SUPPLY CHAIN MANAGEMENT AT

PT. GANDA ARIA PRATAMA

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ABSTRACT

PT. Ganda Aria Pratama is a company engaged in the iron-concrete, steel distributors and others. The strategies used for the business process is make-to-stock company namely booking product to the supplier without waiting for requests. Procurement of products oftenproblems occur because the head of the warehouse doesn't do predictions of the number of products to be ordered to the supplier, so the inventory in the warehousesometimes experience a buildup even emptiness. Other problems when the Manager should do monitoring supplies products in the branch office.

Supply chain Management is applied to address the needs of the company in meeting the demand for branch offices and consumers. The company uses intuition to meet the demand for branch offices and consumers. The results of calculations used as consideration of the number of products to be ordered to the supplier.

Application of SCM control in products built to regulate products and supplies used to make scheduling distribution to each branch office. Based on the test results it can be concluded that the application of SCM to be built can make the head shed, make it easier to Manager, as well as help Purchasing.

Keywords *: forecasting, monitoring, procurement, single moving average, scm.*

1. INTRODUCTION

PT.Ganda Aria Pratama is a company which engaged in field of iron selling since 2003. Product which PT. Ganda Aria produce is iron concrete, light steel, black iron etc. Strategy which the company use is make-to-stock with the intention to anticipate demand from customer and branch office. Supply chain management which the company use is to do a procurement at the top section, meanwhile on the bottom section there is transaction with customer and product distribution to customer or branch offices.

Based on interview results with Mr. Dedy Supratman, the warehouse head officer of PT. Ganda Aria Pratama, procurement product will be executed if stock nearly empty, he use his intuition to determine the numbers that will be ordered, as the result, it is often arise a problem where stock is overloaded or it is empty in the werehouse. If there is product shortage, then demand from customer cannot be fulfiled, this can be a disadvantage for the company.

Based on interview result with Ms. Yuni Hendriani the Manager of PT. Ganda Aria Pratama, the company is having difficulties on monitoring the product stock on branch office if there is a demand from customer to the head office, while stock on head office cannot fullfil demand from customer, so PT. Ganda Aria Pratama must do the stock monitoring in the branch offices. The current monitoring proccess is to contact the branch office via telephone. This makes the monitoring proccess not efficient.

Based on interview result with Mr. Yusep Nugraha as the head of purchasing, he said that distribution process at PT Ganda Aria Pratama is being excecuted everyday except Friday, Sunday, and holiday at working hour on 8.00 AM, to 3.00 PM. The Company has 2 vehcle which used for distribution. The first vehicle is a puck up car with 1300kg capacity, the second vehicle is a truck with 5000kg to 8000kg capacity. If there is an order from customer to branch office at the same time, then the truck is used to send stock to branch office. But if there is a customer who order product with big capacity, there will be a problem because the pick up car have a different capacitu as the truck so it will need another delivery. This will increase another fee.

Based on the problems in PT. Ganda Aria Pratama, then a system to determine number of product demand and distribution monitoring process is needed using Supply Chain Management approach.

2. THE CONTENTS OF RESEARCH

2.1 Supply Chain Management steps at PT. Ganda Aria Pratama

The supply chain management that will be developed in PT. Ganda Aria Pratama compose of a number of steps which can be seen at figure 1.

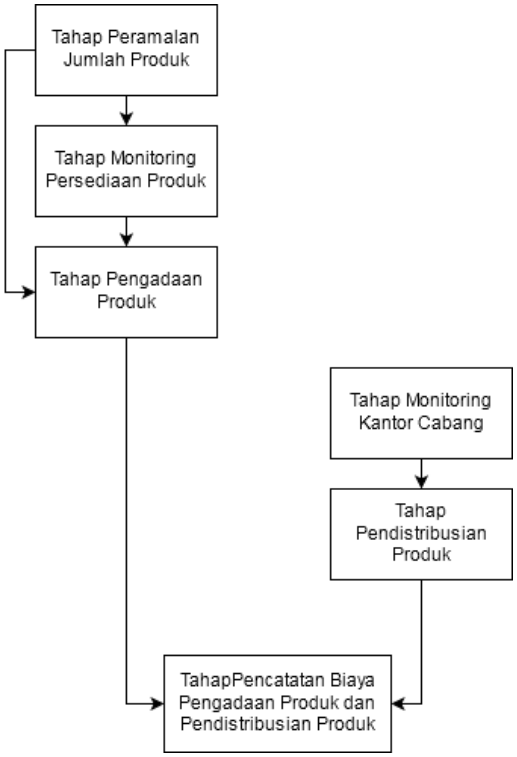


Figure 1. Supply Chain Management steps at PT. Ganda Aria Pratama

On supply chain management information system that will be developed, there are steps that is applied.

1. Product demand number forecast. actors that involved in this step is company internal which is a head officer of warehouse, he will forecast the number of product demand for the next periode.
2. Product stock monitoring actor that involved in this step is head officer of warehouse, after forecast, company will determine the safe number of product that must be on the warehouse to prevent exaustion on the warehouse with the safety stock method. If the stock is not enough then the company will contact the supplier to order the product that is being need.
3. Product procurement actor that involved in this step is the purchasing side. Purchasing will do the procurement to the supplier from the forecast data, safety stock, or the actual stock.
4. Branch office stock product monitoring. Perpetrators involved in monitoring the supply of Branch Office products ie the Manager. Parties Manager will monitor the number of products in branch offices in case of shortage of products, then performed the distribution process.
5. Product distribution actor that involved in product delivery to the branch office and customer is the purchasing. Purchasing will make a product delivery scheduleand determine what vehicle which will send product to the branch office and customer.
6. Fees recordeing actor that involved in this step is finance, finance will make a fee recording report for procurement and distribution of products.

2.2 Single moving average forecast method

Single moving average methode use average from all of the forecast data. This moving average is usually used to forcast next periode. The formula for single moving average can be seen at this equation.

$$F_{t+1} = \frac{Xt + Xt-1 + \ldots + Xt-N+1}{N}$$

dimana :

F_{t+1} : Values forecast for the period (t + 1)

X_t : Actual value in period t

N : The amount of time in the moving average

Moving average for time periode t is mean aritmetics from k new observation. In moving average, load given must equal for every observation. Every new data included in the average, and the earliest data is discarded. This model doesnt handle trend or seasonal very well. Although it is better than simple average method.

Single moving average is a forecast technique based on moving average from past value. Single moving average is

$$Ft+1 = (Xt+Xt-1+Xt-2 +\cdots+Xt-N+1)/N \quad (1)$$

Keterangan :

1. Ft+1 : Values forecast for the period (t + 1)
2. Xt : Actual value in period t
3. N : The amount of time in the moving average

Forecasting result using single moving average method with 2 months moving to 11 months moving can be seen on table 1.

Table 1 Calculation of SMA with 2 moving from monthly to 11 months

No.	Periode	Jumlah Permintaan	Moving Average (Bulanan)									
			2	3	4	5	6	7	8	9	10	11
1	Agustus 2015	335										
2	September 2015	869										
3	Oktober 2015	789	602									
4	Nopember 2015	855	829	664,33								
5	Desember 2015	673	822	837,67	712							
6	Januari 2016	548	764	772,33	796,5	704,2						
7	Februari 2016	593	610,5	692,00	716,25	746,8	678,17					
8	Maret 2016	704	570,5	604,67	667,25	691,6	721,17	666				
9	April 2016	595	648,5	615,00	629,5	674,6	693,67	718,71	670,75			
10	Mei 2016	399	649,5	630,67	610	622,6	661,33	679,57	703,25	662,33		
11	Juni 2016	330	497	566,00	572,75	567,8	585,33	623,86	644,5	669,44	636	
12	Juli 2016	187	364,5	441,33	507	524,2	528,17	548,86	587,125	609,56	635,5	608,18
13	Agustus 2016		258,5	305,33	377,75	443	305,33	479,43	503,625	305,33	567,3	19328,09

2.3 Menghitung Nilai Eror

Mean squared error (MSE) is another method to evaluate forecast method. Every mistakes or leftover will be powered. Then summed then added with number of observation. This approach maintain medium mistakes which possibly better for small mistakes, but sometimes resulting a huge differences.

Mistakes average calculation which made by forecast model everytime is a parameter in which how accurate is the forecast. Mistakes forecast method using MSE (Mean square error). If formulated then formula for MSE is as follow :

$$MSE = (\Sigma |Ft-Y|2)/n \quad (2)$$

Keterangan :

Ft = Peride forecasting results to t

Y = Original data (real) period to t

n = The number of observation period

Ft-Y = Forecasting errors

The results of the calculation of the value of the error using the MSE method with moving 2 monthly until moving 11 monthly can be seen in table 2.

Table 2. Overall value MSE

Periode	Bulan	Data Aktual	Moving Average (Bulan)									
			2	3	4	5	6	7	8	9	10	11
1	Agustus 2015	335										
2	September 2015	869										
3	Oktober 2015	789	623521									
4	Nopember 2015	855	731025	36353,78								
5	Desember 2015	673	452929	27115,11	1521,00							
6	Januari 2016	548	300304	50325,44	61752,25	24388,44						
7	Februari 2016	593	351649	9801,00	15190,56	23654,44	7253,36					
8	Maret 2016	704	495616	9867,11	1350,56	153,76	294,69	1444,00				
9	April 2016	595	354025	400,00	1190,25	6336,16	9735,11	15305,22	5738,06			
10	Mei 2016	399	159201	53669,44	44521,00	46996,96	68818,78	78720,33	92568,06	69344,44		
11	Juni 2016	330	108900	35696,00	58927,56	56548,84	65195,11	86552,02	98910,25	115222,53	93636,00	
12	Juli 2016	187	34969	64685,44	102400,00	113703,84	116394,69	130940,39	160100,02	178553,20	201152,25	177394,12
	Total		2988618	307913,33	286853,19	274792,44	267691,75	312762,16	357516,39	363120,17	294788,25	177394,12
	MSE		298862	34212,59	35856,65	39256,06	44615,29	62552,43	89329,10	121040,06	147394,13	44348,53

Based on the results of the calculations in table 3.4 MSE then the smallest error of forecasting by moving 2 months to 11 months showed that iron-concrete products for forecasting 8 mm CSI August 2016 is forecast using the moving 3 month with a value of error 34212.59.

Based on the results of the comparison of moving in the calculation of Forecast error using MSE, it can be concluded that moving data 3 months before generating the least error. From table 3.4 MSE values from the moving 3 month 34212.59. The most minor error indicates that the accuracy of forecasting results. The result of the iron-concrete product demand forecasting 8 mm CSI for the period hereinafter contained in table 3.4 with moving 3 months, then a PT. Ganda Aria Pratama recommended procurement of products for product iron concrete 8 mm CSI on the next period August 2016 with a total of 305 results calculation:

$$F13 = (X_{12} + X_{11} + X_{10}) / N$$
$$= (187 + 330 + 399) / 3$$
$$= 305{,}33 \approx 305 \text{ Batang}$$

After the calculation is performed then noted that the estimated demand for concrete iron 8 mm CSI in August 2016 as many as 305 stems.

Measurement errors in forecasting used method of MSE (Mean Square Error). This method is a way to measure and evaluate the errors in forecasting techniques

2.4 Product Inventory Analysis with the method of ROP and Safety Stock

After doing the forecasting the next stage of the control product is determining the limits

of safe products to avoid shortage or void the product by using the method of safety stock.

Security or safety stock inventory serves to protect the errors in predicting demand during lead time. Application of the method of Safety Stock calculation process in forecasting sup plies products for the period of the next month. The formula used is the formula equation 2.3, 2.4 and 2.5, the
following example calculation with methods of ROP and Safety Stock:
Nope:
Estimates of the demand for concrete iron 8 mm CSI = 305 Rod
The number of working days within 1 month = 22 day
Lead Time on procurement to supplier (l) = 2 day
The completion of the:

$$Safety\ Stock = d \times l$$
$$= (305/22) \times 2$$
$$= 27{,}72 \approx 28 \text{ Rod}$$
$$ROP = d \times l + SS \quad (2.4)$$
$$ROP = (305/22) \times 2 + 28$$
$$ROP = 55, 72 \approx 56 \text{ Rod}$$

Conclusion:

When the number of the inventory products are already approaching the value of ROP already specified 56 rob, then head of warehouse can file product purchases toinventory in the warehouse. In this case, the product can still be distributed to approach or equal to (=) the value of Safety Stock, namely 28 rob.

2.5 Analysis of Monitoring Product Inventory

Monitoring analysis aims to help PT. Ganda Aria Pratama in monitoring the occurrence of activities out of the incoming existing products in warehouses of PT. Ganda Aria Pratama so that the stock of the product to be discharged or excess stock can
be terlaporkan. Monitoring stock requires an indicator obtained from a method in order to reduce the risk of running out of supplies and excess inventory products. The indicators that will be used data the number of products in the previous month. Methods to avoid the occurrence of excess or shortage of supplies using the method of Safety Stock and ROP (Reorder Point).

By using this method, then planning the demand for products that will be performed if the total value of the supplies was under the limit of safety. ROP and Safety Stock obtained from results of forecasting. ROP will become the reference as an indicator of the monitoring pesediaan products, in stock inventory is less or equal to the number of ROP then status will provide notification "unsafe" which means the products experienced a shortage of supplies and procurement should be done. Monitoringthe inventory products will be presented in the form of tables, where it will be sorted based on the difference between the amount of the stock with a value of ROP andSafety Stock. Presentation of product inventory monitoring can be seen in table 3.

Table 3. representation of Monitoring Product Inventory

Kode Produk	Nama Produk	Satuan	Stok	ROP	Safety Stock	Status
BB013	D10mm SES	Batang	5	11	7	Tidak Aman
BB002	8mm CSI	Batang	275	56	28	Aman
BB001	6mm Blank	Batang	287	40	24	Aman
BB014	10 SRB	Batang	101	50	35	Aman

In table 3 it can be known that stockpiles of products during the period of the SES D10mm insecure and unable to make ends meet, while for the iron-concrete products in stock 8 mm, 6 mm Blank, CSI 10 SRB on the safe period and can meet the needs.

2.6 Product Procurement Analysis

After forecasting the next stage, namely procurement of the product to the supplier.Number of products that must be reserved to the supplier will be determined based on the results of forecasting has been done before.

Examples of cases in the inventory of products in the month of August a PT. Ganda Aria Pratama experiencing emptiness supplies on the product and the quantity digudang SES D10mm 5 rod and for 8 mm CSI despite being on the indicator "safe" but the results of the forecasting for the month of August is not meeting the needs ofdemand because supplies have only as

many as 275 stems. So, to do the process of procurement for supplies in August. After done forecasting for supplies acquired in August proposed the procurement of 9 units to SES and D10mm products 58 products 8 mm rods for CSI. Then to find out the number of optimal product procurementso that does not happen, do digudang buildup the calculation as follows:

1. Calculation of Product Procurement D10mm SES

   The amount of the proposed procurement of forecasting results

   = 4 Rod

   The rest of the inventory in the warehouse

   = 5 Rod

   Safety Stock

   = 7 Rod

   The Number Of Procurement = The amount of the proposed procurement of forecasting results – (the rest of the inventory in the warehouse - *Safety Stock*)

   = 4 – (5 – 7)

   = 6

2. Calculation of Product Procurement 8 mm CSI

   The amount of the proposed procurement of forecasting results

   = 305 Rod

   The rest of the inventory in the warehouse

   = 275 Batang

   Safety Stock

   = 28 Rod

   The Number Of Procurement = The amount of the proposed procurement of forecasting results – (the rest of the inventory in the warehouse - *Safety Stock*)

   = 305 – (275 – 28)

   = 58

The conclusion obtained from the calculations that the procurement of products that do PT. Ganda Aria Pratama to SES D10mm products amounted to 6 rods and iron-concrete products totalled 58 CSI 8 mm rods. Procurement process the product will be presented in the form of tables and can be seen in table 4.

Table 4.
Procurement Products

No	ID Pengadaan	Periode	Kode Produk	Nama Produk	Satuan	Usulan Pengadaan	Nama Supplier	Status	Pilih Supplier
1	PEN001	02/08/2016	BB013	D10mm SES	Batang	6	PT. Bina Bangun Sukses	Diproses	
2	PEN002	02/08/2016	BB002	*8mm CSI*	Batang	58	PT. Power Steel Indonesia	Diproses	

2.7 Product Procurement cost analysis

In this cost analysis, cost only the price of related products that reside in the PT. Ganda Aria Pratama. In this case, namely the information costs in the procurement of products and income from the sale of these products. Here is an example about the information product procurement costs in August 2016 is presented in the form of a table, can be seen in table 5.

Tabel 5. The Cost Of Procurement Of Products

Nama Produk	Jumlah	Harga	Total
D10mm SES	6	Rp 54.000	Rp 486.000
8mm CSI	58	Rp 24.800	Rp 1.438.400
Total Biaya Pengadaan Produk			Rp 1.924.400

2.8 Monitoring Analysis Branch Office Supplies

Stage monitoring offices do to get information about the product inventory in eachbranch office and find out the status of the distribution of the product. If there is a request on the product that is experiencing a shortage of supply of vacuum at warehouse then PT. Ganda Aria Pratama must perform the process of distribution. Example of presentation of monitoring supplies products in the Branch Office can be seen in table 6.

Table 6. Presentation
Of Product Inventory Monitoring Branch Office

Kantor Cabang Bandung						
Persediaan						
Kode Produk	Nama Produk	Satuan	Stok	Stok Minimum	Indikator	Jumlah Kebutuhkan
BB002	*8mm CSI*	Batang	100	20	Aman	0
KW001	Kawat Roll	Roll	8	15	Tidak Aman	95

2.9 Distribution Analysis

The scope of which is in the delivery activities include monitoring product that is ready to send, monitoring the status of distribution, scheduling and distribution capacity of the vehicles that will be used in the delivery of products to branch offices and

consumers. Pendistribusin monitoring was done so that the products reach the goalat the time and the right place, monitoring the status of the distribution is done to find out the status of the distribution of product already up to the place of destination or in the process of distribution. Activity scheduling distribution can be determined by looking at the request of which products are ready to be distributed, then the company determine the vehicle used to deliver products tailored to the capacity of the vehicle at the time of distribution. Suppose a company has a product request data on 16 August 2016, total product demand can be seen in table 7 and table 8.

Table 7. Branch Office requests the period 16 August 2016

Tanggal	Cabang	Alamat	No. Telepon	Nama Produk	Satuan	Jumlah
16/08/2016	Bandung	Jl. Soekarno – Hatta no. 58	(022) 772819663	Kawat Roll	Roll	12

Table 8. Costumer demand Period 16 August 2016

Tanggal	Konsumen	Alamat	No. Telepon	Nama Produk	Satuan	Jumlah	Status
16/08/2016	Karyo	Jl. Gudang Selatan No. 105	(022) 7803018	8mm CSI	Batang	120	Diproses
				6mm Blank	Batang	60	
				10 SRB	Batang	15	

Below in table 9 data for the vehicle to be used in the delivery of the product.

Table 9.
Vehicle Data

Nomor Kendaraan	Jenis Kendaraan	Kapasitas Angkut
B 4682 ACE	*Pick-up*	Besi Beton 200 batang Baja Ringan 50 batang Besi Hitam 30 lembar Alumminium 20 lembar Kawat 20 roll
B 3625 DES	Truk	Besi Beton 1000 batang Baja Ringan 100 Batang Besi Hitam 60 lembar Aluminium 50 lembar Kawat 20 roll

Table 10. Scheduling product delivery Period 16 August 2016

ID Distribusi	Tanggal	Supir	Kendaraan	Tujuan	Nama Produk	Satuan	Jumlah
DIS001	16/08/2016	Karyo	*Pick-up*	Bandung	Kawat Roll	Roll	12
DIS002	16/08/2016	Karyo	*Pick-up*	Kuraesin	8mm CSI	Batang	120
					6mm Blank	Batang	60
					10 SRB	Batang	15

Based on the scheduling process distribution, it will be proposed to apply the scheduling system that will be created. Where, on the system to be built, there is a menu that contains distribution information from the distribution process is done in the form of the send date, destination, driver, type of vehicle, the number of vehicles and the status of the send. Send status is made up of the status "sent" and "sent". The process of monitoring the system that will be created can be seen in table 11.

Table 11. The status of the distribution of the product for the period of 16 August 2016

Tanggal	Tujuan	Supir	Kendaraan	No. Kendaraan	Status
16/08/2016	Bandung	Yudi	*Pick-up*	B 4682 ACE	Diproses
16/08/2016	Karyo	Yudi	*Pick-up*	B 4682 ACE	Diproses

2.10 Distribution Cost Analysis

In the supply chain there is information regarding cost flows ranging from hulu to lihir. For information regarding the cost of distribution of product sales for the period of August 16, presented in the form of tables and can be seen in table 12 information revenue from product sales in August.

Table 12.

Product Distribution Cost information for the period 16 August 2016

No	Rincian	Biaya
1	Bensin	Rp. 100.000

2.11 Analysis Database

Entity-Relationship is a technique to describe the information needed in the system,and the relationship between the data, to describe it used some notation and symbols.

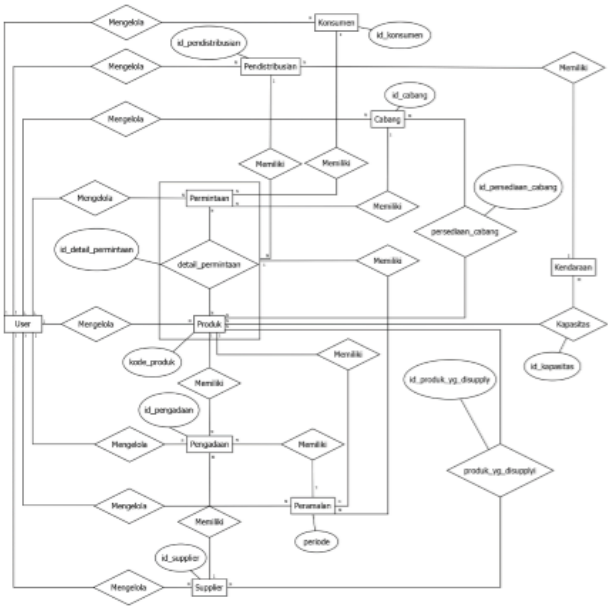


Figure 2. ***Entity Relationship Diagram***

2.12 Dictionary Data Entity Relationship Diagram

ERD Data Dictionary serves to describe a character entity in an ERD. ERD will attribute is described in table 13.

Tabel 13.
Dictionary Data Entity Relationship Diagram

No	Entitas	Atribut
1.	User	{ id_user, username, password, level }
2.	Produk	{ kode_produk, nama_produk, satuan, stok, safety, rop, harga, indikator}
3.	Cabang	{ id_cabang, nama_cabang, kontak_cabang, alamat_cabang}
4.	Persediaan Cabang	{id_persediaan_cabang, id_cabang, kode_produk, stok, stok_minimal, indikator}
5.	Permintaan	{ id_permintaan, tanggal, id_cabang, nama_konsumen, minimal_pembayaran, pembayaran, status}
6.	Detail_Permintaan	{ id_detail_permintaan, id_permintaan, kode_produk, jumlah }
7.	Pengadaan	{ id_pengadaan, id_peramalan, usulan, status, id_supplier}
8.	*Supplier*	{ id_*supplier*, nama_*supplier*, alamat_*supplier*, kontak_*supplier*}
9.	Produk_yg_di_supply	{ id_produk_yg_disupply, kode_produk, id_supplier
10.	Peramalan	{ periode, kode_produk, hasil, status}
11.	Kendaraan	{ no_polisi, jenis }
12.	Kapasitas	{ id_kapasitas, kode_produk, jumlah, no_polisi }
13.	Pendistribusian	{ id_distribusi, tanggal_distribusi, supir, no_polisi, id_permintaan, status, biaya}
14.	Konsumen	{ id_konsumen, nama_konsumen, alamat_konsumen, kontak_konsumen}

3. CONCLUDING

3.1 Conclusion

After doing the analysis, design, and testing with the beta and the black box method, then a conclusion can be obtained as follows:

1. The System has been built it can ease the head of warehouse in determining the amount of a product needs will be booked to the supplier.
2. The System has been built it can make it easier to monitor product inventory Manager in branch office.
3. The System has been built it can make Purchasing in doing scheduling distribution of products to consumers and branch offices.

3.2 Advice

The results have been done until the final stages, there are some drawbacks. Suggestions for adding things that could complement this field of transport control systems. Among them are:

1. Supply Chain Management information system in PT. Ganda Aria Pratama can still be developed again so that the supplier can integrate directly through the system of PT. Ganda Aria Pratama.
2. Forecasting Methods used in the system can be applied also in the regional offices to facilitate the Marketing Branch in determining the supplies needed in meeting the needs of consumers.
3. Building into Mobile Apps in order to increase the mobility of the work.

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