Supply Chain Management Implementation for Food Security besides Rice (Cassava) Using ERP Software

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ABSTRACT

Food is one of basic needs of human to stay alive; it means food security take strategic position for human living continuance. Food diversification can be a solution in Indonesian Food Consumption Pattern has deviated from PPH (Food Consumption Expectation). Implementing Food Diversification can increase food security when climate, endemic, biotic, and seasonal factor happened. To support food diversification, foremost activity is food procurement process, starting from the demand, production, marketing, distribution and consumption of food. This activity series exist in industry concept named Supply Chain Management. With converting rice needs into cassava, this research applied forecasting method to predict the human food needs in the future.

The complexity of this research is not only placed on the converting and forecasting cassava needs but also took on tapioca factory. The tapioca factory is considered as loyal customer of Bulog that will surely affect the existing workflow and distributing system.

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1. INTRODUCTION

Currently, food consumption in Indonesia has not diversified properly. Indonesian food consumption still focuses on grains mainly in rice because it is the main and the first food for them. Meanwhile, tubers as an alternative solutions consumed approximately a third of a whole portion in Indonesia (about 2%-6% from the expected consumption) (Susenas 2002, 2003, 2004). Even though tubers' price in Indonesia considered as cheap sources for food in contrast with rice price that increase up to 60% (50% from the expected price).

In order to keep food sustainability, government established institution named Perum Bulog. Perum Bulog is the only government institution that its main role is managing food needs in Indonesia. For supporting its obligation, Bulog contribute more in increasing domestic's demand efficiency to reduce government's expenses in domestic food. One of its policies is by food diversification, transferring rice into tubers consumption as cheaper food sources and its carbohydrate substance that has almost similarity with rice.

Food diversification takes into account in decreasing number of rice consumption level with enlarge food's choices. Basically, diversification is an effort to gain secondary food sources instead of rice sources. Diversification can modify people's level of consumerism and food substances knowledge. Moreover, it can heighten the Indonesian's abilities to compete with other developed countries [1].

The importance of SCM-IS implementation in food diversification is to help food sources scarcity in the future through integrated information system. Integrated information systems by SCM-IS may improve Bulog's performance to collaborate with its stakeholders. As the function of integrated Supply Chain Management System, that is to integrate information with food flows between food stakeholders, communication obstacles, and process redundancies can be omitted through coordination, monitoring and control process.

2. RESEARCH METHOD

In this chapter will be explained about several relating concepts as a research foundation, for example: food diversification, supply chain management, single exponential smoothing.

a. Food Diversification

In farming terminology, diversification is resources transferring from one source to another mixed source. This aim is to reduce nature disaster like long-term drought that impact to food scarcity. Besides that, this method can be one solvency to increase farmers' wealth. Diversification definitions enlighten the importance of low value resources that is transferred into high value resources in farmers' efforts.

According to several literatures, generally, diversification can be explained through these definitions:

1. Resources transferring from farmers to non-farmers activities.
2. Resources usage in bigger condition as mixed resources from several commodities and supporting programs.
3. Resources transferring from high to low values commodities.

Meanwhile, there are the reasons why food diversification is held:

1. Maximizing resources efficiency usage mainly in land and time usage efficiency, efforts symbiosis and workforce intensification.
2. Reducing production, pricing and incoming risks.
3. Responding demand movements for varied farming commodities that is affected by corporation per capita income and its sustainability.
4. Maintaining land fertility and gradually reducing ecosystem damage.

b. Supply Chain Management

Supply chain management is a strategic management model based on modern information technology between participating corporations. Meanwhile, for logistic purposes and capital flow in whole parts of supply chain management will be controlled and monitored. Thus, one of its aims for reducing operations risks, increasing competition and gaining more profits for participating corporations will be achieved. The main purposes of Supply chain management is to hold uncertainty in demand which may be impacted by demand fluctuation, increase market response and customers demand fulfilling.

According to Ellram (1991) and Wisner (2003), Supply chain management can be defined as *"design and management, added value from specific process that may pass relating corporate's borders in order to fulfill real demand of customers"*. Further development and integration between human resources and technologies is highly correlated with the successful of integrated supply chain. SCM is integrated by approaching for planning and controlling material streams from supplier to end customer by distributed systems. Generally, SCM concepts according to Martin Christopher from Cranfield University, is a strategic process that manage material, parts or goods procurement, movement and saving. This aim is to maximize profits by minimize order cost.

c. Single Exponential Smoothing

Single exponential smoothing is used to predict food demand in a short-term considering food need remain stable, it has no trend and its growth pattern is consistent time after time. The formulae can be seen in these equations (1-4).

$$L_0 = [Sum(i = 1\ to\ n)Di]/n \quad (1)$$

Forecating for all further period same with now condition of level, thus this equation represents it.

$$F_{t+1} = L_t\ and\ F_{t+n} = L_t \quad (2)$$

After having result from demand Dt+1, estimate level dmand is done subsequently.

$$L_{t+1} = \alpha D_{t+1} + (1 - a)L_t \quad (3)$$

$$L_{t+1} = Sum_{(n=0\ to\ t+1)}[\alpha(1-\alpha)^n D_{t+1-n}] \quad (4)$$

F_{t+1} = Next forecast value

D_t = Actual demand in t

α = Exponential smooth factor

$F_{t+1} = (L_t + l_t) + S_{t+1}$ = Forecast for t+l

L_t = Level forecast in t

T_t = Trend forecast in t

F_t = Forecast in demand t

D_t = Actual demand in t

d. Forecasting error measurement

In every forecasting, there are always error rate towards actual data. Measurement of its error can be measured by several measurements such as MAPE, MAE, RMSE or even Directional Statistics (Dstat). MAPE has been choosen as measurement value of this research because it suitable with unite actual and forecast value.

Mean absolute percentage error (MAPE)

$$MAPE^n = \frac{(Sum^{(t=1\ to\ n)}[|E^t/D^t|100])}{n} \quad (5)$$

3. RESULTS AND ANALYSIS

3.1. Rice Demand Prediction using Single Exponential Smoothing

For projecting rice needs in the future, in this research is used simple exponential smoothing with considering that rice demand has no trend. For testing rice demand forecasting results, this research used MAPE which is should value fewer than 20% to be predicated as valid forecasting. After measuring this forecast results, it can be seen that MAPE value fewer than 20% and it can be used for converting rice needs to cassava. As a reference, cassava needs is 277 grams/day per capita. Projecting result about rice needs are formed in the table below.

Table 1. Prediction of rice and cassava needs with its error measurements

Year	Rice needs (Ton)	MAPE (%)	Cassava needs
2010	3,520,162	3.28	4,049,665
2011	3,562,404	3.51	4,135,538
2012	3,605,153	3.75	4,218,249
2013	3,648,415	3.98	4,302,614
2014	3,692,196	4.21	4,388,666
2015	3,736,502	4.44	4,476,440
2016	3,781,340	4.66	4,565,968
2017	3,826,716	4.86	4,657,288
2018	3,872,637	5.07	4,750,434
2019	3,919,108	5.26	4,845,442
2020	3,966,138	5.44	4,942,351

3.2. SCM Implementation in ERP

ERP Implementation towards SCM-IS in farming goods based on Bulog Jatim distribution use OpenERP. Distribution system in Bulog Jatim can be seen in picture 1.

The old scheme of Bulog Jatim's distribution process is done with many parties involved. Crops produced through three parties; wholesaler, traders and the corporation. Wholesaler and traders' jobs are selling crops to the traders group. After that, Bulog should buy crops from the traders group. Bulog also get crops supply from corporation. Crops supplier that has been received by Bulog then should be distributed to the main markets and retailer and consumers. Bulog is just as a temporary warehouse. For distribution system can be seen in picture 2.

Bulog Jatim is an ongoing business process central. In Bulog Jatim is happened equity distribution to customers that needs tapioca through the corporations. Equity process is done by OpenERP and managed by administrator. Before starting the process, forecasting process is began to know how much demand of each corporation. Each process that is done by administrator will be directly monitored by Bulog Jatim. Workflow in OpenERP can be seen in Picture 3.

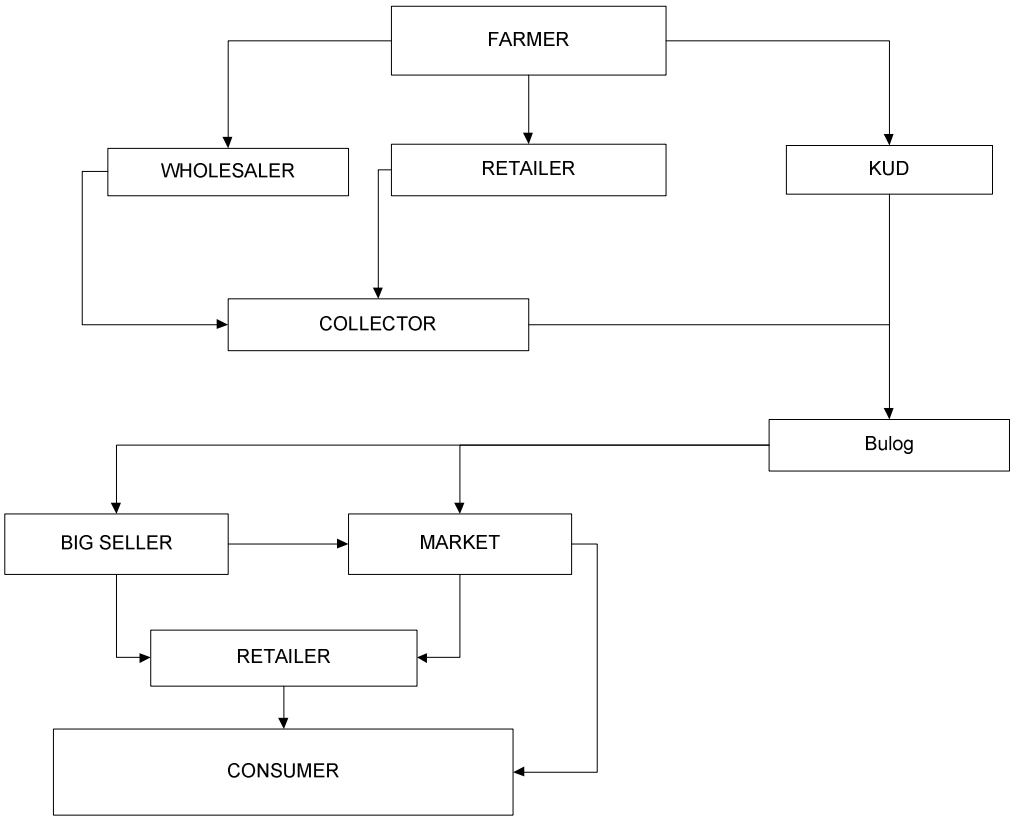

Figure 1. Goods Flow

In OpenERP workflow contain steps for OpenERP development which is adjusted by business needs in Bulog Jatim. These are the explanation about workflow:

Login OpenERP
This is OpenERP homepage for entering password as a validity page to pass main page OpenERP. This page only can be accessed by administrator role.

Input Data Partner
This is a sub-page from Address Book page. Partners are divided into two categories: suppliers and customers. The towns that contain more cassava crops are categorized as suppliers and the towns that need cassava because they don't have those crops are categorized as customers.

Input Product
Input Product page is located in products menu. In this page we should define product type, category and Unit of Measurement.

Purchase Order
It is used as stock order purchase processing from supplier for entering in the warehouse. This process involves the corporation from cassava's producers and Bulog Jatim.

Incoming Shipment
This is accepting process and goods validation that is ordered from supplier. The ordered product will add warehouses' stock.

Sales Order
This is product ordering by the corporation to the towns that needs cassava/consumers.

Delivery Product
It is product delivery process from Bulog to customers.

Report
It is used as report makers to be distributed in every correlating town in East Java.

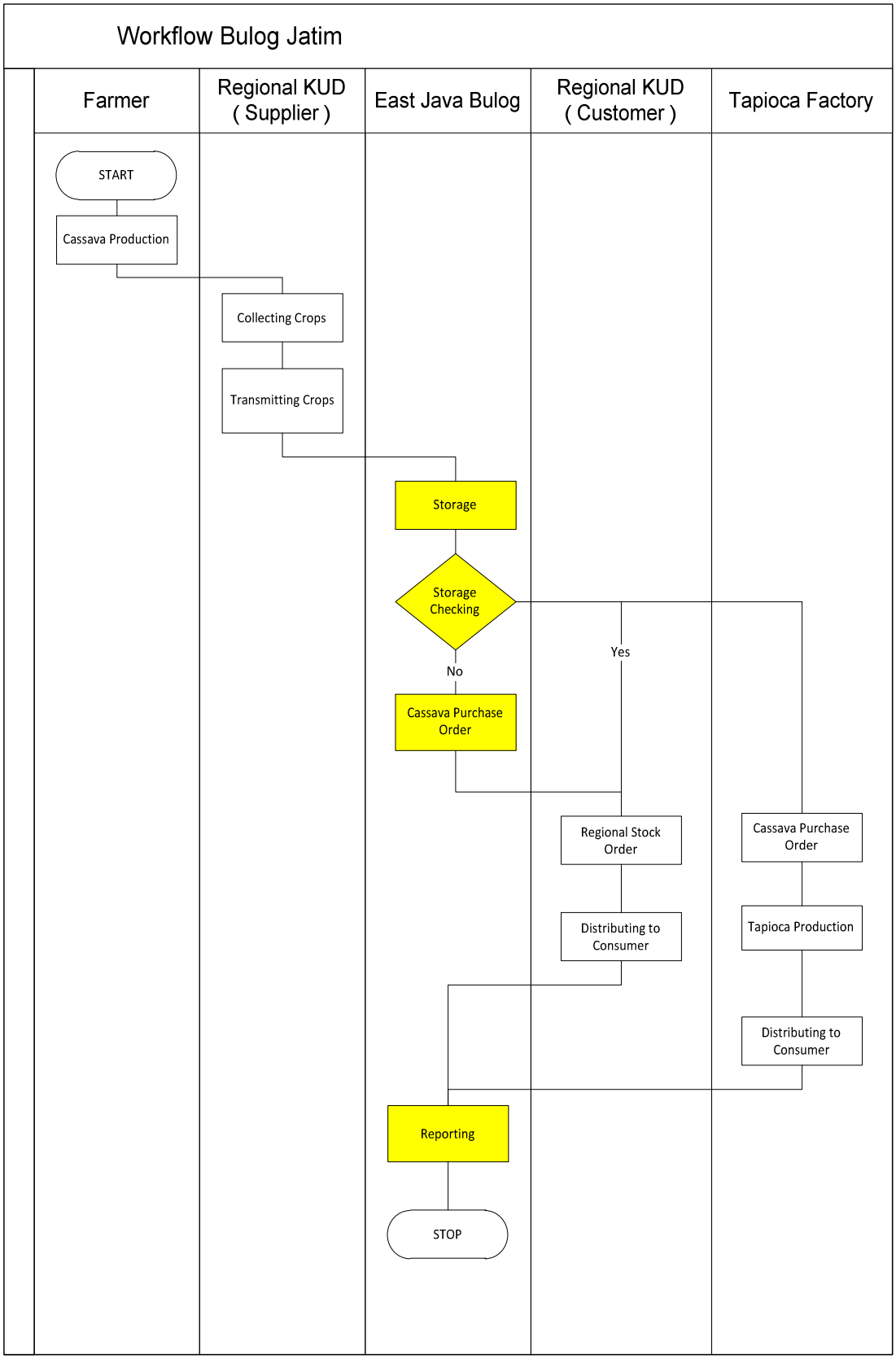

Figure 2. Distribution System in Bulog Jatim (SCM-IS)

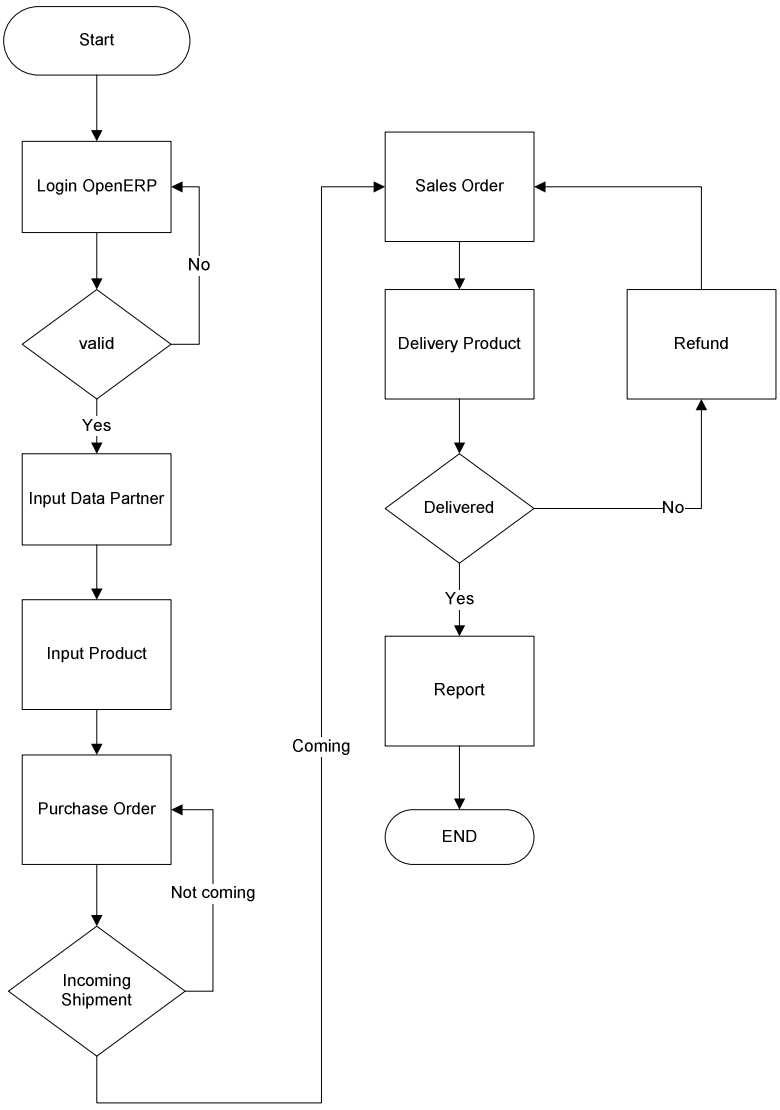

Figure 3. OpenERP Workflow

4. CONCLUSION

This implemented application contributes more to manage supply and cassava distribution. Based on projecting rice demand can be seen that MAPE value is fewer than 20%, thus this forecasting results can be concluded as valid results. Converting rice crops into cassava crops is considered by reference that each person needs carbohydrate's substance in 277 grams/year.

For creating integrated distribution system, in this research is used OpenERP application which take part as automatic distribution from the corporation to customer by the corporation's partners (KUD). Furthermore, suppliers will send cassava to the Bulog Jatim and finally is transferred into customers. Distributed cassava is 60% from yearly crops stock and the remaining portion is distributed to Tapioca Factory to be processed in advance. Technically, customer do sales order to Bulog Jatim and after that they are sent to customers' location.

Last process is report making for distribution and product movements from Bulog Jatim to end customers. Information specification that is displayed consists of cassava's stock in Bulog, in and out cassava's quantity and cassava income to every town.

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