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Logistics Information System for Supply Chain of Agricultural Commodity

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Abstract

The use of agricultural logistics information system in the context of supply chain management can be a strategy to ensure the success of an optimal distribution of agricultural commodities. The surveys conducted in 6 traditional markets in Yogyakarta show that service indicator is indispensable in the process of distribution. Agricultural logistics information system development is expected to support the optimization of the agricultural commodity distribution in the right quality and quantity, at the right location and right time. The agricultural logistics information system requires architectural system which consists of conceptual model, Functional architecture, Physical architecture and Communication architecture
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1. Introduction

The distribution of agricultural products still encounters many problems, such as relatively large product price diversity, long marketing chain, non-proportional profit margins, quality and assurance of products availability. Distribution is all aspects of product delivery from producers to consumers ranging from inventory issue, warehouse selection, to transportation planning. A business is often faced with distribution and inventory uncertainty. The same issue also occurs in the management of agricultural commodities. Conceptually, agricultural commodity supply chain is an economic system that distributes benefits and risks among actors involved in it. The linkage of various processes must be able to create additional value, so that each business actor can coordinate his activities with optimal quantity, location and time. Failure on the agricultural management may lead to declining or even loss of value of a commodity being distributed. A decline in or loss of agricultural commodity value, both on the quality and quantity, may occur due to changes on time-distance or temperature dimension as well as means of transportation used in each chain of distribution activity. Therefore, the use of technology in the form of agricultural

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logistics information system is expected to be able to minimize the problems in determining inventory level and distribution.

2. Literature review

Supply chain management of agricultural commodities is faced with uncertain fluctuating demand which raises the risk of supply shortage and excess. A supply chain consists of activities performed by several actors; hence, the management is not easy. The increasing complexity of the problems must be followed with proper consideration in the management of product, financial, and information flows in the entire supply chain environment. In the context of SCM, a reliable system is needed to support the realization of the above objectives. The use of Information and Communication Technology (ICT) can be one of the strategies to achieve the goals. The rapid development of ICT can be harnessed to support the realization of efficient, integrated and optimum processing control of agricultural industry. The result of the research conducted by Yao and Carlson (1999) shows that the use of ICT increases the effectiveness of the loading-unloading by 6.2%, decreases material handling costs by 5.6%, and increases inventory accuracy by 99.9%. It is also supported by the result of the research conducted by Teklogix (1994) in distribution process. This research shows that the application of ICT increases productivity and throughput by 40% and order fill rates by 99.5%. The literature review in Zhang's research (2011) discusses the positive influence of ICT in the Supply Chain as seen from the aspect of cost, delivery, quality, flexibility, inventory, process improvement, innovation, sales, and finance. The type of technology used are Internet web based, Extranet, E-Business, e-mail and fax, EDI,XML,ADCS-TEDS, electronic board, APS, SFM, ERP, and MRP II.

The use of ICT in the supply chain has been shown to provide significant benefits in the process of information exchange. The availability of information will be helpful in decision making. In addition, the presence of ICT is expected to be part of the instrument creating the final commodity price stabilization at consumer level.

3. Methodology

This research examines the supply chain of agricultural commodities in Giwangan traditional market, Bantul market, Gamping market, Godean market, Beringharjo market, and Sleman market. All of the markets are located in the province of Yogyakarta, Indonesia. The agricultural commodities analyzed were vegetables and fruit. Total respondents in this study were 60 traders. In the development of indicators, some issues or aspects which become major components in ICT application such as performance, information, economics, control, efficiency, and service aspects need to be identified (Wetherbe and Vitalari in Whitten, 2002). These indicators are weighted using Likert Scale 1-5. Each of those aspects needs to be described in the form of main variables which contribute or influence the success of policy implementation. Below is the explanation:

a) Performance: The use of ICT in agricultural sector is expected to provide advantages in terms of productivity increase. Thus, agricultural logistics information system has a high feasibility level which in turn will bring benefits to the efforts to improve efficiency in agricultural business.
b) Information: The developed information system must be based on the consumers and management perspectives, where it has information reliability, information assurance, information serviceability, and information responsiveness.
c) Economics: The role of agricultural logistics information system is creating value for agricultural business actors. This system is a new way in developing cooperation among business actors who are connected through internet without any constraints of time and space.
d) Control: Agricultural logistics information system should be able to help business actors in reducing the existing business risks and be a means for the management in managing them.
e) Efficiency: The role of agricultural logistics information system is as a catalyst in efforts to reduce operational costs which eventually will affect profitability.
f) Service: Various long and bureaucratic processes should be simplified with agricultural logistics information system. The system integrates several processes to become faster and more practical.

4. Result and Discussion

The survey result in figure 1 shows that the service factor is a major concern for traders. The result of the survey acts as an indicator of agricultural logistics information system development
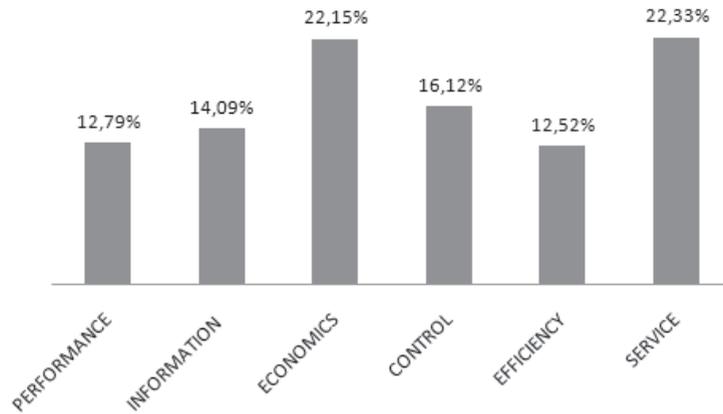

Figure 1. Weighting Results of agricultural logistics information system
Source: Survey, 2011

Agricultural logistics system is developed to integrate agricultural logistics system. The utilization of this system also supports efforts in increasing productivity, controlling or monitoring the movement of agricultural commodities at national, regional, as well as international levels. In the development of agricultural logistics information system, there are three information entities that must be well managed as follows:
a.   Commodity flow information;
b.   Cash flow information; and
c.   Document flow information.

The essence of management of those three information entities is conducting management on data and information attached to each entity. Various agricultural business actors should collaborate with each other to create a good integrated information system. Integrated information system is a system consisting of various interconnected data components, applications, and technologies to support the information needs. The development of agricultural logistics information system is begun with identifying users who need it. Figure 2 below indicates the supply chain of agricultural commodity in Yogyakarta.
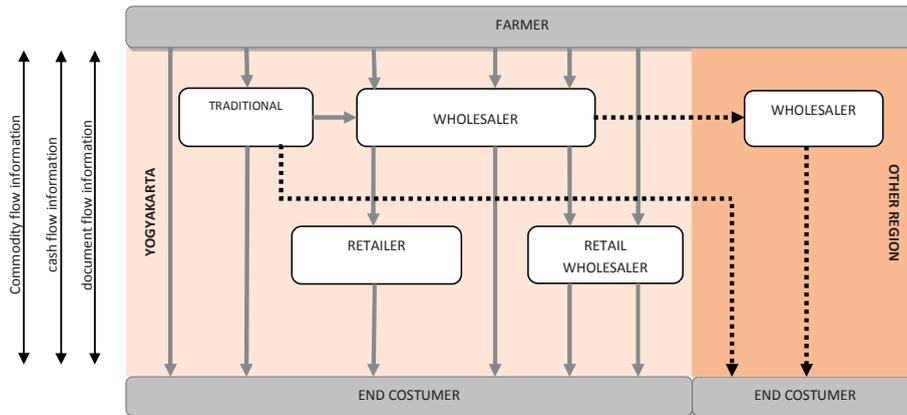

Figure 2. Supply Chain of Agricultural Commodity in Yogyakarta
Source: Survey, 2011

In the development of agricultural logistics information system, an architectural planning is required before the implementation stage is performed. Generally, the architectural components of agricultural logistics information system consist of the following features (Figure 3):
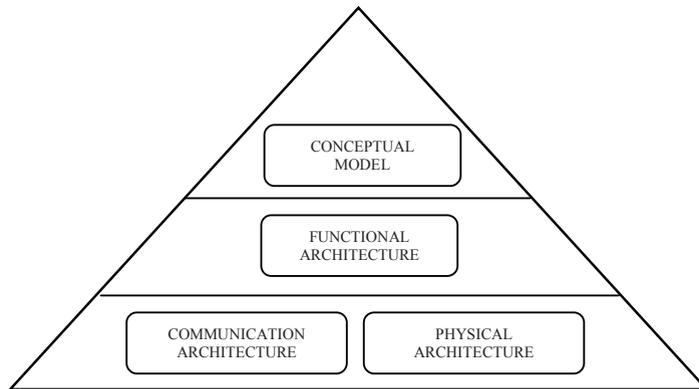

Figure 3. Architectural Component of the System
Source : Themis, 2001

The following is an explanation of Figure 3 (Widodo et. Al., 2011)

a. *Conceptual model* describes the system as a whole and how it works. To support the agricultural information system capability in providing all information needed in decision-making, adequate infrastructure is needed as a means for the information system to process all of the required data into valuable information. Figure 4 is a conceptual model of agricultural logistics information system adapted from a model of information system developed by Mangina and Vlachos (2005)

Infrastructure activity		
Technology Development		
Automation and optimisation of Incoming Flow	Just in time distribution, quality Control in HACCP Food Safety	Retail assistance and consumer information
Various Function		
Material flow management	Shipping order management	Customer relationship Management
Inbound	Outbound	Sales and marketing
suprastructure		
Human Resources Management	Politic	Regulation

Figure 4. Conceptual Concept of Agricultural Logistics Information System

b. *Functional architecture* consists of a series of diagrams and specifications that describe the function or process required to meet the users' needs. Functional architecture is defined as an arrangement of all functions which becomes a necessity that must be met by a system. Structurally, it is divided into two parts, those are functional area which is common coverage function area of several functions and functions which mean transformation of system necessity that manage the users' needs from the existing systems. From this function grouping, a physical architecture which is a translation of functional architecture and communication architecture of the

system can be developed. The scope of agricultural logistics information system is described by figure 5 below.
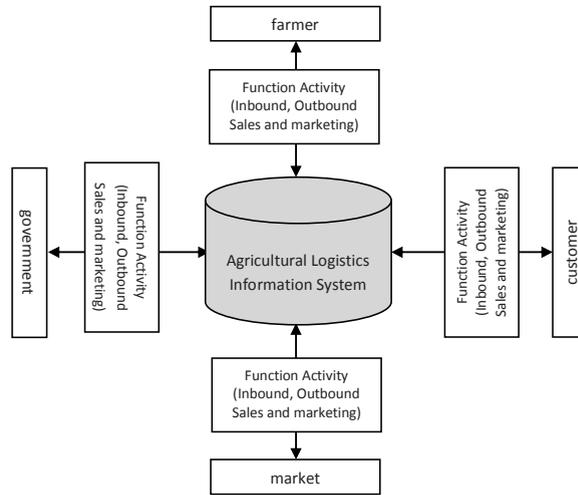

Figure 5. Functional Activity

c. *Physical architecture* consisting of a series of diagrams and specifications of physical components and its location as well as the specific functions performed (Figure 6)
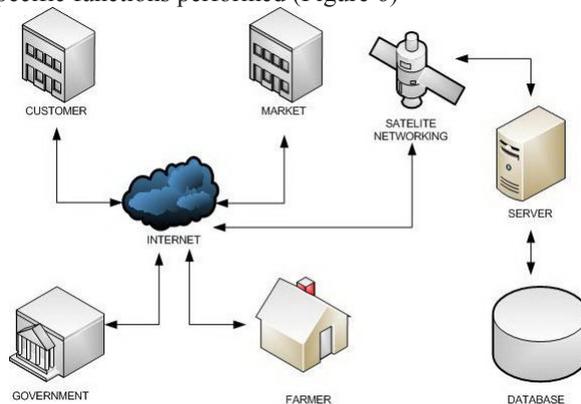

Figure 6. Physical architecture

d. Communication architecture is an analysis of the communication system needs that is used to connect different locations according to the physical architecture. Broadly speaking, there are three types of inter-organizational communication systems based on the infrastructure topology as follows:
   1) Intranet - internal corporate network which connects central office with geographically separated branch offices.
   2) Internet - public computer network which serves as company liaison with customers or prospective customers or markets.
   3) Extranet - a network developed as a means of communication between a company and its business associates.

Communication architecture of agricultural logistics information system is designed as a form of communication that will be used by the users. The form of communication that will be used is determined by many factors including the type of application, users, and users' location.

5. Conclusion

Agricultural logistics information system is a production and distribution activity network of an organization to work collaboratively to meet the consumers' demand. The utilization of agricultural logistics information system shall provide a meeting point among availability, proximity and ease factors which can be realized through good coordination, cooperation and collaboration among business actors. All players must be positioned as partners that are realized in the cooperation with a common goal through mutual trust and open attitude to meet long term development. In arranging agricultural logistics information system, all factors involved in supply chain process of agricultural business must be used as a reference. In other words, an information system should be able to translate a simple to very complex system as a whole into operational decisions. The utilization of agricultural logistics information system has become a necessity in globalization era and global competition. Policies on agricultural logistics information system utilization are expected to provide benefits in the management of agricultural commodity supply chain starting from production, storage, distribution, until wholesaler and final consumers level. In principle, the structure of agricultural logistics information system should be able to accommodate two important decisions both from the producer's and the consumer's point of view. From the producer's side, it is important to consider how products can be available and well distributed, and from the consumer's side, how they can obtain a good quality product, on what location, and at what exact time becomes the main concern.

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