

# Designing Information System To Support Business Process Improvement In A Small-Mid Size Bottled Drinking Water Industry

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**Abstract.** Due to inefficiencies of the business processes in small-mid size of bottled drinking water industries, it is necessary to improve them. The improvements are carried out in business processes of production, warehouse, delivery, marketing, and finance departments. The main causes of the inefficiencies are the inefficiencies of the business process itself and that the business processes of those departments were not integrated. This paper is concerned with designing information system to support for the integration of those departments. First, we mapped the business process of each department using flow diagram. Then analyze the inefficiencies of each department. Next, we redesign the business processes and standardize them. The next step is integrating the business processes by designing the information system. We design the information system modular. The modules are marketing module, production module, logistic module and finance module. Data Flow Diagram (DFD) is used to model the system. Relational database management system (RDBMS) is used to design the database. User interfaces are built to ease in using the program application. The outputs of the information system are reports and documents in monitor screen view and in printing. The validation showed that the information system designed can support the business process improvements.

**Keywords:** business process improvement, integration, information system, small-mid size of bottled drinking water industry

## 1. INTRODUCTION

This research based on the field study in a small-mid size bottled drinking water industry located in Karanganyar, Central Java, Indonesia. In that industry -like other small-mid size bottled drinking water industries-, it was found that many inefficiencies of business processes. It was found that there were many problems which causing inefficiencies of business processes (Sutopo et al, 2006).

The main problems found:

- In the production department; lack of quality control, ordering materials without document transaction, and stock out of gallon bottle which causing production delay.
- In the logistics department; flows of gallon bottle between manufacturer, distributor and retailer were not effective and causing gallon bottle were not adequate

when needed in production. Besides, lateness of delivery, the delivery to distributors using unsuitable document transaction and unadequate delivery vehicles.

- In the marketing department; lacks of coordination with the production department and distributors causing the service level target couldn't be achieved.
- In the finance department; there were for standard procedures for payment which causing many difficulties.

In management data, they were paper-based and using spreadsheet and word processor to store data and to make document. By designing proper information system, it will help management to improve business process based on standardized business process, manage data and documents better.

In market, many software developed to support the business processes, such as WebERP, Global Shop

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Solutions, SAP Business One, Dolibarr, Compiere and Microsoft Dynamics NAV (wikipedia, 2008).

Due to the limitations of small-mid size industries in Indonesia, such as: less ability in using computers and English, many customizations needed for implementation and limited budget provided, there are many difficulties to implement software available in market. So it is necessary to develop an information system that proper with the condition.

So the problem formulations were:

- (1) What factors were casing the inefficiencies in the business processes in the small-mid size bottled drinking water industry?
- (2) The need to propose integrated business processes in the industry?
- (3) How to design an information system based on the proposed integrated business processes?

**2. METHODOLOGY**

The methodology begun with data collection in those departments. Business processes of each department were mapped using flow diagram. The performance of each department were measured and analysed the ineficiencies. Factors that most influence the performance identified as Key Performance Indicator (Vereecke & Muylle, 2006). Next, the business processes were redesigned and standardized.

The next step is integrate the business processes by designing the information system modularly. Data Flow Diagram (DFD) were used to model the system. Relational database management system (RDBMS) were used to design the database. User interfaces were build to ease in using the program application.

**3. DATA COLLECTION**

The data collection method was direct interviews with: the person in charge of each department in the industry and

focused in production, logistics, marketing and finance departments. The reason is we found many problems in those departments.

**3.1 Performance Measurement**

In this research, performance measurements were used to identify factors that influence business processes performance in the industry. Table 1 shows key performance indicator and categorized in three variables measurement based on Beamon (1999) and Neely, et al (2005). They are resources, process and output.

Resources variables were focused on resources that used as input. They were material and human resources cost. Resources variables were measured with considering minimum requirement and efficiency of resources usage. Flexibility variables were focused in activities yang support the flow production process to get the output as desired. Output variables were focused in results of transformation of the production system and product distribution to customers. The results of the performance measurement are factors that most influence the performance and showed in Table 1.

**3.2 Business Process Mapping**

Based on the KPI in Table 1, it was necessary to determine which part of business processes needed to improve the performance of business processes. The next step was mapping the business processes. Figure 1 shows the initial business processes to know the description of the whole business processes and how a department collaborates with others to perform business processes.

**4. DESIGN**

Based on the initial business processes, we propose a standard business processes. The next step is to design the information system to support the business processes.

Table 1: Key Performance Indicator.

Category	Symbol	KPI	Unit
Resources	R1	Delivery material from supplier	Day
	R2	Total Suspended Solids in Raw Material	Ppm
	R3	Delivery Cost	Rp
Process	P1	Delay	Day
	P2	Production process time	Minutes
	P3	Inventory of material	Day
Output	O1	Product Delivery	Days/delivery
	O2	Product Inventory	%
	O3	Product Defect	%
	O4	Product Payment	Day
	O5	Customer Service Level	%



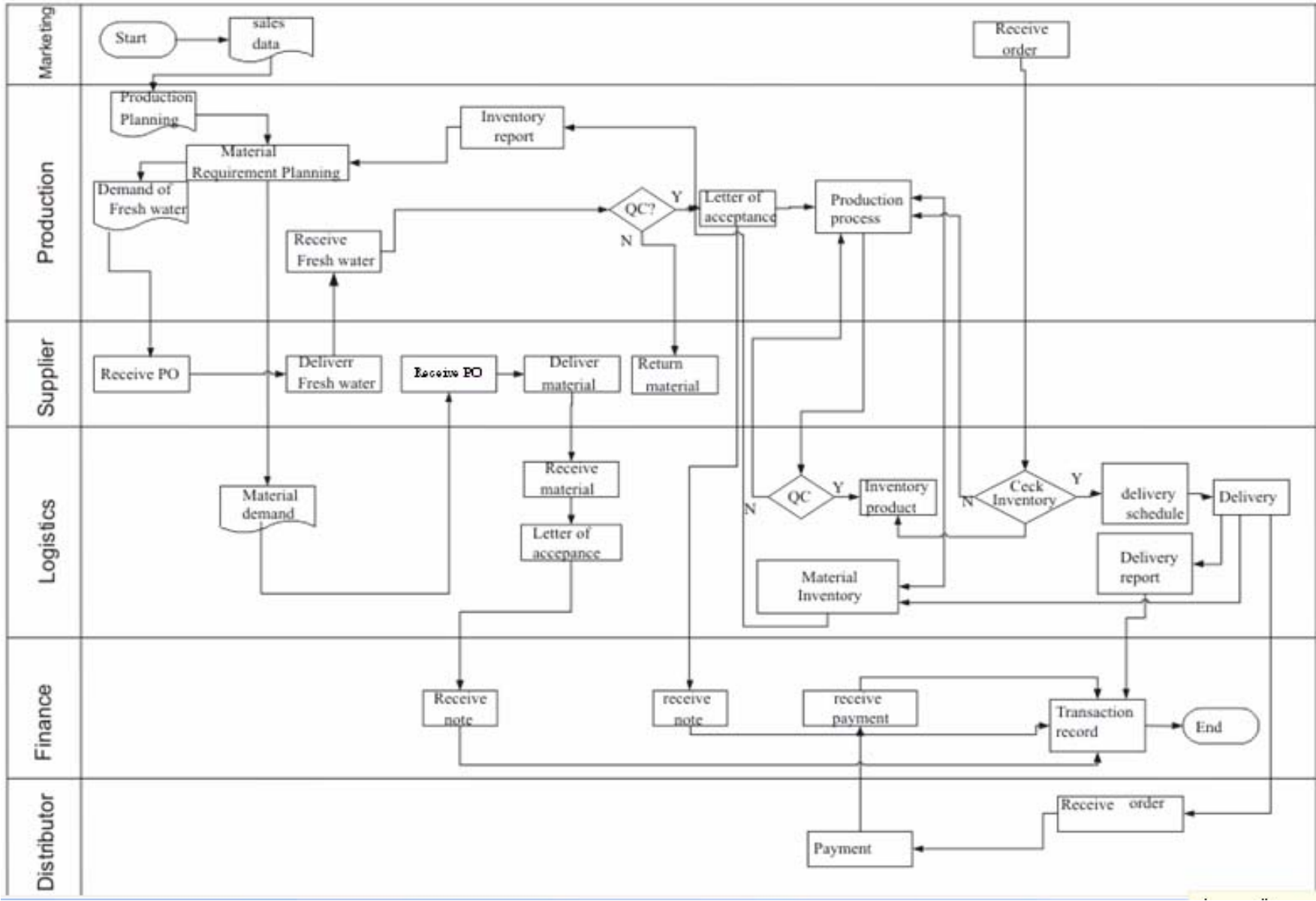


Figure 2: Proposed Business Process

#### 4.1 Business Process Proposed

In this step, we proposed to standardize the business processes. Figure 2 shows the proposed business processes. Comparing Figure 1 and Figure 2, it shows that the proposed business processes begin production considering sales data, production planning and inventory, while the initial do not consider them. It also shows that coordination between departments were less in initial business processes. It causes many problems in the industry. To support the business processes improvement well, it is necessary to design an information system. Using an information system makes users easier to manage data, make and control documents and work to support the business improvement.

#### 4.2 Information System

In this step, we model the business processes modularly in 4 modules. They are marketing, production, logistics and finance modules. Because of they designed modularly, so each module began with DFD level 0. We used DFD for modeling the system because DFD is one of the most popular methods for functional modeling approach. The approach was chosen because the nature of the organization which is developed based on functionalities that performed by departments. Besides, we could easier examine processes of the business processes than mapping all entities or objects involved. We use DFD to model them each in level 0 and level 1. Figure 3 and 4 shows an example DFD level 0 and 1, of production module. Based on the DFD of each module, we designed the information system modularly. The application is web-based and using package program AppServ v. 2.5.1. This package includes Apache as the web server, and PHP as the scripting language and MySQL as database server.

##### 4.2.1 Database

We use RDBMS (Relational Database Management System) concept to support the business processes. This concept chosen because it is familiar to software developers and there are many application exist, include open source applications. Based on the DFD developed of each module, we design tables needed in database and after normalization process we need 23 tables.

##### 4.2.2 User Interface

User interface is designed to ease user to interact with the information system. The user interface is written in Bahasa Indonesia, because the users are Indonesian. The user interfaces designed are 9 forms for master data and 16 forms for transaction data; 16 documents and 17 reports.

The outputs of user interface are in monitor screen and in printer. Figure 5 and 6 are examples of user interface for login and production module respectively.

#### 5. VALIDATION

The aim of validation is to ensure that the information system can perform as it should be. The validation was conducted using dummy data.

The information system designed should be able to:

- a. ease data management  
This validation was performed to know whether the database designed is useful as it wished or not. The validation tested the basic function of database.
- b. ease document making and control  
This validation was performed to know whether the information system can produce documents as needed, and control the documents. The validation was performed by retrieving data from database, producing documents, previewing them in monitor and printing them.
- c. support the business improvement  
This validation was performed to know whether the information system designed is useful to support the business improvement.

The results of validation was that the information system can perform and able to reach goals mentioned above.

#### 6. DISCUSSION

There are several small-mid size bottled water industries in Central Java, Indonesia. Most of them have common characteristics of small-mid size industry, such as: less ability in using computer, small scale production and limited budget. Considering the similarity they have, the methodology used in this paper should be able to be applied in these industries.

This paper has limitations due to the system analysis held only in one industry, although generally they have similar characteristics. The prototype of information system developed should be able to support general operations in these industries, but for implementation, it is needed some customization. And the features for customization are not available in this research yet.

#### 7. CONCLUSION

This paper proposed a methodology for business process improvement in a small-mid size bottled drinking water industry by designing information system. The steps are: map the business processes, analyze the inefficiencies of each departments, redesign and standardize the business processes, and then design the information system to

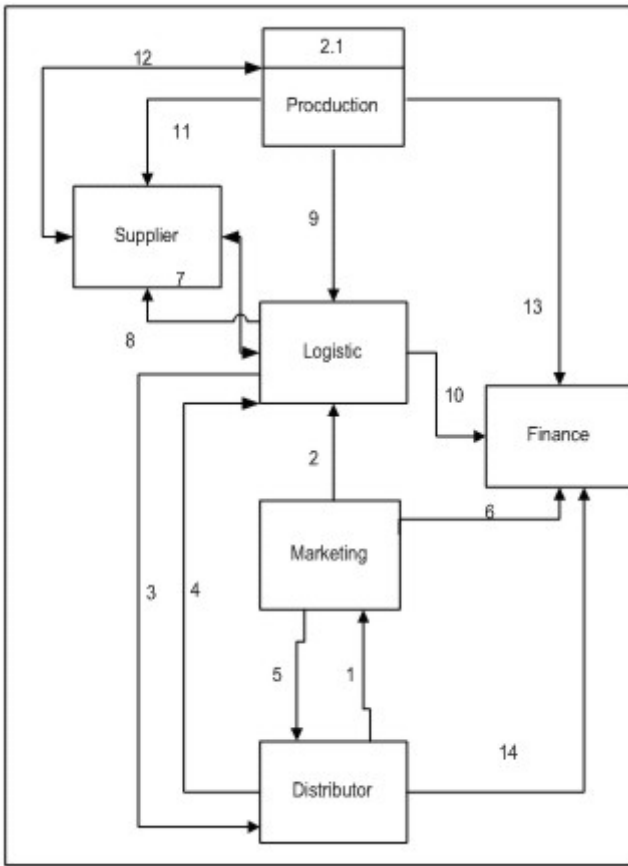


Figure 3: DFD Level 0 of Production Module

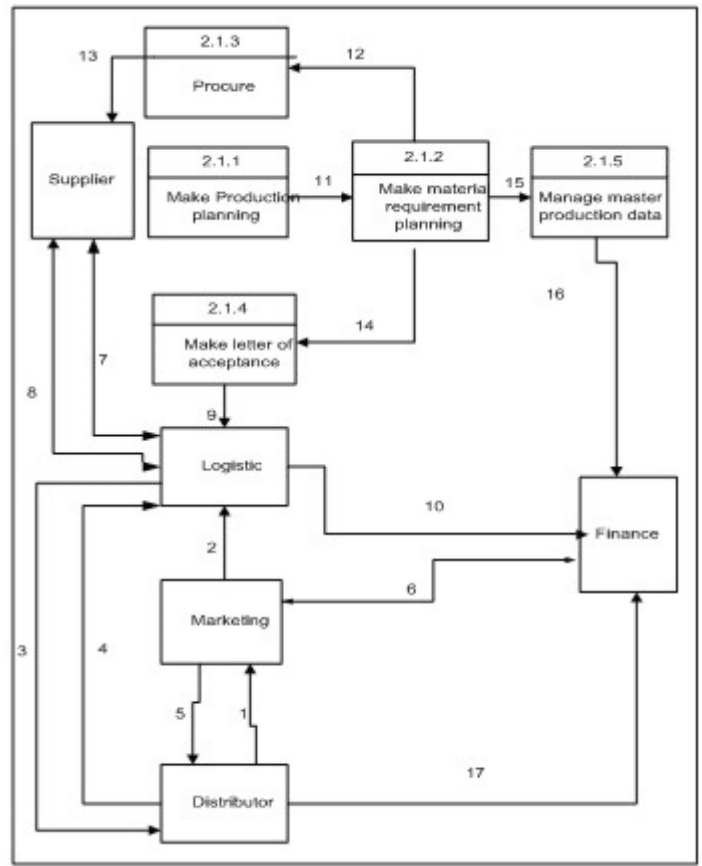


Figure 4: DFD Level 1 of Production Module



Figure 5: Login



Figure 6: Production Modul

support the business process improvement. The information system proposed is designed modularly.

The steps in designing the information system are: model the system (in this paper using DFD), design the database (in this paper using RDBMS), design the user interface, develop the information system, and validate the information developed.

The results of the validation showed that the information system can perform the aim of this paper.

Further research will focus on other Business Process Improvement problems; such problems include the integration of transportation management system and the supplier-buyer management.

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## REFERENCES

Beamon, B. M. (1999) Measuring Supply Chain Performance”, *International Journal of Operations and Production Management*, Vol. 19, No. 3, 275-292,.

Irmansyah, F, Introduction to Database (Pengantar Database), [www.ilmukomputer.com](http://www.ilmukomputer.com). Copyright © 2003 IlmuKomputer.Com

McLeod, R., Jr. and Schell, G.P. (2004) *Management Information Systems*, 9<sup>th</sup> edition, Prentice Hall, Inc.

Neely, A., Gregory, M. & Platts, K.. (2005). Performance measurement system design: A literature review and research agenda. *International Journal of Operations & Production Management*. Vol 25, No. 12, pp. 1228-1263.

O’Leary, D. E. (2000) *Enterprise Resource Planning System: System, Life Cycle, Electronic Commerce, and Risk*. New York: Cambridge University Press.

Sheikh, K. (2002) *Manufacturing Resource Planning (MRP II) with introduction to ERP, SCM, and CRM*. Singapura: McGraw-Hill.

Sutopo, W., Hisjam, M. and Marhama, L .(2006). Pengembangan Usulan Proses Bisnis Terintegrasi Produk Air Minum Ciryu dengan Konsep BPR di CV Titian Mandiri, *PERFORMA*, Vol 5 No. 1, pp. 76-86.

Vereecke, A. & Muylle, S. (2006). Performance improvement through supply chain collaboration in Europe,

*International Journal of Operations & Production Management*. Vol. 26, No. 11, pp. 1176-1198.

Wikipedia accessed October 20, 2008, <http://en.wikipedia.org/w/index.php?title=Special%3ASearch&search=ERP+for+small+enterprise&ns0=1&ulltext=Search>

Wise, R. (2000). Creating Strategy-Focused Organizations using the Balanced Scorecard. *International Journal of Operations and Production Management*, Vol. 20, No. 5, pp. 272-286.

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