply chain management of intelligent manufacturing enterprises has been severely challenged by a sharp decline in orders, lack of supply of materials and other supplies, rising prices, risk preparation, difficulty in meeting customer delivery schedules, and increasingly low profits in many industries. This paper argues and analyzes the BG supply chain management of intelligent manufacturing enterprises in Dongguan, the dilemma and its causes in 2020, proposes countermeasures to solve the problem, and validates the effect. It comes to the conclusion that under the background of epidemic normalization, smart manufacturing enterprises reconstructing supply chain management can quickly and effectively improve the core competitiveness of enterprises, which is expected to provide valuable reference for smart manufacturing enterprises to reconstruct supply chain management efficiently.

Keywords: supply chain management; core competitiveness, reconfiguration

1 Introduction

In the post-global integration and new crown epidemic ravaging the economy, geopolitical influence, market demand changes fluctuate greatly, intelligent manufacturing enterprises are also facing unprecedented challenges. Effective supply chain management can greatly reduce the operating costs associated with the supply chain, thus helping enterprises to increase profits and gain a competitive advantage, supply chain

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management has become a strong support for the core competition of modern enterprises.

This paper empirically researches and explores this, taking the supply chain management of Dongguan intelligent manufacturing BG company as an example, and explores how to reconstruct the supply chain management model of intelligent manufacturing, looking for an appropriate reconstructing scheme, combining the needs of customers and the development of enterprises, adopting or developing a management system that meets the functional requirements of enterprise supply chain management, highly integrating logistics, information flow and capital flow, but also be expected to have some reference in the intelligent manufacturing industry.

2 Literature Review

Supply chain management refers to the various activities and processes of planning, coordinating, operating, controlling and optimizing the entire supply chain system, with the goal of delivering the right products needed by customers.

As more and more smart manufacturing companies around the world are implementing changes to reconfigure their supply chains, academics are also conducting research on the topic of supply chain management. According to Shun-tang Zhang and Peng Hu (2020), using industrial engineering improvement ideas and combining ERP, TOC planning and control theory and other related knowledge, they analyzed and improved the production planning and scheduling system process of the studied company in response to the delayed delivery. [1] Wang Lei (2020) points out that as enterprises continue to develop and receive more and more product orders, improving the overall production speed and promoting the concept of lean production has become an inevitable trend for the development of enterprises. [2]. Qian Yin (2019) pointed out that how to build a material requirement planning system with good performance to meet the various needs of enterprises in the production process is a hot topic of enterprise research nowadays.[3] .Tannady Hendy; Renwarin Joseph M J; Cora Andi Nurhikmah Daeng; Purwanto Edi (2021) argued that: the calculation method of economic order quantity (EOQ) for determining the number of orders of a company with a predetermined frequency and the appropriate time when the company will make reorders. [4] Braulio Brunaud; José MLaínez-Aguirre; Jose M. Pinto; Ignacio E. Grossmann (2019) proposed an extension to the traditional supply chain planning model to optimize the inventory strategy at the same time. [5] Dey Bikash Koli; Bhuniya Shaktipada; Sarkar Biswajit (2021) proposed that: The study focuses on variable lead time and variance under controlled productivity and ad-dependent demand and explores and quantifies the benefits of such reduced lead time on common lot sizes. [6]

Most of the above studies by foreign scholars are based on qualitative research on supply chain management of general enterprises. In this paper, we empirically and quantitatively analyze the dilemma and countermeasures of smart manufacturing enterprise BG, in the context of epidemic normalization from three dimensions, and quantitatively verify the effectiveness of countermeasures.

3 Problems of supply chain management in BG Company

Problems of supply chain management in BG company

Founded in 2014, Dongguan BG is a technology company engaged in the intelligent production of medical device components in Dongguan, China. In this paper, the supply chain SCOR model is used to evaluate the supply chain performance in comparison with benchmark companies, identify the targets that need to be optimized and diagnose the following problems.

3.1 The problem of low production delivery rate

According to the sales orders and forecasts at the end of each month on the 25th, combined with the engineering and technical department to assess the production schedule of the time planner, the average production delivery rate of 60.27% in 2020 is shown in Figure 1, which is low and below the company's target of 85%.

3.2 Low Inventory Turnover Problem

In 2020, the inventory turnover days did not reach the company's target value of 10 days per month, and the four months of January and October-December were higher than the company's "zero limit target" of 16 days, and the average of 19 days for the whole year is shown in Figure 2.

3.3 The problem of high ratio of stagnant materials

Material storage time over 90 days high rate of stagnant materials, January-October did not reach the company's target of 4%, January-June is lower than the company's "zero limit target" 8%, 2020 stagnant material ratio of 8.7% on average throughout the year, stagnant material processing progress

4 Analysis of the causes of the problems of supply chain management in BG company

4.1 Analysis of the causes of the problem of low delivery rate

The analysis of the reasons for not reaching the production delivery rate in 2020 is shown in Table 1, and the analysis of the data in Table 1 shows that the main reasons for not reaching the production delivery rate in 2020 are 14.57% of material shortage and 10.93% of capacity shortage.

Table 1. Analysis of reasons for non-achievement of production delivery Source: Company internal information

In 2020	Under-expected	Equip-ment failure	Insufficient capacity	Abnormal quality	Other	Non-achievement rate
Jan	9.76%	3.66%	7.32%	2.44%	1.22%	24.39%
Feb	10.50%	3.94%	7.88%	2.63%	1.31%	26.26%
Mar	16.06%	6.02%	12.04%	4.01%	2.01%	40.14%
May	15.13%	5.67%	11.35%	3.78%	1.89%	37.82%
Jun	14.19%	5.32%	10.64%	3.55%	1.77%	35.47%
Jul	15.13%	5.67%	11.35%	3.78%	1.89%	37.82%
Aug	14.19%	5.32%	10.64%	3.55%	1.77%	35.47%
Sept	15.71%	5.89%	11.78%	3.93%	1.96%	39.28%
Oct	14.56%	5.46%	10.92%	3.64%	1.82%	36.39%
Nov	19.41%	7.28%	14.56%	4.85%	2.43%	48.53%
Dec	14.57%	5.46%	0.93%	3.64%	1.82%	36.43%

4.2 Analysis of the causes of the problem of low inventory turnover

Through Table 2, Figure 1 can be analyzed, 2020 inventory work in process, raw materials accounted for the highest proportion, the two together accounted for about 70% of the total inventory, improve inventory turnover must reduce the amount of work in process, raw materials inventory.

Table 2. Distribution of inventories in 2020 Source: Company internal information inventory trend chart for 2020

In 2020	Raw ma-teri-als	Semi-finished products	Semi-finished products	In the produc-tion of pins	Inven-tory subto-tal	Sales fore-casting	Target turnaround days	Invento-ry turno-ver days
Jan	1071	578	511	1960	4120	5337	10	20
Feb	1037	642	502	2042	4223	7988	10	14
Mar	1342	429	486	1730	3987	7991	10	13
Apr	1398	462	453	1931	4244	6983	10	16
May	1307	503	396	2735	5941	11833	10	13
Jun	1285	927	471	3079	5763	13736	10	11
Jul	1636	648	1484	3360	7128	13027	10	14
Aug	3342	478	1561	3412	8792	14218	10	16
Sept	3771	706	971	4117	9566	15426	10	16
Oct	4626	412	1196	5019	11252	16880	10	17
Nov	5142	563	2659	4716	13080	13620	10	25
Dec	6485	1077	3144	3643	14348	7849	10	48

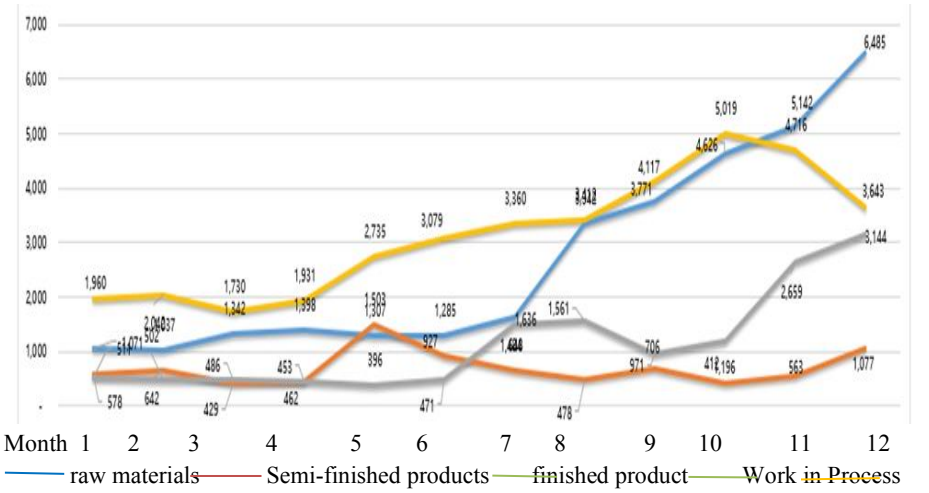

Fig. 1. 2020 Classified Inventory Trend Chart Source: Company Internal Information

4.3 Analysis of the causes of the problem of high ratio of doubtful materials

BG Company defines inventory aged over 90 days (including work-in-process) as dull goods, and the distribution of dull goods inventory in BG Company in 2020 is shown in Figure 2.

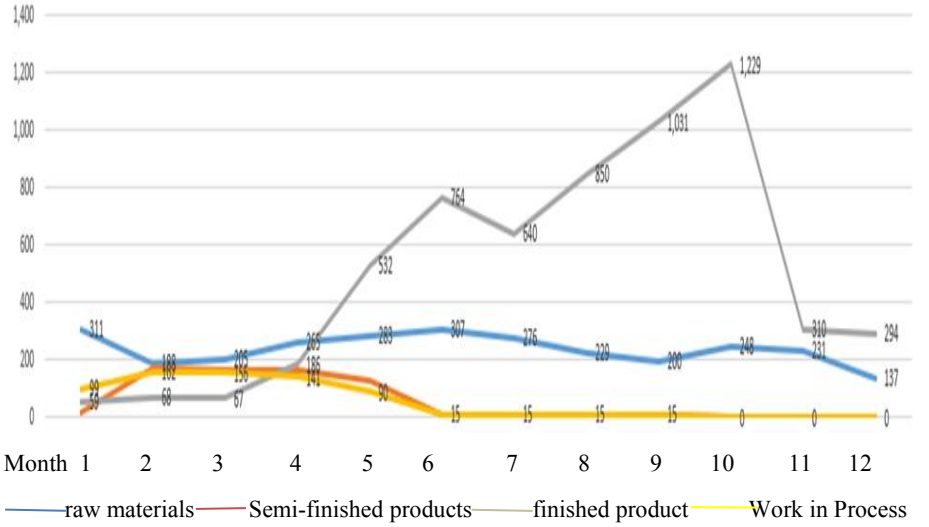

Fig. 2. Sluggish Inventory Trend 2020 Data Source: Company Internal Information

5 Countermeasures to solve the problems of supply chain management in BG Company

5.1 Improvement countermeasures for the problem of low inventory turnover

Through Table 3, PMC needs to update the material plan on the second working day of the order change to transmit the order change information, and purchasing arranges delivery according to the latest material list in the right time and in the right amount to avoid missing materials or excessive inventory.

Table 3. March WK1 over 30 days of work order follow-up information Source: company internal information

Written by the customer	Workshop										
	A1	A2	A3	A4	B2	C2	C3	C4	F3	F4	Total
									2		2
CA01						1		6		13	20
CB01										1	1
CC01								5		4	9
CD01	1			2	12	1	8		3	17	44
CE01	1									7	8
CF01									9	10	19
CG01						2				4	6
CH02										2	2
CE01			2	7	3	3					15
CR01		3									3
CT01			18						5	1	26
CV02			6								6
CW01	2						16				18
CH01	1				1						2
CX01									34		34
CJ01			2								2
Total	5	3	28	9	16	7	24	11	53	59	215

5.2 Solutions to the problem of low production delivery rate

The main reasons for not achieving the production delivery rate are the two problems of material shortage. The PMC department will refine the weekly material arrears into a daily schedule of material arrears so that purchasing can arrange materials to the

factory in the right time and in the right amount. Long-term strategy: BG plans to introduce SRM system, after SRM system is online, input plan will be uploaded to SRM system, the system will account for the outstanding materials, suppliers will maintain the delivery date, and the system will automatically extract the outstanding material warning and push it to the purchasing department. At the same time, we will standardize the capacity evaluation process, evaluate the lack of equipment according to the sales forecast in the next 3 months, and purchase equipment to supplement the capacity gap and avoid the lack of capacity.

5.3 Improvement countermeasures for the problem of low inventory turnover

After SRM is launched, purchasing sets the delivery date in SRM system according to the material plan, and the supplier can't receive the goods in SRM system for early delivery. Purchasing department will review the MOQ (Minimum Order Quantity) on a quarterly basis and negotiate with supply to reduce the MOQ of raw materials in order to reduce inventory due to MOQ problems.

6 Verification of the effectiveness of the solution

6.1 Improve production delivery rate

BG's current situation was analyzed, so that there are materials and capacity in the plan. The production delivery rate increased from 60.27% in 2020 to 81.47% in 2021, which is close to the company's target of 85%, as shown in Figure 3.

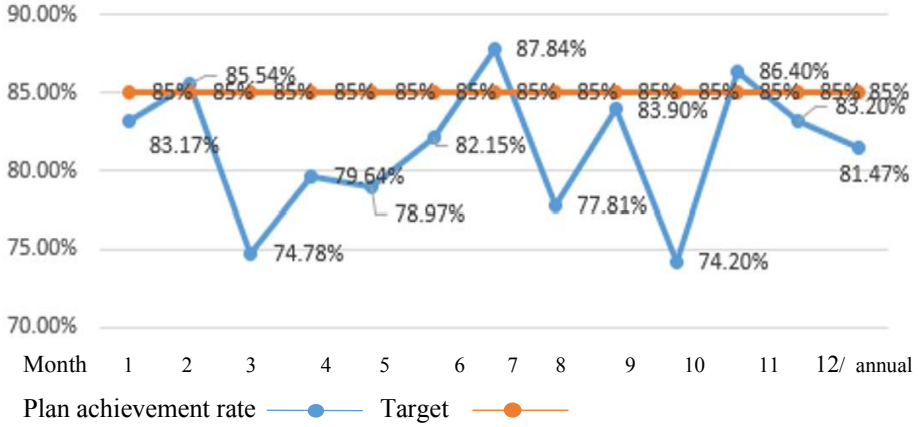

Fig. 3. 2021 production delivery reaching rate data Source: company internal information

6.2 Verification of the effect of improving inventory turnover rate

BG's inventory is now in a state of flux, and we are working on a weekly review of abnormal work-in-process and scheduled delivery of raw materials improvement plan

to reduce inventory stock and improve inventory turnover. The inventory turnover rate improved from 19 days in 2020 to 13 days in 2021, shortening the time by 1 week, as shown in Figure 6. The production delivery rate increased from 60.27% in 2020 to 81.47% in 2021, as shown in Figure 4.

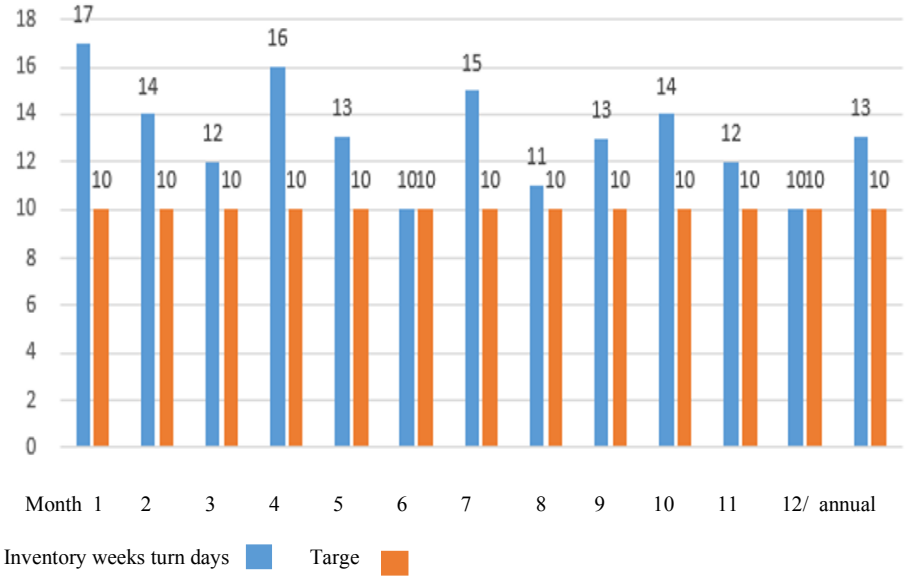

Fig. 4. 2021 Star material ratio ratio data Source: company internal information

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6.4 Verification of the effect of reducing the rate of stagnant materials

BG focused on the causes of stagnant inventory, and drew up improvement plans for finished goods and raw material stagnation, agreed with customers on payment terms for finished goods in stock and reviewed the progress of stagnant material disposal on a monthly basis to reduce the stagnant material ratio. The rate of material obsolescence was reduced from 8.7% in 2020 to 4.41% in 2021., as shown in Figure 5.

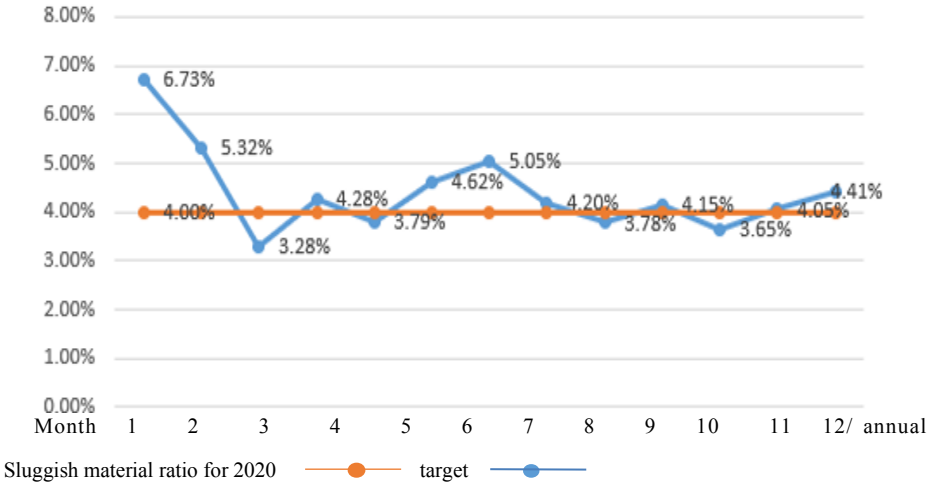

Fig. 5. The inventory turnover rate improved

7 Conclusion

With the new crown epidemic ravaging the world in 2020, smart manufacturing companies are facing unprecedented challenges with higher costs, lower and lower profits, high operational pressure, and fierce competition Only by establishing a suitable supply chain management control system can intelligent manufacturing enterprises improve their management level and reconstruct their core competitiveness. The supply chain of smart manufacturing enterprises is a complex system involving multidimensional elements, highly uncertain environment and cross-enterprise and even cross-border operations. Future research can be conducted based on the ecological perspective of the smart manufacturing industry, and deeper practical guidance for the supply chain management of specific smart manufacturing enterprises and related research.

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