DEVELOPMENT OF SUPPLY CHAIN MANAGEMENT AT PT. GOLDEN KOREA KHARISMA

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ABSTRACT

PT. Golden Korea Kharisma is a manufacturing company engaged in metal casting and machining. PT. Golden Korea Kharisma implements a make-to-order production system. Products produced by PT. Golden Korea Kharisma in the form of machine spare parts for industrial and individual needs. The order is made by the consumer by giving Purchase Order letter to the company by stating the raw materials to be used, the product to be made, and the design details of the product.

Supply Chain Management (SCM) is a mechanism that connects all parties concerned and activities involved in converting raw materials into finished goods. The main process in SCM development at PT. Golden Korea Kharisma is assisting PPIC department in procuring raw materials with the optimal amount to support The smoothness of the production process and scheduling the production. The smoothness of the production process can help the Logistic department in scheduling and monitoring the distribution, so that the company can deliver the finished product to the consumer on time.

Supply Chain Management information system developed using Economic Order Quatity (EOQ) method to calculate the amount of raw materials ordered. Based on the results of black box testing and beta testing, SCM Information System is already meet the purpose and purpose of the research conducted.

Keyword : Information Systems, Supply Chain Management, Make to Order, Economic Order Quatity (EOQ)

1. INTRODUCTION

PT. Golden Korea Kharisma is a manufacturing company engaged in metal casting and machining. In its development, the company currently produces all products made from stainless steel, iron, aluminum and other raw materials. The products produced by PT. Golden Korea Kharisma is machine equipment such as Double Valve, Magmo Pump, Impeller, Screw, and other things. for industrial and personal use. PT. Golden Korea Kharisma implements a make-to-order (MTO) production system or its production is based on orders from consumers.

Based on the results of interviews with PPIC department (Production Planning and Inventory Control) PT. Golden Korea Kharisma, it is known that the activities of the downstream company is to accept consumer orders (custom product). Ordering is done by consumers by giving a purchase order letter (PO) by email, coming to the company, or by sending it using a delivery service. In ordering, the consumer can determine the raw material to be used for each product (one product using one raw material) and also provide sample images and size detail until the volume of the product. While in the process of procurement of raw materials in PT. Golden Korea Kharisma, the problem that occurs is an error in the calculation of the estimated amount of raw material requirements for each ordered product. So the amount of raw materials ordered to suppliers not in accordance with the needs of production that should be. As a result of the errors of raw material estimation, the production process becomes obstructed because the company must place new order of raw materials back and wait for the delivery process of the raw material by the supplier.

Problems that occur in production is the order production process does not run smoothly due to the PPIC department, because of producing new orders entered (with the same raw materials) using raw material inventory for orders that have been received previously without procurement of raw materials in advance for the new order. Due to the inhibition of this production process, there is a discrepancy in the time of distribution of finished goods with the time agreed upon when the consumer made the order.

Based on the problems that have been described, it required for an information system that can assist the PPIC in determining the optimal quantity of raw material order for the production process run smoothly and do the production scheduling, Also helping the logistics department to schedule and monitor the distribution of finished products to consumers on time.

1.1 *Supply Chain Management* (SCM)

Supply Chain is a network of companies that work together to create and deliver a product into the hands of the end user. These companies usually include suppliers, manufacturers, distributors, stores or retailers, as well as support companies such as logistics services [8].

The term SCM was first proposed by Oliver & Weber in 1982, if the supply chain is the physical network, ie the companies involved in supplying the raw materials, producing the goods, or sending them to the end user, SCM is the method, the tool, or the management approach. It should be emphasized, however, that SCM requires an integrated approach or method based on the spirit of collaboration [8].

Thus, supply chain management is not oriented to the internal affairs of a company, but also external affairs involving relationships with partner companies. Why is it necessary to coordinate and collaborate between companies on the supply chain? Since companies in a supply chain essentially want to satisfy the same end-customers, they must work together to make a cheap product, deliver it on time, and with good quality. Only by cooperation between the elements on the supply chain objectives will be achieved. Therefore, it is quite right that many people say that today's competition is no longer between one company and another, but between one supply chain and another supply chain [8].

The spirit of collaboration and coordination is also based on the awareness that the strength of a supply chain depends on the power of all the elements in it. A healthy and efficient factory will not matter much if its suppliers are unable to produce quality raw materials or are unable to deliver on time. It is true that people say that "a supply chain is as strong as its weakest link". Thus, in the supply chain, manufacturers need to provide technical and managerial assistance to their suppliers because ultimately this will create the overall competitive ability of the supply chain [8].

1.2 Komponen SCM

Supply Chain Management has 3 main components that support the running of a business process as follows [9]:

- *Upstream Supply Chain*

Part of the upstream, the entire activity of the manufacturing company by its distribution or distributor relationship can be extended to several levels. The main activity in upstream supply chain is the procurement of goods.

- *Internal Supply Chain*

This part of the internal supply chain is the process of delivering goods to the warehouse. The main activities in the internal supply chain are production management, manufacturing, and inventory control.

- *Downstream Supply Chain*

Downstream supply chain includes all activities involving the delivery of the product to the end customer. In the downstream supply chain, attention is directed to distribution, warehousing and after-sale service.

1.3 Area Cakupan SCM

SCM has an important principle that SCM is transparency of information and the existence of collaboration between internal functions in the company or existing on the parties outside the company that is on the scope of supply chain. When referring to a manufacturing company, the main activities included in the SCM classification are [8]:

- Activities of designing new products (Product Development)
- Activities get raw materials (procurement, purchasing, control)
- Planning of production and inventory (planning & control)
- Activities of production (production)
- Activities of delivery / distribution (distribution)
- Product / goods return management activities (returns)

The six classifications are usually reflected in the form of division of departments or divisions at the manufacturing company. The division is often called functional division because they are clasped according to their function. Generally a manufacturing company will have a product development section, a purchasing or procurement section (in English it may be called purchasing, procurement, or supply function), production department, production planning section (often called Production Planning and Inventory Control, PPIC) Delivery or distribution of finished goods [8].

1.4 *Push* dan *Pull Supply Chain*

According to Indrajit and Djokopranoto, the Model of the supply chain is divided into two kinds, namely [10]:

a. *Push Based Supply Chain*

Is the supply chain model implemented in the anticipation of consumer demand.

b. *Pull Based Supply Chain*

Is the model of supply chain implemented based on customer needs. The modeling of the supply chain is very useful when considering strategic decisions related to the supply chain strategy stage.

Suppliers' suppliers have been incorporated to show the complete relationship of a number of companies or organizations that collectively collect or seek, change, and distribute goods and services to the last customer. One of the key factors for optimizing supply chain is to create an easy and

accurate flow of information between the network or the link and the effective and efficient movement of goods that results in maximum satisfaction [10].

1.5 *Economic Order Quantity* (EOQ)

Economic Order Quantity (EOQ) is a simple model that can be used to determine the size of an economical order. This model considers two inventory costs of postage and shipping costs. The cost of the message in question is the fixed costs that come out every time the order is made and does not depend on the size or volume of the order. While the cost of save is the cost incurred due to the company store the goods during a certain period. The largest part of the cost of savings is usually the cost of capital due to the holding of money in the form of goods of approximately equal to the rate of return (ROR) of the company concerned. More simply the cost of this capital is often equated with the deposit interest in the bank. In addition to the cost of capital, the cost of storage is also caused by warehouse costs, damage costs, obsolescence or expiration, taxes, and insurance. Because the level of obsolescence and the difficulty of storing each item vary, the cost of storage varies between one type of goods with the other type. However, in general the annual savings cost ranges from 20% - 35% per year from the value of stored goods. That is, if the company has an inventory with an average value of 10 billion then the cost of a year save about 2 - 3.5 billion. This large number is often unrecognized because the lion's share of the shelf cost (which is capital costs) is not recorded in the accounting statements [8].

The EOQ method is made with a number of assumptions. That is, this model can only be used quite well if some of these assumptions are met or at least approached. The first assumption is that the demand for an item is continuous at a uniform rate. That is, the item is needed with the same amount over time. In reality, this assumption is never fulfilled but this model is still quite well used as long as the demand variation over time is not too great. In the field many cases where the demand or the need for an item is relatively fixed over time [8].

The EOQ model can be used to determine the quantity of inventory orders that minimize the direct cost of inventory storage and the inverse cost of inventory ordering. EOQ formula that can be used is [11]:

$$EOQ = \frac{\sqrt{2\,SD}}{IC}$$

$$\text{Order Frequency} = \frac{D}{EOQ}$$

$$TC = DC + \frac{D}{EOQ}S + \frac{Q}{2}H$$

Noted that :

D: Raw Material Needs per period

S: Booking Fee.

I: Price of Raw Materials / Unit

Q: Quantity to be ordered (EOQ)

H: Storage cost for each unit

C: Common Storage Costs in Percent

TC: Total cost

2. CONTENTS

2.1 Supply Chain Management Model at PT. Golden Korea Kharisma

Supply chain management model contained in PT. Golden Korea Kharisma can be seen in Figure 1.

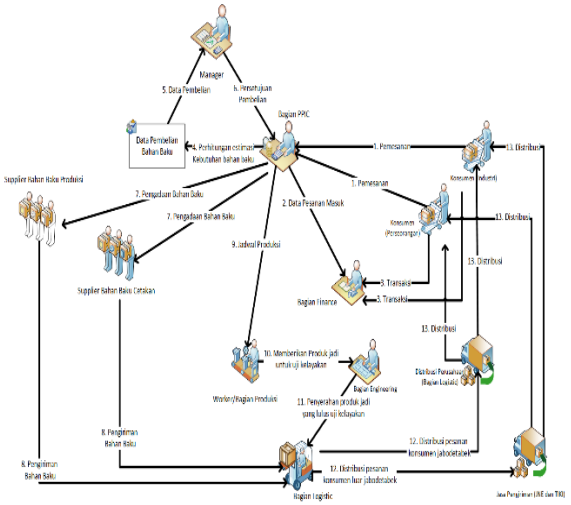


Figure 1. Supply Chain Management Model at PT. Golden Korea Kharisma

2.2 Supply Chain Management Stages at PT. Golden Korea Kharisma

As for the development of supply chain management information system (SCM) in PT. Golden Korea Kharisma consists of several steps which can be seen in figure 2.

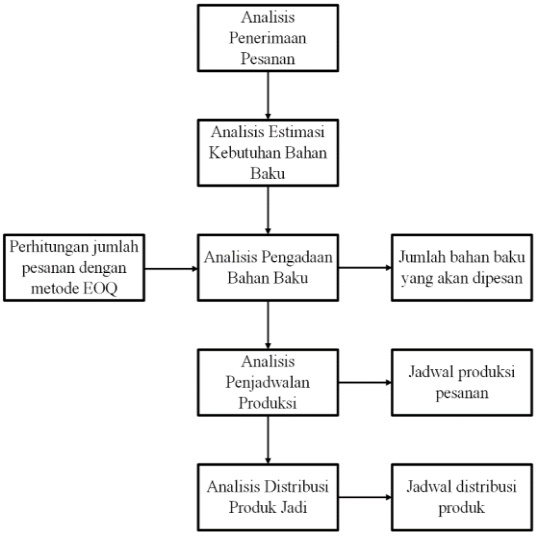


Figure 2. Supply Chain Management Stages at PT. Golden Korea Kharisma

2.3 Analisis Penerimaan Pesanan

Stages of order acceptance analysis is the stage in receiving customer orders by PT. Golden Korea Kharisma. The order received by PT. Golden Korea Kharisma is a purchase order letter containing the ordered product, the quantity of product, the desired raw material, and the detail of the product size (volume). In placing the order, the consumer has agreed on delivery deadline, product price, product distribution, and payment method with company. This is an example of purchase order letter from consumers received by PT. Golden Korea Kharisma on May 04, 2017:

Table 1. Order details of PT. Adi Engineering

Tanggal Pemesanan		04 Mei 2017 13:13		
No. PO		101306/AE-PO/V/2017		
Konsumen		PT. Adi *Engineering*		
Alamat		Perumahan Perum Raya No. 60 Blok A, Karawaci, Tangerang		
Telepon		021-278765		
Batas Waktu Pengiriman		17 Mei 2017		
Pembayaran		DP 30%, pelunasaan saat produk akan didistribusikan		
Distribusi		Oleh Perusahaan		
Keterangan		Usahakan tepat waktu		
No.	**Item (Pcs)**	**Bahan Baku**	**Jumlah (Pcs)**	**Volume (m^3)**
1	Cone Hopper (001)	SUS304	1	0.02484
2	Pump (002)	SUS304	3	0.02068
3	Pump Magmo (003)	SUS304	2	0.02018
4	Flange Body (004)	SUS304	4	0.01942
5	Flange Body (005)	SUS304	3	0.01955

As for the second buyer comes from PT. Eka Pratama Industri from outside Jabodetabek area, namely Purwakarta with order details as follows:

Table 2. Order details of PT. Eka Pratama Industri

Tanggal Pemesanan		04 Mei 2017 15:39		
No. PO		094/EPI/V/17		
Konsumen		PT. Eka Pratama Industri		
Alamat		Jl. Veteran No.155, RT41/RW05, Kel. Nagrikaler, Kec. Kebon Kolot, Nagri Kaler, Purwakarta		
Telepon		021-768543		
Batas Waktu Pengiriman		15 Mei 2017		
Pembayaran		Pelunasan 100% saat produk jadi akan didistribusikan		
Distribusi		Jasa Pengiriman		
Keterangan		Tolong dikerjakan dengan rapih		
No.	**Item (Pcs)**	**Bahan Baku**	**Jumlah (Pcs)**	**Volume (m^3)**
1	Impeller 14x215	FC250	15	0.00599
2	Impeller 14x185	FC250	10	0.00518

Based on table 1 and table 2, on Thursday 04 May 2017 PPIC department received two orders from two consumers, namely PT. Adi Engineering and PT. Eka Pratama Industri. As for the raw materials needed will be ordered the next day that is on Friday, May 05, 2017 because it exceeds 200 Kg in order to be able to produce by company as soon as possible. Because the consumer sends a purchase order letter past the purchase schedule of raw materials PT. Golden Korea Kharisma to the supplier, which is at 08:00 until 10:00 am.

Delivery deadline given by consumers of PT. Eka Pratama Industri until May 15, 2017 and PT. Adi Engineering on May 17, 2017. This delivery deadline is an agreement that has been determined by consumers and companies when making an order.

Based on business rules of order acceptance , payment method chosen by consumer PT. Adi Engineering is paying a 30% down payment at the time of booking (having paid a 30% down payment when placing an order) and repayment of 70% after the finished goods will be distributed. As for consumer PT. Eka Pratama Industri chooses payment method of 100% repayment at the time of ordering of product (have settled when booking).

2.4 Raw Material Requirement Estimation Analysis

The estimation analysis of raw materials for raw materials is calculated to find out how much raw material needed for each product ordered by consumers.

Calculation of the amount of production raw material needs to be ordered (SUS304 and FC250) the company has a policy by using the formula of calculating the density of solid body type.

Table 3. Result Calculation of raw material requirement for each product

No.	Item (Pcs)	Bahan Baku	Volume (m3)	Massa Jenis (Kg/m3)	Berat Estimasi (Kg/Pcs)
1	Cone Hopper (001)	SUS304	0.02484	7930	m = 0.02484×7930 = 196,98 ≈197 Kg
2	Pump (002)	SUS304	0.02068	7930	m = 0.02068×7930 = 163,99 ≈164 Kg
3	Pump Magmo (003)	SUS304	0.02018	7930	m = 0.02018×7930 = 160,02 ≈160 Kg
4	Flange	SUS304	0.01942	7930	m = 0.01942×7930

No.	Item (Pcs)	Bahan Baku	Volume (m3)	Massa Jenis (Kg/m3)	Berat Estimasi (Kg/Pcs)
	Body (004)				= 154,00 ≈154 Kg
5	Flange Body (005)	SUS304	0.01955	7930	m = 0.01955×7930 = 155,03 ≈155 Kg
6	Impeller 14x215	FC250	0.00599	7200	m = 0.00599×7200 = 43,12 ≈43 Kg
7	Impeller 14x185	FC250	0.00518	7200	m = 0.00518×7200 = 37,29 ≈37 Kg

Based on table 3 then we can know the needs of raw materials to be in the message by PT. Golden Korea Kharisma is as follows:

Table 4. The amount of raw material needed for each product

No.	Item (Pcs)	Bahan Baku	Jumlah (Pcs)	Berat Estimasi (Kg/Pcs)	Kebutuhan (Kg)
1	Cone Hopper (001)	SUS304	1	197 Kg	197 Kg
2	Pump (002)	SUS304	3	164 Kg	492 Kg
3	Pump Magmo (003)	SUS304	2	160 Kg	320 Kg
4	Flange Body (004)	SUS304	4	154 Kg	616 Kg
5	Flange Body (005)	SUS304	3	155 Kg	465 Kg
6	Impeller 14x215	FC250	15	43 Kg	645 Kg
7	Impeller 14x185	FC250	10	37 Kg	370 Kg

Based on table 4, it can be seen the amount of raw material needs that must be ordered for the production needs of consumer orders are as follows:

Table 5. The amount of raw material needs of the product

No.	Bahan Baku	Kebutuhan (Kg)
1.	SUS304	2.090 Kg
2.	FC250	1.015 Kg

After knowing the amount of raw materials needed for each product, then the next is to reduce the number of needs with the remaining production available in the warehouse.

Table 6. The amount of demand minus the remainder of production

No	Bahan Baku	Kebutuhan (Kg)	Stok (Kg)	Total Kebutuhan (Kg)	Status
1	SUS304 (*Stainless Steel*)	2.090 Kg	200 Kg	1.890 Kg	Kurang
2	FC250 (Besi Cor)	1015 Kg	150 Kg	865 Kg	Kurang

Based on table 6 then it is known the number of raw material needs to be ordered is as follows:

Table 7. The amount of raw material needs to be ordered

No	Bahan Baku	Kebutuhan (Kg)
1	SUS304 (*Stainless Steel*)	1.890 Kg
2	FC250 (Besi Cor)	865 Kg

After reducing the need of raw materials with the remaining production available in the warehouse, the company will make the procurement of raw materials for FC250 and SUS304 raw materials because the raw material inventory is not sufficient for the production process.

2.4 Raw Material Procurement Analysis

After knowing the amount of need for each raw material to be purchased to the supplier, then next is to calculate the total costs to be incurred by the company. Here are the cost variables that will be calculated using the Economic Order Quantity (EOQ) method starting from the cost of ordering, storage costs up to the result of the purchase amount of raw materials needed.

The cost of ordering that must be issued by the company to be able to order raw materials to suppliers is transportation costs. The transportation costs incurred by PT. Golden Korea Kharisma is IDR 75,000. While the storage costs incurred by PT. Golden Korea Kharisma is 5% of the price of raw materials because the raw material is included in raw materials that are not easily damaged.

Table 8. Storage cost of each raw material

No	Bahan Baku	Harga (Rp)	Biaya Simpan (%)	Total Biaya Simpan (Rp)
1	FC250	Rp.3.500	5%	Rp. 175
2	SUS304	Rp.16.000	5%	Rp. 800

Here is the calculation of raw material order size by EOQ method.

Tabel 9. Calculation of raw material order size using EOQ method

Bahan Baku	Perhitungan EOQ	Hasil EOQ
SUS304	$EOQ = \sqrt{\frac{2 \times 1.890 \times 75.000}{16.000 \times 0.05}}$ $= \sqrt{\frac{283.500.000}{800}}$ $= \sqrt{354.375} = 595.29$ $\approx 595 Kg$	595 Kg

Bahan Baku	Perhitungan EOQ	Hasil EOQ
FC250	$EOQ = \sqrt{\frac{2 \times 865 \times 75.000}{3500 \times 0.05}}$ $= \sqrt{\frac{129.750.000}{175}} = \sqrt{741.428}$ $= 861.06 \approx 861\ Kg$	861 Kg

Here is the order frequency calculation for each raw material.

Table 10. Order frequency calculation

Bahan baku	Perhitungan Frekuensi Pemesanan	Frekuensi Pemesanan
SUS304	Frekuensi pesanan = 1894/595=3.18 ≈3 Kali	3 Kali
FC250	Frekuensi pesanan = 865/854=1.00 ≈1 Kali	1 Kali

After knowing the size of ordering raw materials and ordering frequency, then next is calculate the total cost for each raw material to be ordered.

Table 11. Calculation of total cost

Bahan baku	Perhitungan Total Biaya (TC)	Total Biaya
SUS304	$TC = 1890 \times 16000 + \frac{1890}{595} x75000 + \frac{595}{2} \times 800$ $TC = 30.240.000 + 238.235,30 + 238.000 = Rp.30.716.235,30$	Rp. 30.716.235
FC250	$TC = 865 \times 3500 + \frac{865}{861} x75000 + \frac{861}{2} \times 175$ $TC = 3.027.500 + 75.348,43 + 75.337,5 = Rp.3.178.186,93$	Rp.3,178,186

2.5 Production Scheduling Analysis

Production scheduling analysis is an analysis performed to schedule the production of consumer orders. Production scheduling will be applied to the production process as production targets that must be completed on the ordering of the product order for the finished order to be produced on time. Delivery deadline for each received order has been agreed in advance on the purchase order letter sent by the consumer at the stage of receipt analysis of consumer order.

Scheduling the production of consumer orders is divided into 2 production processes, namely the process of casting and machining process. The casting process is divided into several production steps: casting, mold making, cooling, mold disassembly, cutting, shootblast, and cleaning. As for the machining process is divided into several steps, namely painting, machine process (feasibility test), and wrapping or packing. Here is the production scheduling gantt chart at PT. Golden Korean Kharisma:

No	Item (Pcs)	Jumlah (Pcs)	Tanggal Pesan	Batas Waktu Distribusi	Bulan Mei 2017								
					8	9	10	11	12	13	14	15	16	17
1	Cone Hopper (001)	1	04 Mei 2017	13 Mei 2017										
2	Pump (002)	3	04 Mei 2017	13 Mei 2017										
3	Pump Magmo (003)	2	04 Mei 2017	13 Mei 2017										
4	Flange Body (004)	4	04 Mei 2017	13 Mei 2017										
5	Flange Body (005)	3	04 Mei 2017	13 Mei 2017										
6	Impeller 14x215	15	04 Mei 2017	17 Mei 2017										
7	Impeller 14x185	10	04 Mei 2017	17 Mei 2017										

11 Mei 2017 : Libur Hari Raya Waisak

Keterangan Warna :
- Hari Libur
- Proses Pengecoran, Pembuatan Cetakan, Pendinginan, Bongkar Cetakan, Pemotongan, dan Pembersihan
- Proses Pengecatan, Proses Mesin (Uji Kelayakan), dan Pembungkusan atau kemas
- Distribusi

Figure 3. Production scheduling Gantt Chart

Based on Figure 3, the casting process for PT. Eka Pratama Industri must be finished on May 15, 2017 for all products ordered, so that machining process can be done on May 13-16, 2017 before distribution is done. Also for consumer PT. Adi Engineering casting process should be completed on May 17, 2017 then that the company can do machining process on 12-13 May 2017 before distribution, so that distribution for each consumer order can be delivered on time.

2.6 Distribution Scheduling Analysis

This distribution scheduling analysis is performed based on the distribution process or delivery process contained in the supply chain. Distribution that occurs within the scope of supply chain in the form of activities - activities that consist of monitoring activities on the distribution status that serves to determine the status of the delivery that has been done and find out whether the finished product has reached the consumer or still in the process of delivery. Here is the distribution scheduling at PT. Golden Korea Kharisma.



Figure 4. Schedule distribution of finished products to consumers

Here is the monitoring process found on the system to be built.

Table 12. Monitoring The distribution status of the SCM information system to be built

Tgl Distribusi	Konsumen	Penerima	Tgl Diterima	Status
15 Mei 2017	PT. Eka Pratama Industri	Bambang	15 Mei 2017 13:30	Diterima
17 Mei 2017	PT. Adi Engineering	-	-	Proses Pengiriman

3. CLOSING

3.1 Conclusion

Based on the results of the tests and discussions that have been made then got the following conclusion:

1. The system has been able to help PPIC department in determining the optimal amount of raw material purchase to support the production process and scheduling the production.
2. The system has been able to assist the PPIC and Logistic departments in conducting scheduling and monitoring the finished goods distribution to every customer on time.

3.2 Suggestion

Based on the results achieved in building Supply Chain Information System at PT. Golden Korea Kharisma, things that are expected to be developed in the future can be expanded, among others:

1. Supply Chain Management Information System at PT. Golden Korea This Kharisma can only manage related data supplier, raw material, consumer, order and distribution but not yet able to process further production data. Therefore for the development is also expected to process production data more detail.
2. Further development of the information system is needed, especially in terms of automation of scheduling and purchasing of raw materials and in terms of web security to make corporate data more secure.

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