CHANGING THE CONFIGURATION OF BUSINESS INFORMATION SYSTEMS FOR ADVANCED CONTINUOUS REPLENISHMENT IMPLEMENTATION

CASE STUDIES OF INDONESIAN AND DUTCH RETAILERS ON CONTINGENCY FACTORS THAT DETERMINE THE CONFIGURATION

DISSERTATION

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Changing the Configuration of Business Information Systems for Advanced Continuous Replenishment Implementation: case studies of Indonesian and Dutch retailers on contingency factors that determine the configuration

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Dedicated to my beloved wife and son,
Ketty and Zaky, and my family
and to the development of
retail industry in my country

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Summary

Competition in retail industry is intensified by the presence of new retail formats that could offer better assortment and prices than traditional retailers. Because of this, they need to improve efficiency in assortment, promotion, product introduction, and replenishment.

Kurt Salmon and Associates' study in 1993 concluded that improvement in replenishment practice would count for 11% of the total savings to be gained from improvement of those aspects. The consulting company stated that the improvement is made by implementing the Continuous Replenishment concept in replenishment activities.

Continuous Replenishment (CR) in this study is defined as a concept in inventory management in which companies continuously update and monitor inventory data so that inventory depletion can be detected quickly in order to maintain product availability with minimum inventory costs. The continuous update of data is done by continuously passing actual data from Point-Of-Sales (POS) to the people / function / organisation / computer application that performs the inventory control and releases Purchase Orders (POs) for inventory replenishment in a real time.

Business Information Systems (BIS) play an important role in the CR practice. The definition of BIS in this thesis includes the aspects of data, data processing activities, and data processing technologies that support those activities.

The BIS configuration in a retail company shows the possibility of CR implementation. The availability of advanced capabilities in a company's BIS would enable advanced CR.

Changes in BIS configuration are not described well and cross-national difference that may influence the adoption of CR principle is not investigated in the existing CR studies. This research is motivated by this situation with the objectives to describe BIS configuration among retail companies that implement CR principle, to identify important contingency factors that influence selection of BIS configuration, and to investigate the extent of national culture influence in the selection of the configuration.

A CR-BIS model is developed as a means to study BIS configuration for CR adoption in five retail companies in Indonesia and The Netherlands. Important characteristics to be studied in CR-BIS are extent (breadth and depth) of data sharing, assignment of inventory management tasks between retailer and supplier and selection of technical solutions (business application and data communication mechanism) to be used in CR practice.

A set of contingency factors in a retail business context are hypothesised to influence the retailer in configuring those characteristics. The causal effect relationship between contingency factors and CR-BIS configuration is the research model in this

thesis. The cultural influence is categorised into two: antecedent and moderation effect. The antecedent effect is cultural influence on contingency factors that influence the condition of the factors. The moderation effect is cultural influence on contingency factors that influence their relative importance in determining the configuration of CR-BIS.

The research model was tested in five retail companies, three in Indonesia and two in The Netherlands. Case study was the research method because the objective was to describe and explain differences in CR-BIS configurations. Semi-structured interviews, non-participant observation, and a document study were the data collection techniques in the case study. Critical Incident Technique (CIT) was used to identify significant changes in the companies that led to changes in CR-BIS configuration. Those changes were described and their impacts on CR-BIS configuration were stated. The influences of contingency factors were assessed in each case and cultural influence is highlighted by comparing the expected contingency factors to be found with the actual contingency factors found in the case study. At the end of a single case study there is a summary of the critical incidents and changes in CR-BIS sub-systems caused by those incidents, important contingency factors and the extent of cultural influence in the case study.

The data shows that four of the five cases implemented the Retailer-Managed Inventory (RMI) style, a CR-BIS configuration in which retailers do not share proprietary data and responsibilities with suppliers in managing their inventory. Only one of them, i.e. Company D, was implementing combination of RMI and SMI. SMI in this company is practiced on the DC level and is limited to fast-moving and premium products.

Cross-case analysis concludes that data sensitivity and suppliers' trustworthiness are the main factors that limit data sharing with suppliers. Data sensitivity is determined by the type and quality of data presentation. The sensitivity is gauged by its strategic value in the retail companies. These companies did not trust their suppliers' in keeping data safe and confidential. The level of suppliers' involvement in the companies' inventory management activities was determined by the added-value of this action. Added-value is a function of the benefits of suppliers' involvement vs. the risks associated with their involvement, including misuse of data; improper handling of data or a data overloaded condition. The technologies that are used to support CR practice were selected for their functionality, flexibility, vendor support, and adoption costs. These characteristics are ranked in order with functionality as the most significant. Functionality is important because the technology should be able to deliver functions needed by the companies to run the CR principle. These functionalities include the ability to capture real time data, update and monitor inventory status, and automatically recognise out-of-stock conditions in the inventory systems. Advanced functionalities include the ability to identify deviations in inventory forecast and to use this information to change sales and inventory plans. Another important functionality is the

ability to receive electronic documents sent through an Electronic Data Interchange (EDI) network and use the information to plan inventory management. Adoption cost was less important because the case companies wanted to have reliable systems even if it cost them a lot of money. The technical solutions selection depends on the existing IT infrastructure in both retailers and suppliers.

From the case study it was concluded that there are five factors that are vital for developing CR practice: data accuracy, suppliers' trustworthiness, IT and logistics infrastructure, and CR knowledge. Data accuracy is the main factor in CR practice. It is difficult to formulate accurate replenishment orders without accurate data. Suppliers' trustworthiness is important because retailers exchange confidential data that need to be kept from competitors and unlawful usage. Capable IT and logistics infrastructure is needed to support the operation. An efficient logistics infrastructure is needed to make quick response to changes in operations. The benefits are greater if suppliers have knowledge on practising CR principle, specifically the knowledge of retailers' operations and the characteristics of the retailers' market.

The extent of cultural influence in the case studies cannot be determined using the measurement done. The expected antecedent effect of culture is found in the Indonesian cases but not in the Dutch cases. The moderation effect of culture is not clear in the case studies as research findings are inconsistent with the expected moderation effect based on the theory of cultural influence on contingency factors and their influence on CR-BIS configuration. Seven possibilities are proposed to explain this situation. From those, two are supported by available research findings. Within these two the researcher state that national culture influence is limited to warehouse level and that the deviation from expected cultural effects is caused by inappropriateness of the company to represent their national culture. The other possibilities cannot be judged by the results of this research because there are data that needs to be collected in order to check their validity. A further study of culture theory is needed. It will result in a more comprehensive understanding of cultural dimensions and their influence on CR-BIS configuration. The output will be helpful for CR-BIS designers in finding an optimal configuration within their context.

Overall conclusion from cross-case analyses are:

1. Technical capabilities cannot be used as a single source in explaining the extent of CR practice in the retail companies; non-technical factors also influence this situation.
2. Technology needs to be treated as an enabler not as a driver, because otherwise it will create a technology-dependent situation that reduces the awareness of companies to maintain data accuracy and performance of other sub-systems.
3. A mutual adaptation approach is recommended for improving CR collaboration with suppliers. Mutual adaptation is intended to balance development of internal and external capabilities. It is important to focus on internal capability before

external capabilities, because the extent of advanced collaboration with suppliers is determined by the readiness of internal systems.

4. The extent of cultural influence cannot be determined from the available evidence. There are different possibilities that can explain this situation. Available research findings can support only two of them: cultural influence is limited to warehouse level or the companies do not represent their national culture. A further study needs to be conducted to examine the applicability of the other possibilities and to get a better overview of cultural influence on contingency factors in configuration of CR-BIS.

List of abbreviations

AR	Automatic Replenishment
ASN	Advanced Shipping Notice
ASO	Automated Store Ordering
ASP	Application Service Provider
BIS	Business Information Systems
CAO	Computer Assisted Ordering
CEO	Chief Executive Officer
CIT	Critical Incident Technique
CM	Category Management
COO	Chief Operations Officer
CPFR	Collaborative Planning, Forecasting and Replenishment
CR	Continuous Replenishment
DC	Distribution Centre
EA	Efficient Assortment
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
EDP	Electronic Data Processing
EP	Efficient Promotion
EPI	Efficient Product Introduction
ER	Efficient Replenishment
HO	Head Office
IDEF0	Integration Definition for Function Modeling
IS	Information Systems
IT	Information Technology
JIPECR	Joint Industry Project on Efficient Consumer Response
JMI	Jointly-Managed Inventory
NDC	National Distribution Centre
NFC	National Fresh Centre
PDT	Portable Data Terminal
PKM	Penentuan Kebutuhan Maksimal (Maximum Order Quantity)
PO	Purchase Order
POS	Point Of Sales
QR	Quick Response
RDC	Regional Distribution Centre
RMI	Retailer-Managed Inventory
SB	Super Bazaar
SKU	Stock Keeping Unit
SMI	Supplier-Managed Inventory

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CHAPTER 1 INTRODUCTION

1.1 Issues in retail inventory management

Competition in retail industry has intensified with the appearance of new players and retail formats, such as mail discounters and electronic retailers. These actors present a significant threat for traditional retailers because they can offer lower prices to consumers (Harris and Swatman, 1997). This pressures traditional retailers to improve their operational efficiency. Kurt Salmon and Associates (1993) found that significant savings in operations were possible when retailers were able to improve their inventory replenishment activities. Retailers' inventory replenishment activity at that time was characterised by forward buying, where retailers order more than they need in order to get a discount from suppliers or to speculate on price. Forward buying was responsible for high inventory costs to retailers (Harris and Swatman, 1997). The consultants mentioned that retailers needed to improve this situation by replacing it with a replenishment practice that uses actual information about sales and inventory. By using actual demand as the basis for replenishment, retailers are able to reduce inventory costs by only keeping products their consumers need. This practice also increases inventory turn-around. The consultants added that the data needs to be continuously updated and monitored in order to improve response to changing consumer demands. Retailers were encouraged to involve suppliers in their inventory management process because they possess knowledge valuable to overall efficiency; including knowledge about products, production and logistics systems.

The use of continuously updated and monitored actual data for inventory replenishment and the suggestion to involve suppliers in inventory management practice are two characteristics of modern inventory management (Kotzab, 1999; Bowersox and Closs, 1996). Bowersox and Closs (1996) mention that the use of relevant data avoids problems associated with forecast data in traditional inventory management practice. Dependence on forecast data limits retailers' response to stock level changes. They need to use a lot of safety stocks to avoid loss in sales and this results in high inventory costs. This problem is mitigated in modern inventory management by using Information Technologies (Knorr and Neuman, 1992). Technologies such as data scanning, data processing and data communication systems give support for timely data processing activities. Using this technology, companies become well-informed about changes in stock level and are able to adapt their inventory systems quickly. Improvement in reaction to changing stock levels reduces the need to acquire safety stocks and enables companies to reduce inventory costs, improving efficiency in fulfilling consumer demands.

This IT-enabled inventory replenishment program is known by several names. ECR Europe, JIPECR (1998), Andraski (1994) and Kurt Salmon and Associates (1993)

call it the Continuous Replenishment (CR) program. Daugherty, *et al*. (1999) and Stank *et al*. (1999) called it the Automatic Replenishment (AR) program, and Fiorito *et al.* (1995) called it the Quick Response (QR) program. CR is used to represent those terms in this study because this term better represents the requirement to continuously update and monitor inventory data as mentioned above.

There are two characteristics of this IT-enabled inventory management practice, the use of continuously updated and monitored actual data for inventory replenishment and the involvement of suppliers in inventory management activities. In the literature, the first requirement becomes the basic principle of CR implementation whereas the second one is considered an advanced feature (Tyan and Wee, 2003; Involvation, 2002; JIPECR, 1998).

Retailers are adopting the basic principle of CR, but only a few involve suppliers in their inventory management practice. This statement is supported by studies in different countries. Stank *et al.* (1999) conducted a study in the American grocery industry and found that only large retailers adopted advanced CR practice. Ellram and Hendrick (1995) found that American retailers lacked the motivation to adopt advanced CR practice. Kurnia and Johnston (2003) conducted a study in the Australian retail industry and found that retailers were not enthusiastic about pursuing advanced CR practice. Pramatari *et al* (2002) found advanced data sharing between retailers and suppliers in Greece was limited to major retailers. They also found that this co-operation was conducted on Distribution Centre (DC) level. The authors were conducting a study on how to extend the cooperation to store level. This finding was also reported in The Netherlands. From ECR Nederland report (ECR Nederland, 1998) it was found that advanced CR practice was not common for Dutch retailers. They are more motivated to adopt Category Management (CM)[1] practice with suppliers in order to improve sales performance. Advanced CR collaboration among Dutch retailers was only reported in one instance and was limited to the DC level. In Germany, it was reported by Brochert (2002) that German retailers were still learning about implementing advanced CR practice at the time of his article, despite the fact that CR was introduced in German in 1994 and retailers have sufficient infrastructure to support advanced CR practice. Tyan and Wee (2003) reported similar findings in the Taiwanese retail industry that advanced CR adoption was not common among retailers even though CR has been known for 6 years at the time of their study.

A logical question regarding this identical finding is why advanced CR practice is not conducted by all retailers and what factors keep retailers from practising advanced CR implementation with suppliers. A literature study was conducted in order to gain state-of-the-art knowledge on this issue. The findings are presented in the next section.

[1] Category Management is a product management practice in which product category instead of brand is used as the basis for resource allocation in the practice

1.2 State-of-the-art knowledge

Discussions about the issue, i.e. the slow adoption of advanced CR practice, in literature are taken from three perspectives. The first perspective explains this situation by examining internal conditions of retailers and suppliers. The second one explains this situation by measuring the economic value of practising advanced CR cooperation from the perspective of retailers and suppliers. The third perspective explains this condition by investigating the nature of the retailer-supplier relationship. The following provides an overview of these perspectives.

1.2.1 Perspective 1: Retailers' and suppliers' internal situation

Advanced CR practice requires certain conditions of organisation structure: human resources, Information Systems (IS) and logistics infrastructure within the adopting companies. Companies need to redesign these elements if they do not support the practice of advanced CR cooperation.

Collins (1997) stated that a barrier in CR practice is the organisational structure of retail companies. He states that the traditional organisational structure with functional silos is still common in retail companies. Different functions in organisation have different and conflicting objectives. They also have different data formats (Collins, 1997), which makes coordination for inventory replenishment difficult. The author suggests companies break functional silos in organisation to allow continuous and uniform data flow for inventory replenishment (Collins, 1997). He also states that a lack of skills in human resources reduces the opportunity to adopt advanced CR practice. He mentions that CR introduces new business practices that require new demands from human resources. These include cross-functional communication and fast decision-making skills. Collins (1997) mentions that these skills are still missing in retail companies. Martin (1995) added that 'people skills' in retail companies count for a high percentage of barriers in CR implementation.

The internal condition of suppliers also influences the adoption of advanced CR practice. Kurnia *et al*. (1998) mentioned that inflexible Information Systems and incapable logistics systems in suppliers were the main reasons why European and American retailers did not adopt advanced CR practice with suppliers. A lack of flexibility in suppliers' IS infrastructure becomes a barrier in receiving data from retailers. They will not be able to receive timely information about changes in retailers' stock level if they do not have flexible IS infrastructure. Angeles and Nath (2000) added that flexible IS infrastructure in business partners enables reliable communication between the two parties. Kurnia *et al*. (1998) also found that suppliers' logistics infrastructure was not capable to appropriately respond to those changes. The infrastructure was not designed to support frequent deliveries to retail warehouse as a consequence of advanced CR practice.

1.2.2 Perspective 2: Economic value

This perspective investigates the economic value potentially gained by retailers and suppliers from advanced CR practice. Economic value is calculated from the benefits and costs or risks obtained by retailers and suppliers if they develop CR practice to a higher level. The hypothesis is that slow adoption is caused by unequal, unclear, and/or unreliable values for both parties. Huang and Gangopadhyay (2004), for example, mentioned that often data sharing relationships between retailers and suppliers did not occur because it is more beneficial to suppliers than to retailers. Inversely, Vergin and Barr (1999) mentioned that suppliers could not justify the added-value of advanced collaboration with retailers in inventory management. They state that the practice only transfers supply chain costs to suppliers. From these examples it can be said that the value of advanced CR practice is not always clear to both parties. Due to this uncertainty, they are reluctant to adopt advanced CR practice. Kurnia and Johnston (2000) summarised that differences in benefits, costs and risks are the barriers to advancing CR practice.

1.2.3 Perspective 3: Nature of retailer-supplier relationship

A relationship between retailer and supplier is characterised by power and trust. Scholars in this group analyse power and trust balance between both parties to explain the slow adoption of advanced CR practice. Hart and Saunders (1997) defined power as capability of a company to exert influence over another company to act in a prescribed manner. The authors mention that power use could negatively effect the adoption of advanced CR practice. When a call for advanced CR practice from the first party is considered by the second party as a mechanism to increase the other's influence then it is possible that this relationship will not take place (Hart and Saunders, 1997). This might not happen if there is a power balance between the two parties. A power balance describes a situation where there is no big gap in terms of power between retailer and supplier in the market. Hogart-Scott (1999) mentions that power balance needs to be maintained in relationships of retailers and suppliers if CR practice is to be advanced to a higher level. Another important factor in the retailer-supplier relationship that influences the adoption of advanced CR practice is trust. Trust is important because companies share sensitive data. They expect partners who receive the data will use the data in a way they agree on. If this cannot be assured then advanced data sharing relationship will not take place (Hart and Saunders, 1997).

1.3 Research areas to be explored

The three perspectives explain why retailers do not adopt or initiate advanced CR partnership with suppliers. However, this explanation is not enough for the following reasons:

1. These studies focused on data sharing between retailers and suppliers, but do not describe data processing tasks and data processing and communication technologies involved in any data sharing relationship. There are situations where retailers share similar data to different suppliers, but the suppliers' responsibilities regarding data processing are different. There are also situations where retailers use different data processing and communication technologies in their relationship with different suppliers. These aspects are not well-described in the CR body of knowledge despite the fact that data, data processing tasks and data processing and communication technologies are integrated aspects in CR practice. It is necessary to make a comprehensive study of these aspects to identify different configurations that exist in CR practice. The aspects are parts of Business Information Systems (Feurer *et al*., 2000; Scheer, 1992; Zachman, 1987; Welke, 1977). Thus, a study needs to be conducted on BIS that is used in CR practice as a whole in order to properly describe its configuration.
2. The development of BIS configuration in relation to the objective to advance CR practice was not described in these studies. For example, it was mentioned in a study that IS infrastructure in retailers and suppliers is not flexible enough to support data communication, but it was not mentioned whether the company changed their IS infrastructure so that it fits CR requirements. Study on this development is required in order to know whether companies are able to maintain a balance between the aspects of BIS for an effective BIS configuration development.
3. There is lack of knowledge about cross-national differences in terms of BIS configuration used in practising the CR principle and the factors that influence companies to choose a specific BIS configuration. Available evidence is based on single country studies, with a notable exception of the work done by Kurnia and Johnston (2000) in which they compared contingency factors in selected American and European retailers that influenced adoption of Efficient Consumer Response (ECR) within those retailers. Because CR is a global initiative it is sought to obtain understanding on cross-national differences so that these factors can be taken into account in cross-national transfer of CR knowledge and best practices can be realised effectively.

The limitations mentioned above indicate that a cross-national study that focuses on BIS configuration in companies for adoption of CR principle and the factors that influence those companies in selecting the configuration is required in order to enhance CR body of knowledge.

1.4 Research motivation and positioning

The development toward adoption of the CR principle is enabled by the improvement of all aspects of BIS. The existing studies of BIS development in CR practice tend to focus on the data aspect of BIS only. Accordingly, knowledge about factors that influence advanced CR adoption is not complete. This makes it difficult for companies to analyse their situations in order to improve their CR practice. This research is done with a motivation to study changes in all aspects of BIS when companies advance their CR practices along with factors in the companies' business environment that drive them to instigate those changes. The fact that CR is a global initiative that involves cross-national transfer of CR knowledge and best practices, motivates an analysis of national differences. Because of this the research intends to take a cross-national perspective so that better understanding about BIS for CR practice can be obtained

1.5 Research scope

This research studies BIS configuration used by retailers in practising CR principles. Configuration is defined as arrangement of aspects within BIS (Nasution *et al*., 2002). Aspects are defined as the elements considered in BIS (van Slooten, 1995) or components of BIS (Falkenberg *et al*., 1998). These include data, data processing tasks and data processing technologies. Derivation of these aspects is described in Chapter 3. Thus, BIS configuration is defined as arrangement of data, data processing tasks and data processing technologies to fit the context of BIS applications. The aspects are arranged by characteristics. Important characteristics of aspects considered, depends on the context of BIS application. Consequently, there are particular characteristics of data, data processing tasks, and data processing technologies in the CR context that should be considered as these distinguish BIS configuration between retailers. The arrangement of these characteristics yields specific CR-BIS configurations. BIS configuration is important because CR implementation is enabled and developed by changing and developing this arrangement. From the configuration people know how the CR principle is executed in companies. Furthermore, potential for advanced CR practice can be analysed from CR-BIS configuration since information about availability of required capabilities for advanced practice can be assessed from the configuration.

This research studies factors in business environments that influence the design of the configuration. Those factors are conceived as contingency factors because the design of BIS configuration is contingent upon them.

Retailers are selected as the focal organisation in this study because they play a central role in CR practice. Their sales and inventory data become the main input and the success of CR practice is determined by the capability of retailers' BIS in providing this data accurately and in a timely manner.

The study is conducted in the context of developing and developed countries. The reason to select those country types is the potential to find significant differences in the status of CR practice, BIS configuration for CR practice, and factors that influence the design of the configuration.

Indonesia and The Netherlands are selected to represent developing and developed countries respectively. The two countries have significant differences in terms of national infrastructure and culture that may influence CR practice within those countries (De Koster and Neuteboom, 2000; Hofstede, 1997; Walker, 1996). Investigation of cultural aspects is justified by two reasons. Firstly, culture has significant impacts on CR implementation (Kurnia and Johnston, 2000; Brockman and Morgan, 1999) and, secondly, culture has significant impact on contingency factors and their influences on the design of BIS configuration (Ginsburg, 2003; Kitayama *et al*., 2003; Hasan and Ditsa, 1999; Huff and Kelley, 1999; Constant *et al*., 1994).

1.6 Research objectives and research problem

The objectives of this research are:

1. To study BIS configuration and its development in relation to CR implementation within Indonesian and Dutch retailers.
2. To investigate contingency factors in the companies' business environment that influence the design of BIS configuration for CR implementation within the companies.
3. To investigate the extent of cultural influences on contingency factors and their influences on the design of BIS configuration for CR implementation within selected companies in the two countries.

The research problem that will be studied in this research is formulated below:

"How do retailers in Indonesia and The Netherlands configure BIS for practising the CR principle and what are the factors that drive them to select those configurations? To what extent do cultural differences affect these factors and their influences on BIS configuration for CR practice?"

1.7 Research strategy

In order to be able to answer the research problem a research strategy is formulated as seen in Figure 1.2.

The unit of analysis is BIS configuration for CR implementation in Indonesian and Dutch retailers. The configuration is described by as the arrangement of BIS aspects. The arrangement describes important characteristics of the aspects for CR context. CR literature is used to find relevant characteristics, and is described in Chapter 2. The aspects and their important characteristics for CR context constitute CR-BIS models.

Additionally, knowledge on contingency factors is necessary to explain the configuration's selection. Specifically, this knowledge is used to explain why companies make special arrangement for those aspects. Since the factors are used to explain the arrangement of those aspects, the aspects, and their important characteristics that fit a CR context, will be considered when identifying relevant contingency factors.

The relationship between CR-BIS model and the contingency factors is illustrated in the research model. The relationships are detailed in a table showing the precise relationship between arrangement of aspects in CR-BIS and the contingency factors. Those relationships are assessed in the field by describing CR-BIS configuration within the case companies. The assessment results are the important contingency factors considered within the case companies when configuring CR-BIS for application of the CR principle.

Identification of contingency factors that potentially influence CR-BIS configuration is used as the basis for cultural analysis in this study. Theoretical foundation of cultural influence on those factors and their effects on CR-BIS configuration will be examined.

The theory would be used to highlight cultural influences in this study. Specifically, it will be applied to investigate the extent of cultural influence.

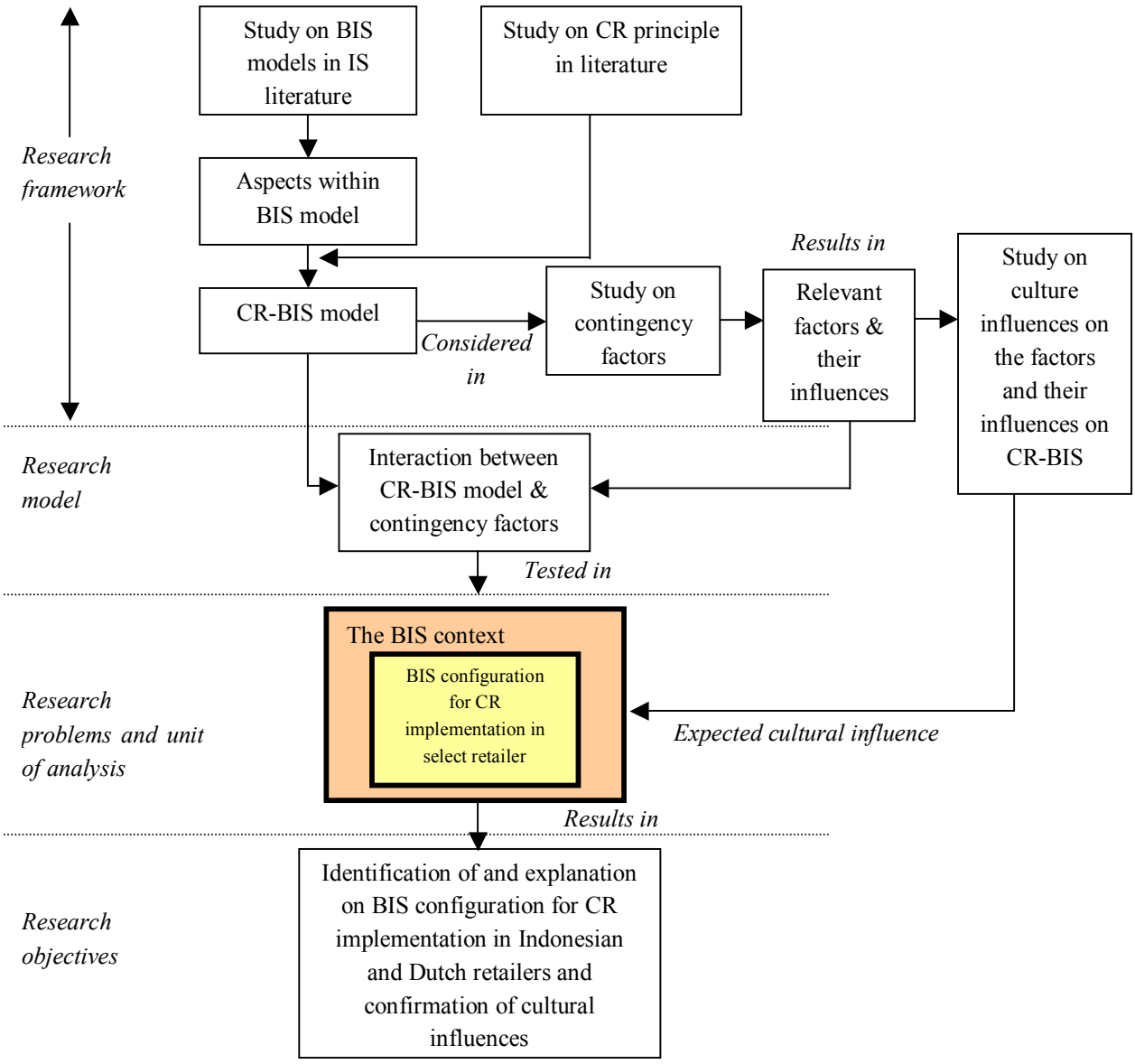


Figure 1.2 Research strategy

1.8 Research concepts

There are three main concepts in this study: continuous replenishment, business information systems and contingency factors. Those concepts are described in the following paragraphs.

1.8.1 Continuous Replenishment

Continuous Replenishment (CR) is defined as a concept in inventory management in which companies continuously update and monitor inventory data so that inventory depletion can be detected quickly in order to maintain product availability with minimum inventory costs. The continuous update of data is done by continuously

passing actual data from Point-Of-Sales (POS) to the people / function / organisation / computer application that performs the inventory control and releases Purchase Orders (POs) for inventory replenishment in a real time. This is considered a basic principle that will be used to justify whether a retailer is truly practising CR. Execution of this principle can occur in three forms (Palmer and Markus, 1999; JIPECR, 1998; Martin, 1994). The first is Retailer-Managed-Inventory (RMI). This is the basic form of CR where suppliers are not involved in retailer's inventory management practices. The second is Jointly-Managed-Inventory (JMI), in which retailers and suppliers share data and responsibility in managing inventory and the final decision for inventory replenishment is discussed by both parties. The last is Supplier-Managed-Inventory (SMI). As implied by the name, this most advanced CR practice delegates all inventory management responsibilities to suppliers. The authority to decide a replenishment order is held by suppliers. Retailers are informed when the delivery is done.

The benefits of shifting from RMI to SMI are reported by Fiorito *et al*. (1995), Palmer and markus (1999), Seidmann and Sundararajan (1997) and McLaren (2002). Those include inventory costs reductions, faster delivery time, and improved product availability. Detailed explanation of the benefits is found in section 2.2.

There are other concepts in literature, such as Quick Response (Fiorito *et al*., 1995) and Automatic Replenishment (Daugherty *et al*., 1999) that are also associated with CR practice between retailers and suppliers. The relationship between CR as defined in this study and those concepts in literature is described in Chapter 2.

1.8.2 Business Information Systems

The Business Information Systems (BIS) term is used in this study to represent systems that consist of data, tasks, and Information Technology aspects arranged to provide relevant data and perform and/or give support for data handling activities in business processes. Data and tasks are always present at the same time and are therefore combined into one sub-system, i.e. the data processing sub-system. Since data processing can be done manually, Information Technology is not always present in data processing activities and forms a separate sub-system, or the technical sub-system.

Due to different applications of BIS in business there are various types found in practice: marketing BIS, logistics BIS and finance BIS, for example. Those BIS are different in terms of data, tasks, and technology requirements and how these aspects are arranged. Similarly, BIS for CR practices are unique because they involve specific data, tasks and technology not found in other BIS types (JIPECR, 1998). BIS configurations for CR practice are different for different retailers because of different environments. The differences can be found in how characteristics of data, tasks and technology are arranged within those retailers.

In the data processing sub-system the important characteristics are the breadth (type of data) and depth of data (detail of data) shared with business partners and the actor that will perform CR-related tasks. Common data types in CR practice are inventory, sales, forecast, and order data. This data can be shared daily, weekly, or monthly depends on agreement between retailer and supplier. A supplier can receive his data or together with his competitors' data. The period and scope of data determine the detail (depth) of exchanged data. CR-related tasks in this study are stock updating, monitoring and decision-making for stock replenishment. Actor of the tasks can be people or a function within the retail company or the retailer's suppliers.

The important characteristics in the technical sub-system are functionalities of business application for inventory replenishment and the mechanism for communicating replenishment-related data with suppliers. Basic functionalities as stated in JIPECR (1998) and Martin (1994) are ability to update inventory status, create forecast and order generation. Advanced functionalities of inventory management application are the ability to perform real-time data updating and accommodate operational exceptions into existing inventory replenishment planning (JIPECR, 1998; Martin, 1994). A more detailed description of CR-BIS structure can be found in section 2.5.

1.8.3 Contingency factors

Contingency factors are defined as factors in a business context that influence the performance of a system in achieving its stated objectives (Donaldson, 2001). Because of this influence, contingency factors are considered in configuring the system. The aim is to ensure efficiency by fitting the system configuration with the condition of the contingency factors.

There are various factors that influence CR-BIS configuration in retail companies. Because of unique environments, the significance of these factors is different for each company. Accordingly, companies in different contexts consider different factors when configuring CR-BIS.

An objective of this research is to identify the factors that influence CR-BIS configuration in the case companies. The contingency factors are grouped into three categories: retailer characteristics, supplier characteristics and industry characteristics. Retailer characteristics include data characteristics (data sensitivity and accuracy), task characteristics (strategic fit of task, knowledge specificity and time specificity), and other characteristics: prior or existing business process configuration, data handling knowledge, technical knowledge, IT infrastructure capability, IT infrastructure flexibility, and relative market power. Supplier characteristics include supplier's trustworthiness, IT infrastructure capability, IT infrastructure flexibility, data handling knowledge, and technical knowledge. Industry characteristics are divided into two categories: IT solutions and IT vendor characteristics and other industry characteristics. The first category contains six contingency factors: functionality, flexibility, adoption

rate, security, vendor support, and costs of adoption and implementation. The second one consists of industry bodies related to CR practice, legal systems, and Application Service Provider (ASP) capability in performing inventory management functions.

Influences of those contingency factors on CR-BIS configuration are described in section 3.3 of Chapter 3.

1.8.4 Culture

Culture is defined as a collective programming of mind that distinguishes members of one group from those of other groups (Feng, 2004; Hofstede, 1997; Erez and Earley, 1993). A group can be an organisation, a society or a nation (Hofstede, 1997). According to Hofstede (1997) national culture can be described along five dimensions: power distance, individualism, uncertainty avoidance, masculinity and time orientation. Description of those dimensions is in section 3.5. The national culture dimensions of Hofstede (1997) are adopted to investigate cultural influences in this study since those dimensions have been studied in relation with contingency factors within this study (see for example Hasan and Ditsa, 1999; Shane, 1995; and Constant *et al*., 1994) and form an accepted theoretical base for it.

An objective of this research is to uncover cultural influence on contingency factors within this research. Two types of cultural influences are identified: antecedent and moderation. Antecedent effect occurs when national culture influences condition of contingency factors that can be stated as high or low. For example, data sensitivity and suppliers' trustworthiness can be considered high or low within a nation because of cultural characteristics of the nation. The condition of contingency factors will affect their importance in a systems design.

Moderation effect occurs when national culture moderate influence of a contingency factor on CR-BIS configuration. A contingency factor can be significant in one nation but insignificant in another nation. This is due to differences in culture of the two nations (Chen *et al*., 1999).

There are contingency factors in this study influenced by antecedent effect of national culture and there others influenced by moderation effect. A detailed description about this can be found in section 3.5.

1.9 Research questions

According to the research strategy stated in section 1.7 there are two steps to be conducted in this research: concept building to make a research model and empirical testing of that model. CR, BIS, contingency factors, and culture are the main concepts in this research. Regarding those concepts there are four research questions to be addressed as follow:

1. What is the principle of CR practice?
2. What aspects constitute Business Information Systems models in Information Systems (IS) literature?
3. What are the main characteristics of those BIS aspects relevant to the CR context?
4. What are the contingency factors that determine the arrangement of those aspects in retail companies?
5. What are the influences of culture on contingency factors and their influences on CR-BIS configuration?

The answers of those questions result in three models. The first model is CR-BIS model. The model describes the structure of CR-BIS. The second is the research model that describes the relationship between contingency factors and CR-BIS and the third is a model of cultural influence in this study. To test the influences of the contingency factors in selected retailers in Indonesia and The Netherlands and to investigate the extent of cultural influence in this research the following research questions are addressed:

6. How to test the influence of the factors in practice?
7. How do the selected Indonesian and Dutch retailers configure their BIS for implementing CR?
8. What are the important contingency factors as perceived by those companies in arranging the BIS aspects?
9. To what extent can cultural influence be identified in the individual cases in this study?
10. What similarities and what differences can be found in these companies in terms of CR-BIS configuration, contingency factors and culture influences?

Question 6 is about the research method design. Considerations in method design are the knowledge requirements and practical situation of retail industry in the two countries. Question 7 describes CR-BIS configurations within selected retailers in the two countries. Contingency factors that drive the selection of the configuration are assessed by question 8. Question 9 is addressed to investigate cultural influence in this study. Question 10 indicates that this research is aimed at making general conclusions from the empirical data. The objective is to increase the applicability of the outcomes and to identify potential future research projects. Parts of this thesis used to answer those research questions will be identified in section 1.11.

1.10 Research design

The method is developed by taking into account the knowledge needed to answer the research questions as well as practical conditions that influence the applicability of specific method. The types of knowledge are described in Verschuren *et al*. (1999). The authors mentioned five types: descriptive, explanatory, predictive, evaluative, and prescriptive knowledge. The research is aimed at generating descriptive and explanatory knowledge. The descriptive knowledge is generated from the description of CR principle, CR-BIS model, contingency factors in CR-BIS configuration, and CR-BIS configuration in the case companies. The explanatory knowledge is companies' explanations about important factors in configuring CR-BIS.

A literature study is used for descriptive knowledge about CR, the CR-BIS model, and contingency factors in configuration of CR-BIS. It is supported by interviews with Dutch and Indonesian experts to check the appropriateness of the concepts and applicability to the field.

Case study is selected as the research method for generating descriptive knowledge on CR-BIS configuration and factors that influence the configuration in the selected companies. This method is selected based on its suitability for building descriptive and explanatory knowledge from the field. Characteristics of case study research appropriate for this study are the ability to employ different data collection techniques as well as the ability to conduct both quantitative and qualitative analyses (Krathwohl, 1996; Yin, 1984). This allows the researcher to take different sources of data to support his findings. Triangulation will be conducted in data collection, and interviews, observation, and document study are the data collection techniques used. The possibility to perform different kinds of analyses gives flexibility to the researcher in building arguments on his findings. This results in deeper insights needed to understand the complex relationship between contingency factors and CR-BIS configuration. A detailed description of the applied data collection and analysis techniques is given in Chapter 4.

Table 1.1 summarises the relationship between research questions, knowledge requirement and suitable research methods. The case study will be executed in parallel as seen in Figure 1.3. The objective is to enable fair comparison between cases since the research model will not be changed when the case study is conducted in parallel; each case will be treated equally. As indicated by the picture, pilot case studies will be conducted prior to in-depth case studies. The objective is to test the comprehensibility and applicability of the research model. The pilot case studies are conducted in Indonesia and The Netherlands by using two companies implementing CR practice, industry experts, and scholars in CR field. Necessary revisions are made based on the output of the pilot case studies.

Table 1.1 Applied research methods

Research question	Type of knowledge	Research methods	Remarks
RQ1: What is the principle of CR practice?	Descriptive	Literature study and expert interviews	This combination was needed because CR was relatively new and there are terms in literature that share similar meaning.
RQ2: What aspects constitute Business Information Systems models in Information Systems (IS) literature?	Descriptive	Literature study	
RQ3: What are the main characteristics of those BIS aspects relevant to the CR context?	Descriptive	Literature study and expert interviews	This combination was needed to check the comprehensibility and applicability of the model in practice
RQ4: What are the contingency factors that determine the arrangement of those aspects in retail companies?	Descriptive	Literature study	
RQ5: What are the influences of culture on contingency factors and their influences on CR-BIS configuration?	Descriptive	Literature study	

Table 1.1 Applied research methods (*Cont.*)

Research question	Type of knowledge	Research method	Remarks
RQ6: How to test the influence of the factors in practice?	Descriptive	Literature study, expert interviews and pilot case study	Practical situation is examined and suggestions from experts were taken into account
RQ7: How do the selected Indonesian and Dutch retailers configure their BIS for implementing CR?	Descriptive	Case study	Triangulation is done for data collection. Case study is done in parallel (see Figure 1.4)
RQ8: What are the important contingency factors perceived by these companies in arranging the BIS aspects?	Explanatory	Case study	
RQ9: To what extent can cultural influence be identified in the individual cases in this study?	Explanatory	Case study	
RQ10: What similarities or differences can be found in these companies?	Explanatory	Case study	

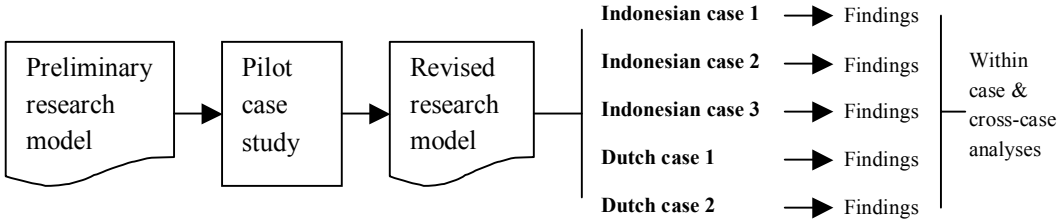


Figure 1.3 Case study execution plan

1.11 Research outline

The research outline is depicted in Figure 1.4. The thesis consists of seven chapters. The first chapter introduces the issue in retail inventory management and how it is dealt with in the literature. A gap in the literature is identified and research is conducted to fill the gap. The gap is formulated in a research problem statement. The research problem indicates a need to study four main concepts: Continuous Replenishment (CR), Business Information Systems (BIS), contingency factors, and culture. CR and BIS concepts are discussed in Chapter 2. This is the answer to Research Question 1, 2 and 3. Contingency factors and culture are discussed in Chapter 3, which will be the answer to Research Question 4 and 5.

Knowledge about CR and BIS is used to develop a model which is then used to identify relevant contingency factors and cultural influences. Before identifying the factors, the contingency notion is defined in order to give a precise definition of the term in this study. The factors and the CR-BIS model create influential relationships, which are proposed to take place in practice. This influential relationship is the research model of this study. The model will be an input to specify a suitable empirical research method. As mentioned in section 1.10 the research method is case study and a case study protocol is described in Chapter 4. This provides an answer to Research Question 6. Empirical data and analyses are presented in Chapter 5. Cultural influence will be highlighted in each case study. The whole description in the chapter is the basis for formulating answers to Research Question 7, 8 and 9. Cross-case analysis is presented in Chapter 6 in order to determine the general BIS configuration and contingency factors and the extent of cultural influence. This is the basis for answering Research Question 10. Chapter 7 contains conclusions from the analyses and recommendations for further research. The answers to Research Question 7 thorugh 10 are provided in this chapter using the basis formed in Chapter 5 and 6.

In terms of order, the research outline depicts different steps to be conducted in this research: problem formulation, framework building, model building, method setting, empirical data collection and analysis, and conclusions. The research outline indicates that Chapters 2 and 3 are the theoretical parts of this research as framework and model are built within those chapters. The framework is created prior to building the research model and gives an indication of different sources of contingency factors to be considered when conducting the research as well as a general relationship between the factors and CR-BIS. These relationships will be detailed and operationalised in the research model.

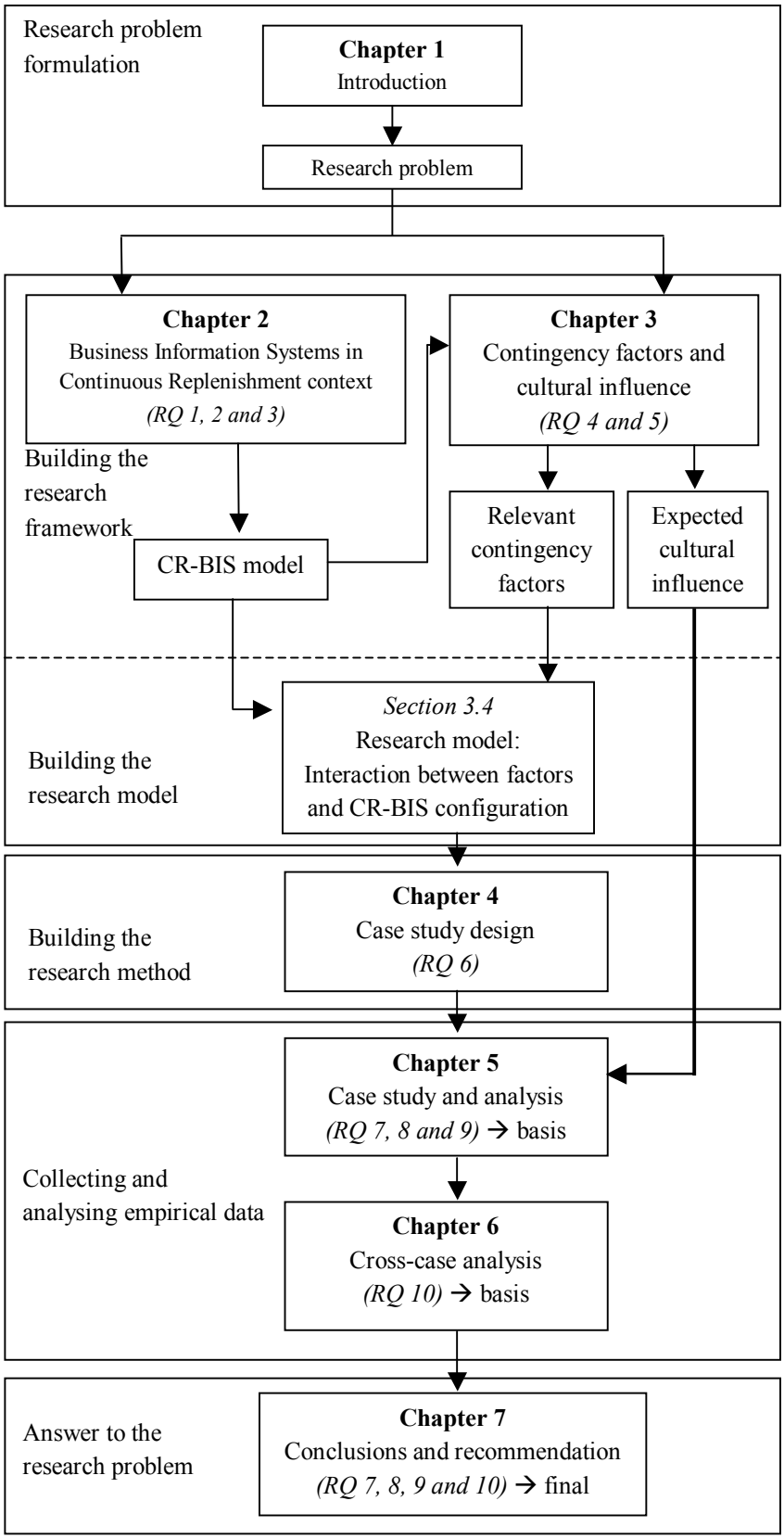


Figure 1.4 Research outline

CHAPTER 2 BUSINESS INFORMATION SYSTEMS IN CONTINUOUS REPLENISHMENT CONTEXT

2.1 Development toward the Continuous Replenishment Concept

Rapid development in production and data communication technology supported by changes in trading relationship, has changed the old paradigm of inventory management. Formerly, stocks were used to anticipate demand over a long period rather than in the short term (Bowersox and Closs, 1996). Nowadays, they are prepared to serve short term demand. Bowersox and Closs (1996) named the old systems anticipatory inventory systems and the new one time-phased inventory systems.

2.1.1 Anticipatory inventory system

This method is characterised by reliance on forecasting data (Myers *et al*., 2000). Based on historical data, companies envisage the demand months or years into the future. Generally, their information is limited to one step ahead; for instance, a supplier may know the demand of retailers but not of consumers. This lack of information causes uncertainties in later stages of the supply chain. The uncertainties can completely deplete stocks or cause a bullwhip effect (Lee *et al*., 1997). Bullwhip effect refers to amplification of demand fluctuation from downstream to upstream parties caused by addition of extra stocks to anticipate uncertainties (Hopp and Spearman, 2001; Lee *et al*., 1997). The additional stocks are (Robeson *et al*., 1994):

- Decoupling/in-transit/work-in-progress stocks, additional stocks to anticipate delays in production or delivery,
- Safety/seasonal stocks, additional stocks to anticipate the uncertainties of demand fluctuations,
- Speculative stocks, additional stocks as a result of speculation.

Because of its high dependence on stocks to anticipate uncertainties, this system is called an anticipatory system. The following pitfalls are inevitable:

- Obsolete historical data causes inaccurately forecasted data,
- Companies respond to something that happened in the past (usually long ago) making it more difficult to analyse the data and accurately forecast for the future.
- The large amount of stocks held by companies, results in high inventory carrying cost.

This practice characterised retail industry in the 90s. It is widely known as forward buying (Harrison and Swatman, 1997). Retailers ordered stocks in large amounts to anticipate uncertainties in demand, to receive discounts from suppliers and to speculate on price. They expected this would help them minimise out-of-stock

probability and to receive more profit from the suppliers' discount. However, this could not be realised when new products were introduced and the demand for old products dropped. As a result, retailers had to cut prices in order to increase sales and give space to new products (Tyan and Wee, 2003). This situation contributed to low efficiency in traditional retail companies. When new retail formats entered the market, they were under threat because the new players were able to offer flexible retail solutions to consumer demands. The key was to use actual demand information for driving inventory management activities (Myers *et al*., 2000; Lee *et al*., 1997; Robeson *et al*., 1994). This gave them insights into consumer demand and the opportunity to adapt their inventory decision in timely manner. In inventory management practice this is called time-phased inventory systems (Bowersox and Closs, 1996).

2.1.2 Time-phased inventory replenishment

This system was enabled by developments in Information Technology (IT). Bar code scanning systems, data warehousing, data mining, and electronic data communication are the main technologies behind this system. These technologies make it possible to update, process, and transfer data in a timely manner. Accurate measuring of demand is improved by continuous data updates. Using advanced techniques for data warehousing and mining, retailers are able to get information about consumer preferences quickly. The same data can be shared with upstream partners to adjust production and delivery planning. Uncertainties and inventory can be reduced. Kurt Salmon and Associate (1993) reported that this would reduce inventory days from 104 to 61 in the total supply chain. This would also contribute to as much as 4% from the total 11% of sales price reductions made by retailers (Kurt Salmon and Associates, 1993).

2.2 Defining Continuous Replenishment principle

The above IT-supported system is associated with different terms in literature. It was first established as the Efficient Replenishment (ER) strategy under the Efficient Consumer Response (ECR) initiative introduced in grocery retail industry in 1993 (Kurt Salmon and Associates, 1993).

Within ECR there are three other strategies: Efficient Assortment (EA), Efficient Promotion (EP) and Efficient Product Introduction (EPI). EA aims at improving product assortment in order to boost profitability of products by helping consumers locate the products in store as well as helping retailers to maximise shop floor utilisation. EP and EPI are done in conjunction with EA. Those strategies are intended to plan promotion and product introduction activities in such a way that they would not reduce the profitability of the old products drastically and for retailers and suppliers to maximise their resource for promotion. ER is focused on improving the replenishment side. The aim is to increase the accuracy and speed of inventory replenishment activities and

reduce costs associated with the activities (Kurt Salmon Associates, 1993). This becomes the norm of ER.

This norm underpins other programs in literature: Quick Response (Fernie, 1999; Fiorito *et al*., 1995), Continuous Replenishment (Vergin and Barr, 1999; Andraski, 1994; Cross, 1993) and Automatic Replenishment (Myers *et al*. 2000; Daugherty *et al*., 1999; Stank *et al*., 1997).

Bowersox and Closs (1996) mention that Quick Response (QR), Continuous Replenishment (CR), and Automatic Replenishment (AR) are on different levels. According to them, QR practice involves continuous update of stocks and orders are released to suppliers as soon as a potential depletion is detected. CR goes a step further. Instead of sending a Purchase Order (PO) to suppliers, retailers send raw sales and inventory data to suppliers and let them determine the time for replenishment (Bowersox and Closs, 1996). Suppliers' authority is extended even further in AR where retailers give suppliers the right to anticipate future requirements according to their overall knowledge of the merchandise category (Bowersox and Closs, 1996, p. 493).

This demarcation, however, becomes blurred in the literature. There is now a common understanding in the literature that QR and CR are independent concepts. Palmer and Markus (1999), consider QR an initiative in the textile industry and CR in the grocery industry. Although CR was inspired by QR it was not considered as an extension of the former concept. Those concepts are used separately and in their development the two terms share similar ideas. Palmer and Markus (1999) describe how QR can be conducted in four levels. The lowest level is when the retailer performs all the responsibilities to make replenishment orders from actual data. This can be extended to higher levels where retailers gradually shift responsibility for inventory management to suppliers. On the middle level, there is collaboration between retailers and suppliers in managing inventory and on the highest level, suppliers completely manage retailers' inventory. On the other hand, JIPECR (1998) also states that CR can be conducted in three forms. The first is where retailers completely manage their own inventories. The second is cooperation between retailer and supplier and the third delegates inventory management responsibility to suppliers. This description indicates little or no difference between QR and CR since those concepts, in practice, can be performed in similar ways.

There is no difference between CR and AR in the literature; the two terms are interchangeable. Myers *et al*. (2000) used AR to define the relationship between retailers and suppliers in which suppliers replenish or restock inventory based on actual product usage and stock level information provided by retailers. This is the same definition used by Cross (1993) to define CR. Specifically, he defines Continuous Replenishment as:

"An initiative that involves *transferring responsibility for buyer replenishment to the supplier* who is provided with actual warehouse inventory withdrawal information or consumption at the stock-keeping unit level. The supplier re-supplies the buyer's inventory to mutually agreed upon and predefined inventory levels"

Although definitions from Myers *et al*. (2000) and Cross (1993) indicate that responsibility to manage retailers' inventory is delegated to suppliers, this conception is not universal in practice. JIPECR (1998) states that there is a difference how suppliers are involved in CR practice. They could receive sales data from retailers, meaning they are responsible for managing retailers' inventory, or they may only get information about order mentioned in Purchase Order (PO) documents.

Thus, the basic principle in CR is to continuously update and monitor inventory data so that inventory replenishment is always based on data that reflects actual consumer demands. The extent of suppliers' involvement is different in practice. This will be decided based on conditions of the business contexts of both parties.

From this description, it is concluded that ER is a replenishment concept on a strategic level and CR/QR/AR are the implementation of ER norms on a tactical level. The CR principle is executed differently on an operational level. There are three ways to carry out the principle. The first is Retail-Managed Inventory (RMI) in which retailers perform the CR principle by themselves. The second is Supplier-Managed Inventory (SMI) in which suppliers replace retailers in managing the inventory. The last is Jointly-Managed Inventory (JMI) in which the two parties consult each other before determining orders for inventory replenishment. Following Palmer and Markus (1999) this practice would evolve from RMI to JMI and finally to SMI. The idea is to extend suppliers' involvement in inventory management practice.

Those relationships are depicted in Figure 2.1.

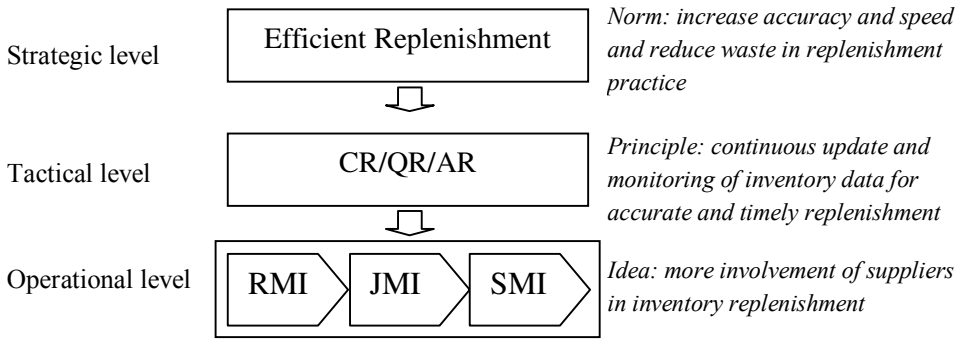


Figure 2.1 Relationship between concepts in time-phased replenishment system

Fiorito *et al*. (1995), and Palmer and Markus (1999), report that shifting from RMI to SMI will benefit retailers. This includes lower inventory costs, faster deliveries, improved product availability, and faster inventory turns. It does not mean however, that suppliers cannot gain benefits from advanced CR practice.

Seidmann and Sundararajan (1997) developed an analytical model based on Game Theory to explain benefits obtained by retailer and supplier in advanced CR practice. The variables in their model are: inventory cost, supplier's strategic and competitive revenue, reduction in retailer's bargaining power, and contractual payment. According to the authors, the benefits received by both parties depend on the following factors:

1. The extent of data shared by retailers electronically. The authors divided data into three categories: operational (order data), strategic (inventory level of supplier's products) and strategic and competitive (Point of Sales data that contains information about supplier's and its competitor's products). Sharing operational data electronically only reduces administration costs, but sharing strategic and competitive data would result in inventory cost reduction and faster response from suppliers due to a better overview of the situation.
2. Suppliers' expertise. Data is shared because retailers expect suppliers can use it more efficiently with their superior knowledge of products. Without knowledge to handle data, the retailer cannot expect added value. Because of data sharing, a supplier may have superior knowledge of regular product performance and may be able to bargain for more favourable price schedules to compensate for the costs of managing retailer's products.
3. The operational economies of scale. Although ordering costs are transferred to suppliers, they can still benefit if many retailers are involved in the SMI practice. Suppliers can then use the same technology, process, and knowledge to handle the demands of all retailers.
4. Position on the supply chain. Equal value sharing is more likely when a firm that is far from the consumer on the supply chain is contracting with suppliers because the firm cannot extract value from suppliers the way retailers do.
5. The type of contract used by both parties. Different types of contracts (long vs. short term, complete vs. incomplete) may end up with different outcomes. A long term contract is better in keeping suppliers' commitments. However, it depends on the supplier market situation. Retailers need to evaluate this situation to formulate an optimal contact with suppliers.

McLaren *et al*. (2002) adds that the benefits created from advanced CR practice also depend on technology used in the collaboration. They formulated a cost-benefit model for calculating net profit of all possible technical arrangements between retailer and supplier in advanced CR practice. According to them, different technology results in different profits. It is then necessary for both parties to examine the consequences of technology selection in their situation (McLaren *et al*., 2002). Other analytical

approaches of SMI benefits can be found in Clark and Lee (2000). The authors report that SMI benefits can be realised if suppliers can manage an optimal shipment from their plant to retailers' warehouses. This is important because SMI practice results in frequent deliveries from suppliers to retailers (Clark and Lee, 2000).

This thesis is not geared toward formulating another analytical model of SMI benefits; the objective is to find contingency factors that create specific CR-BIS configuration in retail companies. However, the researcher will use the insight gained from applying analytical model in CR practice to explain why retailers in this study did not change their CR practice to an advanced level.

The term CR is used in this research because the study is conducted in the grocery industry. Additionally, it better represents the requirement to continuously update and monitor inventory data in the time-phased replenishment systems. This is reflected by the word 'continuous'. The basic principle in CR is to continuously update and monitor inventory data for accurate and timely replenishment practice. This is stated in Definition 1 below.

Definition 1: Continuous Replenishment
Continuous Replenishment (CR) is an initiative in inventory management in which companies continuously update and monitor inventory data so that inventory depletion can be detected quickly in order to maintain product availability with minimum inventory costs. The continuous update of data is done by continuously passing actual data from Point-Of-Sales (POS) to the people/function/organisation/computer application that performs the inventory control and releases Purchase Orders (POs) for inventory replenishment in a real time guided by predefined procedures to minimise waste.

To summarise, the principles of CR implementation are as follow:

1. Continuous update of stock level made possible by continuous data flow from POS terminals to the replenishment decision-making point (people / function / organisation / computer application),
2. Continuous monitoring of stock levels by responsible party (people / function / organisation / computer application) to ensure appropriate decisions in inventory replenishment,
3. The use of predefined procedures and settings in decision-making to avoid any waste caused by forward buying activity.

These principles will be used to judge whether the retailers are practising CR. This information is used to demarcate the time before and after CR implementation in the companies. The objective is to analyse how these companies develop and configure their BIS in order to implement CR.

The norms of other strategies in ECR (EA, EP, and EPI) are carried out by Category Management (CM), which is intended to increase profitability of products in store by focusing on managing product category instead of brand. Between the two are practical differences listed in Table 2.1. CR intends to improve product's availability, but with minimal inventory. Companies are expected to reduce inventory levels when they practice the CR principle. To achieve this objective companies need to use real time data to monitor fluctuations in stock levels to determine when to make a replenishment order. Companies are supported by inventory management application, automatic store ordering and exception handling in practising the CR principle. CM has a somewhat different objective. CM is also expected to improve company's product profitability. It is possible, by grouping in categories that match consumers' preferences and locating the categories in specific places, to find products easily and conveniently. The data requirements of CM are less time-critical. Analysis of consumer behaviour requires more time than stock level analysis. Therefore, data collection in CM practice is done over a longer period. In terms of business applications, companies need applications for market basket analysis, space management and product grouping in doing the analysis.

Table 2.1 Differences between CR and CM
Source: AC Nielsen

Dimension	Continuous Replenishment	Category Management
Objectives	Improve product availability and reduce inventory costs at the same time	Improve profitability
Key data source	Sales and inventory	Sales, market, in-store audit, pricing & promotional analysis, space & range management, and customised research
Data usage	Real time	Daily, weekly or monthly. Hardly real time
Intensity of retailer-supplier collaboration (if any)	More intensive	Less intensive
Key business applications	Automatic inventory management, store ordering and exception handling	Applications for market basket analysis, space management, and product grouping,

2.3 Importance of Business Information Systems in Continuous Replenishment practice

Business Information Systems (BIS) are generally defined as application of Information Systems (IS) in business. Hence, in order to understand BIS one needs to elaborate the concept of Information Systems. According to Jayaratna (1994) Information Systems can be conceptualised into two levels: technology artefacts level and organisational level. Within the first level, IS are defined as collection of IT artefacts, while on the second level IS are defined more generally as systems that provide, process, and communicate relevant information for business to achieve its objectives. Within the second level there is no restriction that those functions need to be computerised. They can be performed by people manually or with IT supports. The second conception is used because both technical and non-technical aspects of IS are equally important in CR implementation.

Business Information Systems are the main part of Continuous Replenishment practice. Configuration and reconfiguration of BIS is conducted in order to develop CR practice. One may observe companies' ability to implement CR from BIS configurations. By studying the configuration, one may expect that companies would practice a certain type of CR practice. For example, when ability to capture and communicate sales data in real time is identified from BIS configuration of a company, then it's expected that the company would practice SMI with suppliers, since they could provide real time data for suppliers to manage their inventory.

In order to be able to study BIS configuration, an appropriate representation of BIS model is needed. This can be used to describe available capabilities in companies' BIS and to conclude whether the companies can advance their CR practice to a desired level. Because BIS are applications of IS in business then BIS models can be obtained by identifying aspects within IS and defining relevant characteristics that fit the context of businesses where IS are used.

2.4 Information Systems models

Welke (1977) states that IS can be modelled in four levels. The first level is 'systological'. According to the author this is the highest level of BIS models. This level describes data objects from an organisational point of view as well as interrelationships between the data. The second layer is the 'infological' level. The data objects are detailed and data processing activities are elaborated. The third layer is the 'datalogical' level. This level presents a technical view of data objects and processing structures in a programming language. The lowest layer is the technical level. This level presents information technologies required to store data and run programs. Welke's model provides specification of data processing activities from an abstract level to a technical level. Detail specification of data and process in BIS, however, is started from the 'infological' level. Detail requirements of data and data processing functions can be

found here. These will be used as inputs for detailing technical specifications in the lower level. This model explains that IS consists of three aspects: data, data processing activities, and information technology for data storing and processing. In Welke's model data and process are always found in parallel, while information technology is used to support this process. The technology provides data and services for data processing activities. An illustration of this relationship is seen in Figure 2.2.

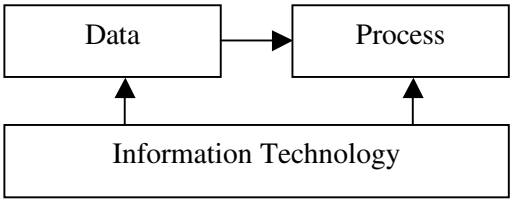


Figure 2.2 IS model from Welke (1977)

This relationship is also found in Feuer *et al.*'s model and Zachman's model. Feurer *et al*. (2000), in their paper about business and IT strategy alignment state that organisational strategy can be broken down into strategy, information and process needs. Those needs determine the technical requirements of the organisation. These requirements are: business applications and database systems (Feurer *et al*., 2000). Process execution is supported by business applications and information is provided by database systems. According to the authors, Information Systems have function to provide data and support for the execution of business processes. In their conception, IS are denoted by process, information, and information technology aspects that further break down into database systems and business application. This model is illustrated in Figure 2.3. In their model, Feurer *et al*. (2000) did not specify explicit relationships between process and information or application and database.

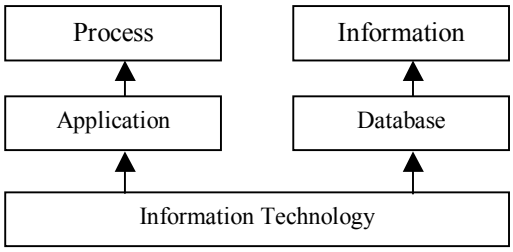


Figure 2.3 IS model according to Feurer *et al*. (2000)

Zachman (1987) introduced an Information Systems framework, now commonly known by the name 'Zachman's framework'. In this framework, he posits five models: the scope, enterprise, system, technology, and out-of-context models. The first four are developed by taking into account the context of the information systems while the last is developed out-of-context. The programming activity is done in the last model. It is not necessary for programmers to be concerned with the overall context where the program will be applied (Zachman, 1987). The scope model contains strategic information about important data, business processes and business locations of a company. Relationships between those dimensions are found in the enterprise model. These relationships are detailed in the lower levels of the subsequent models until technical specification of the relationships are formulated. Zachman extended this framework in 1997. In his new framework he added people, time and motivation as other important dimensions in data processing activities in Information Systems.

It is argued that there are three key elements in IS models as found in Zachman's framework: data, process and information technology. Other dimensions in this framework are considered as important concerns of data processing activities allocation. The network dimension determines the location of data processing functions and the people dimension determines the actor(s) that will perform the data processing functions. The time dimension specifies the timing of function execution and the motivation dimension describes the objectives of doing that function. Similar to Welke's model, those key aspects in BIS are placed in a specific relationship, seen in Figure 2.2. The difference is that Zachman indicates important things to be considered in designing those aspects.

Another IS model is from Scheer (1992). In his Architecture for Integrated Information Systems (ARIS) he states that Business Information Systems are applications of IT in business processes. IT supports for business processes can be realised into three aspects: data, control and function. The requirements and specifications of those aspects are determined by the requirements of organisations at the top level. The ARIS structure can be seen in Figure 2.4. ARIS model supports the idea that IS consist of three aspects: data, function and IT. The difference is that ARIS model conceives the first two as parts of IT supports for business process. This is because the model is built for software design. If the model is brought to a higher level then one can see that the ARIS model is comparable with the IS model from Feurer *et al*. (2000) in which data and function resemble information and process in Feurer *et al*.'s model respectively.

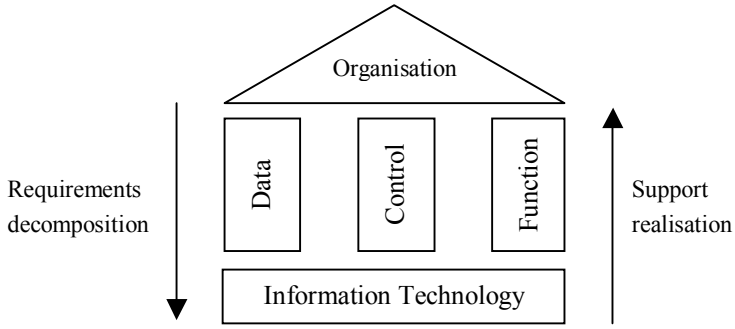


Figure 2.4 BIS components in ARIS

From these models it can be concluded that Business Information Systems consist of three key aspects: data, process, and information technology. The relationships between those aspects are shown in Figure 2.5.

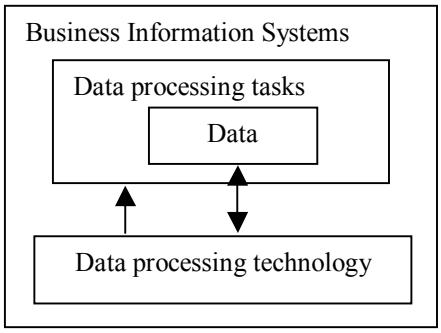


Figure 2.5 Aspects in Business-Information Systems

Data is a fundamental aspect of Business Information Systems. It will be processed to obtain information useful for decision-making. In a CR context companies require sales, inventory, and forecast data for making inventory replenishment decisions. The second aspect is data processing activity. This aspect is executed by following specified data processing flow and procedures. In a CR context, the activities are stock updating, stock monitoring and decision-making for inventory replenishment. Data and process are not separated in a CR context. In the figure, this is represented by including data within process. Those aspects build a sub-system in BIS called the data processing sub-system. The last aspect of BIS is information technology. This aspect is a separate sub-system since data processing function in CR context is not always supported by technology. The technical resources needed are data server (the double arrow) and data processing supports for task execution (the single arrow).

Those sub-systems are considered as basic sub-systems within BIS and BIS is then defined as follows:

Definition 2: Business Information System
Business Information System is a collection of data, data processing tasks, and data processing technology (also called Information Technology or IT) aspects whose objective is to provide, process, and communicate data and information to relevant parts of the business. Those aspects are arranged in two sub-systems: data processing and data processing technology. The first sub-system consists of the first two aspects while the second consists of the third aspect in this definition.

2.5 Relevant characteristics of BIS aspects in CR context

These aspects alone are not enough in describing BIS configuration in a CR context. Their characteristics need to be elaborated so that BIS configuration for CR implementation in the case companies can be described. The following sub-sections describe important characteristics of BIS aspects that will be studied in a CR implementation context.

2.5.1 Aspects in data processing sub-system

Data is input for data processing tasks that creates required information. The type of relevant data to be processed depends on the context of the BIS application. In a CR context this includes sales, inventory, forecasting, and/or order data. Because CR can be conducted in three forms, the type of data shared with suppliers will be different in each of those forms. In SMI relationships, retailers share sales data with suppliers, but in RMI, retailers only share order data with suppliers. The range of data or variations of data types included in data processing activities refers to the breadth of data (Clark *et al*., 2001; Jun *et al*., 2000; Cunningham and Tynan, 1993).

Deloitte Consulting (2002) states that data can be shared in different details in CR partnerships. For example, a supplier might receive complete sales data of its products and its competitors' products, but another may only receive sales data of its own products. This level of data detail is called the depth of data. Another example that shows different depth of data is when retailers share daily sales data with one supplier but only monthly data with another. In decision-making processes the level of data depth influences the detail of analysis and accuracy of the decision.

Another aspect of data processing sub-systems is data processing tasks. In IS literature this includes: data capturing, updating, calculation, formatting (i.e. formatting data into specific standards for communication), warehousing, data sharing, and decision-making. In a CR context these are condensed into three activities: data updating, data monitoring, and decision-making (Involvation, 2002). Data updating brings actual sales from a POS terminal and product arrival information from receiving

areas into a database to update the inventory position. Data monitoring monitors the current status of sales and inventory to determine whether a replenishment order should be released. Decision-making specifies the amount and time of a replenishment order to the supplier.

Ould (1995) and Avison and Wood-Harper (1992) mention four characteristics of tasks: functionality, owner, property, and context.

a. Functionality:
   Functionality defines activities to be performed in task execution and explains the task's objectives in relation to the organisation's objectives.
b. Owner:
   This is the person or actor responsible for conducting the task. Clear specification of the task owner is needed to eliminate redundancy and ambiguity in task execution.
c. Property:
   The properties of a task are interdependency and commonality with other tasks, information load within the task, and the size of the group that executes the task. Interdependency defines the flow of tasks and indicates the number of other tasks to be conducted prior to execution. Commonality defines organisation resources shared with other tasks. Information load describes type and quantity of information required to perform the task or to be processed in the task. Group size is a property that delineates the number of actors involved in the task.
d. Context:
   The context defines the specific situation in which the task occurs. A task might be inter-personal, inter-functional, or inter-organisational. The broader the context, the more factors are involved in the execution of the task.

The inventory management task in a CR context consists of three activities: stock updating, stock monitoring, and decision-making for stock replenishment. Descriptions of these functions are given above.

Investigating the task owner is relevant in a CR context because assigning inventory management tasks between retailers and suppliers as described in section 2.2, is a main difference in CR practice. The difference lies in the actor conducting monitoring and decision-making tasks since data updating tasks are always the responsibility of retailers (Involvation, 2002; JIPECR, 1998). The task owner is referred to in this study as task actor. This is the terminology used in CR studies (JIPECR, 1998).

Interdependencies, commonalities, and information loads of the tasks will be described in a flow diagram. Special attention is given to the activities involved, IT use, and data requirements. A contingency study will not be conducted on these characteristics because these details occur on a micro level and the study is focused on a

higher level. They may, however, provide useful information about differences between case companies in executing the CR principle.

The task context in this study is retail inventory management. The updating, monitoring, and decision-making tasks are performed to manage retail inventory. Although the tasks are conducted for managing retail inventory, they are influenced by a larger context of suppliers and industry. Chapter 3 addresses contingency factors that influence the configuration of CR-BIS in a retail context. The context will therefore be described in relation to the effort to find contingency factors that influence the allocation of process responsibility between retailer and suppliers.

From the above description it is concluded that the task actor is the only characteristic of task relevant for this research.
The summary of this sub-section is given in Definition 3 and Table 2.2.

Definition 3: Data processing sub-system
The data processing sub-system is a sub-system in Business Information System whose aspects are relevant business data for inventory replenishment activity and data processing tasks. The relevant data are sales, inventory, forecast, and/or order data. The tasks are inventory data updating, inventory data monitoring, and decision-making for inventory replenishment. The extent of data sharing (breadth and depth) and task owner are relevant characteristics of data and task in CR practice.

Table 2.2 Relevant characteristics of data and task in CR context

No	Characteristics	Definition
Data aspect		
1	Breadth of data sharing	The extent of data type variations. Data types including sales, inventory, forecast, and/or order data
2	Depth of data sharing	The extent of data detail. Extent of data detail explains aggregation of data (daily, weekly, monthly or other periods) and data relation to suppliers (supplier's data or suppliers' data and data of their competitors)
Task aspect		
1	Task actor(s)	People or functions within the organisation or the organisation itself responsible for execution of data handling tasks for inventory replenishment. The tasks are data updating, data monitoring and decision-making for inventory replenishment. The options for actor are retailer, both retailer and supplier, or supplier.

2.5.2 Aspects in technical sub-systems

The technical sub-system consists of Information Technology (IT) aspects which are generally divided into two categories: hardware and software.

Hardware can be categorised into four components: data capture, data processing, data storage, and data communication hardware (Curtis and Cobham, 2002). Data capture hardware is needed to capture data. In a CR context this is a scanner or bar code reader installed in POS terminals. Data processing hardware consists of computers that run the data processing function. The functions in a CR context consist of inventory data updating, inventory monitoring and decision-making for inventory replenishment. Data storage hardware keeps processed data to be used in the future. Data communication hardware is needed to access and share data between functions in an organisation or between organisations.

Data communication hardware is the most often mentioned in the CR literature. The focus is on the selection of the mechanism used to send data between actors involved in CR practice (Involvation, 2002; ECR Europe; JIPECR, 1998). The mechanism is generally divided into: paper and non-paper based (Curtis and Cobham, 2002; Chesher and Kaura, 1998; Cash *et al*., 1994). Paper-based communication is done by fax whereas non-paper is done by sending electronic files to a recipient. The latter can be done by electronic mail (e-mail) or an Electronic Data Interchange (EDI) application.

E-mail is an asynchronous[2] electronic interchange of information between persons, groups, and functional units of an organisation that permits the creation, distribution, consumption, processing, and storage of this information (Chesher and Kaura, 1998). EDI is defined as the transfer of structured data by agreed message standards, from one computer/application to another computer/application by electronic means, and may occur within an organisation or inter-organisation (Chesher and Kaura, 1998).

Non-paper based (electronic) data communication can be done through a private, public, or value-added network (Cash *et al*., 1994). A private network uses dedicated lines inaccessible to other companies. A fibre optic line that connects different locations of a company is an example. A public network includes general access dial-up and leased lines. A public telephone line is an example of public network. A value-added network is operated by a third party. The services within a value-added network are enhanced and may include a gateway and document translator (Cash *et al*., 1994).

The network determines the possibility to connect with existing suppliers (Broadbent *et al*., 1999). It is almost impossible for other companies to access a private line. A value-added network, although more flexible, is still limited. It can only be accessed by its members and communication between different value-added networks might be limited by the network standard. For example, a common standard for a value-added network in North America is ANSI ASC X12 while in Europe it is EDIFACT. Because of limitation imposed by different data communication media/channels it is

[2] Has the ability to send a message when the recipient is not logged on.

then important to know which channel retailers use in communicating data with suppliers (Involvation, 2002, VICS, 1998; JIPECR, 1998).

To summarise, data communication technology is the hardware component in technical sub-systems that will be observed in practice. The type of data communication mechanism used to send data between actors involved in CR practice is the characteristic of data communication technology that will be compared between retailers. Options for the mechanism are paper-based and non-paper based. Paper-based communication is done by sending data through a fax machine, while non-paper based data communication is done by sending e-mail or EDI messages through a private, public or value-added network.

According to Curtis and Cobham (2002), software is the general name given to programs or parts of programs. They divide software into two categories: operating systems software and application software. Operating System software is needed to make smooth and efficient program execution. Linux and Windows are two examples of Operating Systems. Application software is needed to support business functions. For example, a manufacturing division of a company requires Manufacturing Resource Planning software to help organise manufacturing resource utilisation. Besides supporting the execution of business processes, application software is needed in bridging different hardware and software. The objective is to create good communication and functionality between different systems. This kind of application software is called interface (Broadbent *et al.*, 1999). Another type of software, programming language (Curtis and Cobham, 2002), has the capability to build software or modify existing software written in that language.

In a CR context, business application or application software for supporting inventory management processes is the most relevant software type (Involvation, 2002; VICS, 1998; JIPECR, 1998). This application is used by retailers to help update inventory status, monitor stock levels, and make decisions for inventory replenishment (JIPECR, 1998).

Important characteristics in CR business applications of retail companies are the functionalities provided for supporting CR implementation (JIPECR, 1998). Because different vendors may have different functionalities in their business application for retail inventory management, business application in this study will be identified by their names as registered by their vendors, for example SAP R/3, Retek Merchandising Systems or Oracle Database Systems. JIPECR (1998) mentions basic and advanced functionalities provided by business application for inventory replenishment. Basic functionality is the ability to update inventory status, create forecasts, and generate order recommendations; in other words, the application is able to determine the amount of products to be purchased. Advanced functionalities are the ability to update data in real time and accommodate exceptions in existing inventory replenishment planning. An exception is a difference between the forecast and actual data. When an exception is

detected, systems must adjust the inventory plan accordingly. Another important characteristic of business applications is the placement of the application, or specifically, the location of application installation (Involvation, 2002; VICS, 1998; JIPECR, 1998). VICS (1998), states that the application can be provided by retailers, suppliers, or an Application Service Provider (ASP). However, this issue is more related to task assignment because when retailers outsource particular functionalities to other organisations, the responsibility of those tasks is delegated and this would not be discussed in technical sub-system.

Technical sub-systems in a CR context consist of data communication technology and business applications for inventory management. The important characteristics are the mechanism for data communication between actors involved in CR practice, and the functionalities that can be provided by the application to support inventory replenishment activities in CR practice. This summary is restated in Definition 4 and Table 2.3.

Definition 4: Technical sub-system
The technical sub-system of Business Information Systems contains two aspects: data communication technology and business application software. The data communication mechanism is the characteristic of data communication technology and functionality of business application software is the characteristic of the business application software. The mechanism can be categorised as paper or non paper-based. Non-paper based applications can be divided into e-mail and EDI sent through a private, public, or value-added network. Basic functionality of a retail inventory management application is the ability to update inventory status; advanced functionality is the ability to update data in real time and accommodate exceptions in existing inventory replenishment planning.

Table 2.3 Relevant characteristics of data communication technology and business application

No	Characteristics	Definition
Data communication hardware aspect		
1	Data communication mechanism	The mechanism used to transfer data between actors involved in CR practice (paper vs. non paper-based; private, public or value-added network for non paper-based communication)
Business application aspect		
2	Business application functions	Functionalities that can be provided by the application to support CR implementation (basic: ability to update inventory status, create forecast and generate order recommendation; advanced: update data in real time manner and accommodate exceptions in existing inventory management)

2.5.3 Summary of CR-BIS structure

CR-BIS structure in this research is seen in Figure 2.5. The structure consists of two sub-systems: data processing and technical sub-systems.

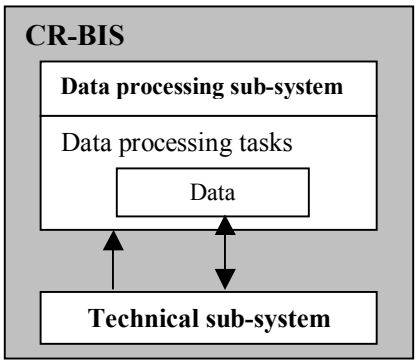


Figure 2.6 CR-BIS structure

The data processing sub-system is a combination of data and data processing tasks. Because these two are not separated in a CR context, they are combined in one sub-system. This sub-system consists of relevant data for inventory management in retail companies and necessary tasks for handling this data. Data involved in inventory replenishment are sales, inventory, forecast, and/or order data. The breadth and depth of data shared with suppliers are important characteristics of data to be observed.

Data processing tasks in a CR context consist of three activities: inventory data updating, inventory monitoring and decision-making for inventory replenishment. An important characteristic of the tasks is process actor: whether the tasks are performed by the retailer, the supplier or both. Task assignment between retailer and supplier determines the type of CR practice: whether it is RMI, JMI or SMI.

The technical sub-system consists of IT components relevant for the CR application. These are data communication technology and business application aspects of data-handling activities. The characteristic notable in data communication technology is the mechanism of data communication. Identification of data communication mechanism enables one to examine the ability of retailers to communicate with their suppliers. Functionality provided by business application for CR execution is important characteristic of business application in this study. The functionality determines the extent of CR practice in the retailer-supplier relationship. When advanced features exist, retailers are able to practice advanced CR practice with their suppliers. Those aspects of the CR-BIS model and their relevant characteristics for this study are summarised in Table 2.4.

Table 2.4 Relevant aspects and characteristics of Business Information Systems in Continuous Replenishment context

Sub-system	Aspects	Characteristics	Options
Data Processing	Business data for inventory replenishment decision-making	Breadth and depth of data to be used in data processing activities	Breadth: sales, inventory, forecast or order data Depth: aggregation (daily, weekly, monthly or other) and number of suppliers involved in the data (one supplier or two or more competing suppliers)
	Data updating task	Actor(s) of the tasks	Actor: retailer, supplier or both
	Data monitoring task		
	Decision-making task		
Technical	Data communication technology	Data communication mechanism	Mechanism: paper-based and non paper-based Non-paper: e-mail or EDI through a private, public or value-added network
	Business application	Functionality	Basic functions: inventory updating and order generation. Advanced functions: real time inventory updating and exception generation.

CHAPTER 3 CONTINGENCY FACTORS AND CULTURAL INFLUENCE

3.1 Contingency theory

The contingency term was coined by Lawrence and Lorsch (1967) as a reaction to 'universal' management theories. The authors challenged those theories by stating that there is no 'one best way' of managing organisations. The statement was made after conducting studies on six companies in the plastics industry. They found that the companies developed separate departments to confront different environmental segments of the industry. According to the authors, decision to establish separate departments were effective in achieving the organisations' objectives. This finding highlights the need for different structures in different situations.

Contingency theory is not used, however, to replace previous universal theories in management. Instead, the contingency view was developed to unify them. This view gives guidance when a theory can be effectively applied. Depending on the situation, the contingency view argues that different theories have different degrees of effectiveness in organisation management. For example

The concept of contingency says that there is a variable W that influences structure X in achieving target Y (see Figure 3.1).

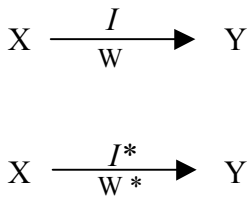


Figure 3.1 Illustration of contingency relationship between structure (X), target (Y) and business environment (W)

In a certain condition of variable W, the structure X will get certain influence I from W that affects the achievement of target Y, but if the status of variable W changes into W* then the influence may take another value (say I*) that in return would affect the effectiveness of structure X in achieving target Y. The effectiveness of X in achieving Y is determined by the fitness of X with the condition of W. In this example it is assumed that X fits the condition of W. Therefore, X will not be effective when W is changed to W*. The structure X needs to be adapted to fit the new situation. This example tells us that contingency approach suggests companies to continuously look at elements in their business environment that affects their effectiveness and adapt their

structure to the changes in those elements in order to remain effective (Donaldson, 2001).

Galbraith (1973) states that there is no one best way to organise and any way of organising is not equally effective. An example of this is the selection between mechanistic and organic organisation structures. Mechanistic structure is characterised by strong adherence to structure and procedures that give less flexibility to adapt with environmental changes. Due to this characteristic, this structure might work effectively in a situation where uncertainty is low. If it is high, then a flexible organic structure would probably give a better result. In this example, the uncertainty level is the contingency factor that determines the effectiveness of organisation structure in achieving its objectives.

The influencing characteristic of contingency factors is of an intervening style, which means that it will undermine or strengthen the effectiveness of a structure to achieve its objectives. This characteristic is illustrated in Figure 3.2.

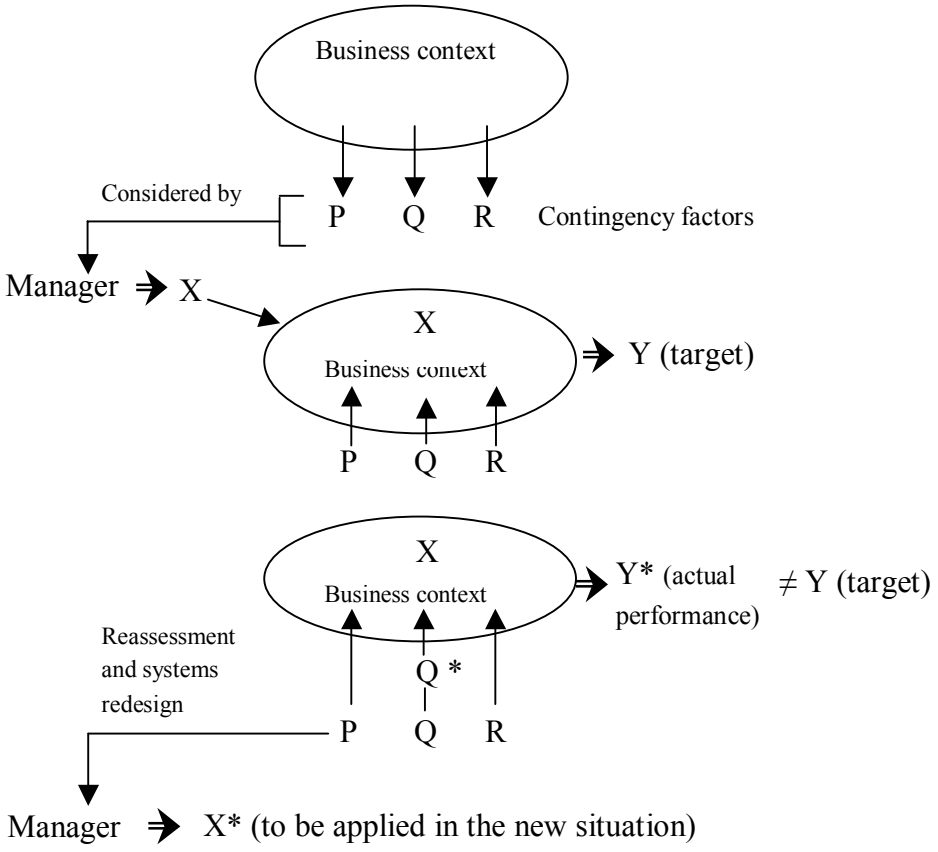


Figure 3.2 Illustration of the intervening role of contingency factors

At the beginning of a system design, a manager identifies three contingency factors to be considered in the design: P, Q, and R. These are considered since they would interfere with a system's performance in practice. The system to be designed is

denoted X and the objective is Y. X is designed in such a way to fit the condition of P, Q, and R. The fitness is assumed to make the system (X) effective in achieving Y. After the design process, X is operated in the context. In the process, the status of a contingency factor changes. In this example, Q is changed to Q*. This would influence the effectiveness of X in meeting its objectives (Y). The manager then needs to adjust the system (resulting in X*) to accommodate this change to regain effectiveness.

There are two criteria to consider a factor a contingency factor: the factor needs to intervene in the systems and that the factor influences the systems' effectiveness in achieving their objectives, not other aspects of the systems (Donaldson, 2001). An illustration in Figure 3.3 demonstrates the importance of the second criteria.

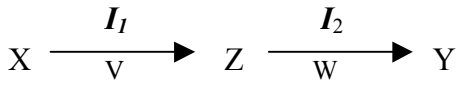


Figure 3.3 A typical causal relationship in contingency theory

If Z is the performance indicator and Y is the consequence of having that performance, then the contingency factor is V, that brings a certain influence I_1 in the relationship between X and Z, not W. For example, a reduction in distribution costs occurring after a retailer built a Distribution Centre, creates an opportunity for the retailer to grow their business and eventually creates a need for new employees. Since the employee additions were not the performance indicator, the moderating factor W (which moderates the number of employees a retailer can recruit) is not the contingency factor. It is just an ordinary moderating factor (Donaldson, 2001).

Based on this consideration, an explicit definition of organisational performance is mandated (Donaldson, 2001; Drazin and Van de Ven, 1986). The emphasis on system performance is very important. A simple case below illustrates how different definitions of performance affect the focus of systems design.

Consider a retailer facing a logistical problem of whether to build a distribution centre to achieve operational effectiveness. If performance is defined as reductions in distribution costs, then the extent of operations dispersion of the retailers might be a significant contingency factor. For a retailer with a dispersed operation, a distribution centre is more efficient; for another with only one or two shops, it is better to arrange a direct store delivery from the supplier. In this case, the extent of operations dispersion is a significant factor moderating the effects of DC on t distribution costs (see Figure 3.4).

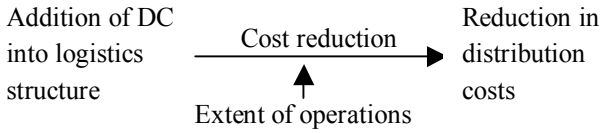


Figure 3.4 Moderating effect of the extent of operations on the distribution costs reduction incurred by the DC

However, if performance is defined as reduction of administration costs, it could be found that warehouse management skill is the contingency factor in this relationship (see Figure 3.5). Retailers that have sufficient warehouse management skills may reap the benefits of having a DC because it will simplify the administration process. For those who don't have the skills, a DC may cause administration troubles, increasing administration costs.

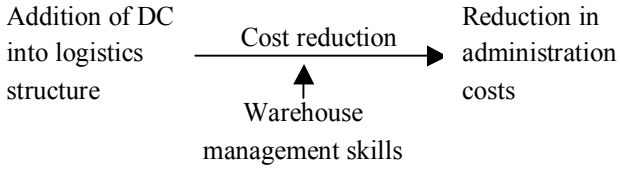


Figure 3.5 Another perspective of the relationship between DC and operational effectiveness

The above descriptions and examples lead to the following definition:

Definition 5: Contingency factor
Contingency factors are factors in business environment that influence the effectiveness of a system. The fitness between system structure and the factor determines the effectiveness of the system in realising objectives.

3.2 Assesing contingency factors' influence

Contingency theory literature indicates two kinds of studies about contingency factors that can be conducted as follows:

1. A study can be conducted to identify factors considered by the manager in designing a system. The real influence of the factor over the systems' effectiveness is not considered. A study from Finch and Cox (1988) is an example. The authors studied factors that influenced the design of information

systems which support production planning and control functions in process industries.

2. A study can be done to measure the real influence of the factors in the practice of the systems. Changes in factors' condition are recorded and the impacts on the systems' effectiveness are evaluated.

This research is conducted in the first stream. The objective is to identify factors considered by retail companies in designing their BIS for CR implementation. The second type of study was not feasible due to inaccessible performance measures. The case companies selected in this study, however, were recommended by industry experts in Indonesia and The Netherlands because they were considered successful in implementing the CR principle.

Klaas (2004) mentions that research in the first stream has resulted in an overwhelming number of contingency factors upon which organisations are dependent. For example, structural centralisation, formalisation, technology, task uncertainty, and organisational climate all influence the structure of organisation (Klaas, 2004).

Another problem in the first stream is that different operationalisation of factors may result in different influences of the same factor on organisation (Donaldson, 2001). Contingency theory is often criticised in the literature on this point. The theory cannot be precise about the influence of a factor on a system's performance because of different operationalisation. As Fry and Smith (1987) state, a theory needs exact statements about the relationship between two factors. Those relationships between factors and structure indicate that the interaction between them is more complex than is normally assumed by writers in this field (Drazin and Van de Ven, 1986).

Donaldson (2001) declares that this problem can be mitigated by building groups of factors and making precise operationalisation of factors and their influence on the systems. He mentions three groups of factors: size, technology, and uncertainty. Within each group, a number of factors share similar characteristics. For example, 'number of business units' and 'number of employees in organisation' constitute 'size of the organisation' because those factors can be used to measure the actual size of an organisation. Donaldson (2001) stated that those groups would be sufficient to explain contextual factor's influences on organisation and a statement of precise cause-effect relationship between factors and organisation in contingency theory can be made. Operationalisation of factors is also important. Different operationalisation will result in different outcomes.

Donaldson's grouping cannot be used in this research, however, because the research problem is not about the structuring of organisation. Another grouping is needed to fit the research context. In the following section those groups are identified. Contingency factors within the groups and operationalisation of those factors are described in section 3.3.

3.2.1 Identifying groups of of contingency factors in CR-BIS configuration

A general framework of contingency sources in CR-BIS can be derived from general theories in management: Resource Dependence Theory, Transaction Cost Economy Theory, Agency Theory, and Institutional Theory. The focus of these theories is resource sharing, responsibility sharing, and governance structure within inter-organizational relationships. This is related to the issue of data sharing, task allocation and technology selection in CR practice.

These theories suggest looking at different sources of factors in retailer's business environments to explain CR-BIS configuration. The suggestions obtained from individual theories are called 'input'. Identification of those sources is needed to classify the contingency factors described in section 3.3. Furthermore, the grouping enables a systematic study for improvement of CR practice because companies can concentrate on particular factors before they analyse others. These theories and their relationship with the CR context are described in the following paragraphs.

Resource Dependence theory

This theory is based on the work of Pfeffer and Salancik (1978). The focus is on the effectiveness of organisations within their environment. The main idea is that effectiveness depends on the organisations' ability to acquire and maintain resources from their environment because they are not internally self-sufficient. One implication of this theory is that organisations always try to find resources they need to improve their effectiveness in a business environment.

In a CR context, this theory can be used to explain why companies change or maintain CR-BIS configuration in order to improve or maintain CR effectiveness. This theory implies that companies examine both internal and external conditions in order to find resources to improve CR-BIS effectiveness. To achieve the research objective to explain the application of specific CR-BIS configuration these internal and external conditions need to be evaluated. This gives the first input needed to build a research framework.

Input 1

Specific configuration of CR-BIS within companies can be explained by examining internal (retailer) and external resources' influences on the effectiveness of the configuration.

Transaction Costs Economy theory

Transaction Costs Economy was developed by Williamson (1975) who based his study on the work of Coase (1937).

The focus of this theory is the allocation of business processes[3] among organisations in the supply chain. The objective is to find a structure that can minimise transaction costs. Companies may choose from market and hierarchy structures or the combination of both to carry out the transaction. They always evaluate the existing transaction process to find a better way to perform the process.

The application of this theory in the CR context is that companies change their CR-BIS configuration from one type to another when the latter is considered more effective than the former. This gives the idea that an explanation of chosen CR-BIS configuration might be found in the existing configuration of the organisation, specifically the ability of the present configuration to deliver expected results. This is the second input for building the research framework.

Input 2
Specific configuration of CR-BIS can be explained by assessing the effectiveness of the existing CR-BIS configuration.

Agency theory
Agency theory deals with the situation where a company (called the principal), delegates work to another company, namely an agent. The agent is in a condition to negatively affect the principal, because of bad performance that the principal may not be able to control or predict. A point of interest in this theory is how the principal delegates work to the agents and specifically how they should transfer responsibility (Eisenhardt, 1988). In a CR context, this can be delegation of inventory replenishment tasks to suppliers. This may explain how retailers change CR practice from RMI to JMI and finally to SMI.

According to the theory, responsibility is enlarged according to improvement of the agents' reliability. If the agents prove they are reliable, then the principal may increase their involvement in the process. Otherwise, the principal may exclude the agents from process execution. It is necessary for the principal to evaluate agents' characteristics that may contribute toward their reliability. In a CR context this can be that retailers increase suppliers' involvement in inventory replenishment activities when suppliers prove reliable. To assess this, a retailer would evaluate characteristics assumed to influence reliability.

The theory suggests looking at factors on suppliers' side that influence reliability. This theory gives another input as follows:

[3] In the original conception business processes refer to production and distribution processes

Input 3
Specific arrangement of suppliers' involvement in data processing activity in CR-BIS configuration can be explained by evaluating suppliers' characteristics that influence their reliability

Institutional theory
Institutional theory developed from awareness that organisations become isomorphic after evolving for a long time. The proponents of this theory (Powell and Di Maggio, 1983; Scott, 1998) state that this is because of an institutionalisation process within organisations. Institutionalisation is a process of acceptance and implementation of a system into an organisation, to be used later as a model or foundation for the organisation's development. This creates a pattern of activity in the organisation.

Powell and Di Maggio (1983) mention three mechanisms for institutionalisation: coercive, mimetic, and normative. The first mechanism occurs when an organisation uses its power over another organisation to follow a certain rule or practice. The mimetic mechanism is imitating practice in other organisation. This normally happens in a situation where the new practice is poorly understood or when the environment is uncertain (Powell and Di Maggio, 1983). This is also used by companies that want to follow a trend in the industry. The last mechanism is done by organisations that realise their needs and develop a practice to fit their situation.

The three mechanisms of institutionalisation in this theory can be used to explain organisation tendency to use specific CR-BIS configuration. According to the theory, this can be an influence of a powerful company, imitation of best practice brought by institutions in the industry or independent decision of the organisation. This idea is formulated in the fourth perspective below.

Input 4
Specific configurations of CR-BIS within companies is a result of influence from other company, institutions in the industry or conscious decision of the company based on assessment of their situations.

3.2.2 Preliminary research framework
The four perspectives indicate three sources of factors: retail company, supplier company and industry. Factors within retail companies are, for example, business process and technology. In suppliers there are factors to be examined such as technology and reliability of performance. In industry, government and institution policies for example, may shape CR practice within the companies into a specific configuration.

A preliminary research framework is seen in Figure 3.6. Retailer characteristics and CR-BIS are put in the same box because the study is focused on CR-BIS

configuration within retail companies. Elaboration of factors within each group and their influences on CR-BIS configuration is presented in the next section.

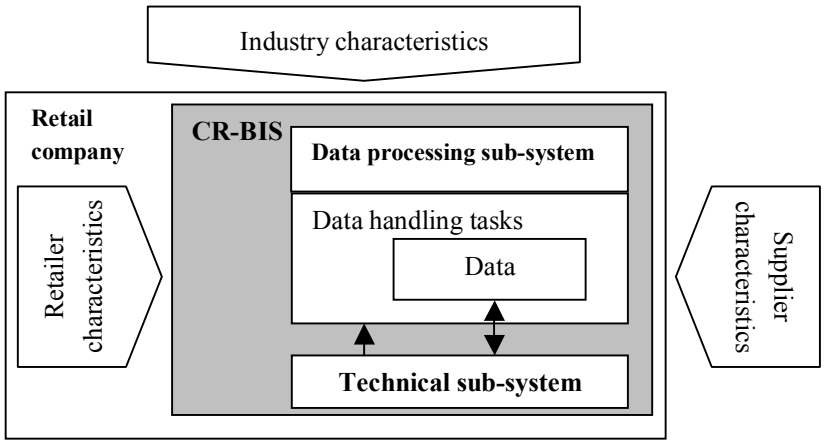


Figure 3.6 Preliminary research framework

3.3 Contingency factors in CR-BIS configuration

Chapter 2 states that CR-BIS consists of two sub-systems: data processing and technical sub-systems. The aspects and important characteristics of each sub-system are described in Table 2.4.

Due to different business environments, arrangements of these characteristics vary from company to company. One objective of this research is to find contingency factors that cause those variations in practice. The sources have been identified from four general theories in management. Relevant contingency factors will be elaborated and grouped into the relevant sources in Figure 3.6. Those factors are helpful in explaining specific configuration of CR-BIS in companies.

3.3.1 Contingency factors in extent of data sharing

Svensson (2002), Dussart (1997), and Verra (1997), state that the extent of data sharing depends on the strategic sensitivity of the data; the more sensitive, the less likely it will be shared. Data is considered sensitive if it may provide an opportunity for others to reveal information related to company strategy (Verra, 1997). This is related to information about sales trends and policies, inventory policies, and pricing and promotional policies that can be extracted from the data (Lee, 2000). In general, data used in inventory replenishment is sensitive because it can provide information about those aspects (Lee, 2000; Dussart, 1997; Verra, 1997). Retailers protect this data from their competitors. There is a potential for competitors to receive this data from suppliers who received it from retailers. The reason suppliers give the data to the retailers' competitors is that they want to negotiate with the competitors about price and products. Because of this possibility, retailers limit suppliers' access to sensitive proprietary data.

Suppliers' trustworthiness is another influential contingency factor. Trustworthy suppliers may be granted data access by retailers and vice versa. Trustworthiness of business partners is an important factor to be evaluated before starting a strategic relationship such as advanced CR practice. As Blumberg (2001, p. 5) notes, cooperation between firms may not begin if one party does not trust the other. There is always a level of trust or a trust threshold that should be achieved or exceeded before starting any collaboration. Mentzer and Min (2000 p. 556) state that trust is an essential antecedent to partnership. It is needed to ensure that time and effort invested in the relationship is not likely to be wasted (Klein-Woolthuis, 1999).

In the literature, there is considerable attention paid to how to build trust and start collaboration. Lewicki and Bunker (1996) declare, "If there is no prior trust, on the basis of previous experience and institutionalized norms, relations typically start with 'economic' trust". Economic trust is a kind of trust generated by calculating risks and benefits of partnering with a company (Child, 2001; Hogart-Scott, 1999). When benefits outperform risks then the company believes that partnering is valuable. Benefits are a function of partners' capabilities in handling retailer's data and risk is the function of partners' opportunistic behaviour that they will disclose information to competitors. Based on this, it is said that suppliers' trustworthiness depends on their goodwill and capability in handling retailers' data. In this thesis, capability is considered outside trustworthiness as it can be divided further into other contingency factors. Therefore, trustworthiness refers just to suppliers' goodwill or benevolence.

Further elaboration of capability is given by Whybark (1971). He says that the capability to be considered in a data sharing relationship is trading a partner's knowledge for processing the shared data appropriately. This is a conclusion from his experiment about people's tendency towards data sharing with their partners. He found that partners' knowledge about proper data handling was an important factor in this activity. He found that people were willing to share data with knowledgeable persons. The knowledge factor is also mentioned by Choudury and Sampler (1997) based on their study of knowledge specificity influence over data sharing. They state that data processing tasks have a specific level of knowledge specificity: the type and amount of knowledge required to perform the tasks. This characteristic of data processing tasks influences access people may have to data (Choudury and Sampler, 1997). Gavirneni *et al*. (1999) support this statement. They say that sharing information in a supply chain is valuable when business partners have the capability to respond appropriately to the information (Gavirneni *et al*., 1999). According to the authors, one capability necessary was knowledge to handle the data appropriately. Within CR context the important knowledge is inventory management, product characteristics, and retail operations (Tyan and Wee, 2003). Inventory management knowledge is the basic knowledge for suppliers because CR partnership is about management of the retailer's inventory. Included in this knowledge is understanding of different forecast techniques and

economic order quantity (Tyan and Wee, 2003). Knowledge of product is important since different types need different management techniques. Fresh foods for example, require continuous monitoring whereas non-perishable items with an estimated time of consumption can be planned more easily. Retail operation is important as different entities in the supply chain might have different characteristics due to differences in market size and regulations. Tyan and Wee (2003) state that retailers may involve suppliers in inventory management practice if they have better knowledge about those aspects.

An additional factor in determining suppliers' data handling capability is technical infrastructure for data processing. IT infrastructure capability becomes a factor considered by retailers in selecting suppliers for data sharing relationships (Angeles and Nath, 2000). This is supported by Verra (1997), who states that an insufficient IT infrastructure in a supplier is a barrier to advancing the supply chain partnership towards a viable and timely data sharing relationship. The infrastructure consists of Information Technology (IT) components used to receive and process data from retailers. These are business application for order management and data communication infrastructure (JIPECR, 1998). According to Martin (1994) and JIPECR (1998), suppliers' business application for order management needs to have the capability to integrate different kinds of retail data and exceptions from retailers' operations into their actual production and distribution plans.

Martin (1994) declares that the capability to integrate different kinds of retailer data is needed because there might be different kinds of CR arrangements with retailers (RMI, JMI and SMI). In addition, the data might be sent in different formats. For example, there are retailers that send EDI messages and those that use e-mail. These need to be supported and combined into a single delivery plan. Martin (1994) adds that with the move to SMI, suppliers need to make a customer- and location-specific forecast. Previously, sales forecasts were developed for all customers, and then broken down into regions, territories, and DC categories. This certainly needs the capability to integrate various data formats into suppliers' order management application (Martin, 1994).

An exception is a condition where actual data differs significantly from the forecast. An adjustment will be sent to suppliers who need the capability to accommodate this change into their order management systems and adjust production and distribution plans (JIPECR, 1998). Martin (1994) mentions that the capability is real-time load building and capacity planning.

To be able to receive real time data from retailers and respond quickly, suppliers need a broadband data communication infrastructure that supports EDI. This is because of data communication volume between the two parties; EDI would enable both parties to have accurate, reliable, and responsive data communication systems.

Other factors that influence the extent of data sharing are mentioned by Wigand *et al*. (1997). They state that data is useful when it is new and confirmed. The first factor explains that a data-sharing relationship between retailers and suppliers is useful when the exchanged data is new to suppliers. A translation of this statement is that data needs to be delivered in a timely manner for making the appropriate reaction, and that suppliers have no access to this data beforehand. The second factor explains that data needs to confirm the actual condition of the inventory status in the retail company. Thus, data timeliness and accuracy are both important for initiating a data sharing relationship. Accurate and timely data enables both parties to make a proper reaction to the changing situation in operational level. The importance of data accuracy and timeliness were stated by Van der Vorst *et al*. (1998):

> Data timeliness and data applicability are prerequisites when exchanging information. Inventory control systems must be up-to-date and well managed in order to provide current information on stock levels and stock availability (p. 490).

The ability to provide accurate and timely data depends on retailers' IT infrastructure. JIPECR (1998), states that the ability of the infrastructure to capture detailed product movement is important for a valuable data sharing relationship. In addition to improving product-scanning technology, retailers need to invest in inventory management applications that can help them provide demographics and seasonality information for every item in every store (Martin, 1994). Another capability is to send and receive EDI messages so that data can be distributed in an accurate and timely manner. Finally, the infrastructure needs to allow higher data volume and traffic in data sharing with suppliers. JIPECR (1998) states that data volume and traffic will increase in CR practice due to the constant need to update and communicate data and make appropriate responses to operational changes. The capability depends on the bandwidth of retailer's data communication infrastructure.

In particular circumstances, retailers give access to suppliers because their market power is acknowledged and considered important by other companies. They can use this power to ensure that suppliers will deliver what they expect from the data handling that becomes the suppliers' responsibility. Wal-Mart and Albert Heijn are two examples of this (Collins, 1997; Verra, 1997). Collins (1997) states that Wal-Mart gives suppliers access to its internal data but with the implicit risk of lost business opportunities if they fail to deliver what Wal-Mart expects. This was also found by Verra (1997) in The Netherlands. He studied the relationship between market leader Albert Heijn and its suppliers and found that Albert Heijn will sanction suppliers who cannot deliver what they want (Verra, 1997). The opposite condition may occur however, if a supplier has more power than a retailer. In a balanced situation, the presence of legal systems and an

independent body may encourage data sharing between the two parties, provided that the legal systems and the institutions can give sufficient protection to retailers from information misuse by suppliers (Kurnia and Johnston, 2000). The independent body could be an ECR organisation or other respected retail institution.

A summary of contextual factors that influence the extent of data sharing in data sub-systems as well as the operationalisation of those factors is given in Table 3.1. Data sensitivity is considered a factor in retail companies since the sensitivity of data is perceived by the company. It is not mentioned in the literature which factor influences the breadth of data sharing and which influences depth of data sharing; those contingency factors are assumed to influence both characteristics simultaneously.

Table 3.1 Contingency factors that affect the extent of data sharing

Contingency factors	Operationalisation
Retailer characteristics	
Data characteristics	
Strategic sensitivity of data	Potential of data to reveal strategic information such as sales trends and policies, inventory policies, and pricing and promotional policies.
Data accuracy	The accuracy of data in representing the actual situation (accurate and detailed product movement)
Other retailer characteristics	
Data-handling knowledge	Staffs' knowledge of inventory management, product characteristics, and retail operations
IT infrastructure capability	Availability of advanced product scanning technology that can capture detailed information on products, capability of inventory management application to provide demographics and seasonality information for every item in every store, the capability to send and receive EDI messages so that data can be distributed in accurate and timely manner, and availability of broadband data communication to allow high traffic of data access and sharing.
Relative market power	Retailer's power relative to supplier

Table 3.1 Contingency factors that affect the extent of data sharing (*Cont.*)

Contingency factors	Operationalisation
Supplier characteristics	
Trustworthiness	Suppliers' perceived intentions or goodwill to keep the confidentiality of data.
IT infrastructure capability	Capability of suppliers' business application to integrate different retailers' data and exceptions from retailers' operations into their actual production and distribution plans using real-time load building and capacity planning functions. The capability includes bandwidth of suppliers' data communication infrastructure to receive a higher volume of real time data from retailers and capability to support EDI communication
Data-handling knowledge	Staffs' knowledge of inventory management, product characteristics, and retail operations
Industry characteristics	
Legal system	A set of legal systems that can provide protection to retailers from data misuse by their trading partners
Independent influential industry bodies	Organisation(s) in industry that bring retailers and suppliers into cooperation whose members are independent from key players in the industry and whose regulations are influential to the players

3.3.2 Contingency factors influencing tasks assignment

Observation is conducted on the assignment of inventory replenishment tasks between retailer, supplier, and another company in the supply chain[4]. Essentially, the objective is to examine the actor of the tasks. The tasks under consideration are data updating, data monitoring, and decision-making.

Van der Vorst *et al.* (1998), state that the existing process configuration in a company is a significant factor in the selection of future process configuration. The influence of existing configurations in task assignments can be considered in two ways. The first is the effectiveness of the existing configuration compared to the effectiveness of a new configuration. If the existing configuration is more effective it will be maintained, and vice versa. For retailers, effectiveness of CR practice is measured by service level achievement, out-of-stock rate, inventory turn, and inventory costs. The second way is to evaluate the resistance to change in people as created by the existing configuration. To a group of people, process change may be a negative sign that can reduce their involvement in organisation. In this condition, a new process configuration can be rejected or applied, but after a longer period than expected. In the latter case people may not notice the changes because they cannot feel the impact and are conditioned to accept them. To summarise, the influences of an existing configuration

[4] Those are Application Service Provider (ASP) or a broker that can provide services for retail inventory management.

occur in two ways: either it is more effective, or people are reluctant to change and the new configuration is rejected or applied gradually until resistance has diminished or the new configuration is able to deliver better outcomes than the old one.

Another factor that affects the assignment of tasks is the strategic fit of the tasks. Strategic fit is defined as the contribution of the task toward the realisation of business strategy (Armistead and Machin, 1997). For example, retailers whose strategy is to be the leader in fresh products will execute all the processes related to the handling of fresh products and may delegate the handling of non-fresh products to suppliers. In a CR context, the meaning of strategic fit of task needs to be extended. In this context, tasks are strategic because strategic data is involved in the execution of those tasks. For example, an inventory-monitoring task is strategic because it involves the observation of sensitive stock data. Suppliers' trustworthiness needs to be mentioned as well because suppliers may use the data for other unwanted purposes. Task assignment will be effective only if suppliers are trustworthy.

Skills and knowledge required to execute the tasks are also important in task assignment. These factors are mentioned in Ruekert *et al*. (1985) and Choudhury and Sampler (1997) as knowledge specificity of the task. Knowledge specificity is a type of knowledge and a skill required to perform the task. Suppliers need to have knowledge for data handling if they want to perform inventory management for retailers. If those knowledge and skills are absent, then the tasks will not be delegated to them. Important knowledge in a CR context is inventory management, product characteristics, and retail operations (Tyan and Wee, 2003). Explanation of this knowledge can be found in section 3.3.1.

Choudury and Sampler (1997) add another characteristic of task that affects its assignment: time specificity of the process. Time specificity is defined as the time period between information acquisition and use as perceived by the retailer. In inventory replenishment it is the time interval between data updating, monitoring, and decision-making. This interval is normally short. For example, replenishment decisions are usually made once it is known from monitoring that the stock level for particular products is below a pre-determined level.

In this situation, IT infrastructure plays a significant role. IT can help a retailer or supplier perform inventory replenishment tasks in a timely manner. The key is passing actual data from POS terminals to the database server in a real time manner and having the capability of real-time data processing in the inventory management application. However, as reported by Verra (1997) and Martin (1994), data updating in retail is still done in batch. Retailers normally collect sales data of a day and update the database at the end of the day (Verra, 1997). A reason for this is network traffic. Existing data communication networks cannot support high data traffic from POS terminals to the database server. As this is an IT infrastructure capability (Byrd and Turner, 2000;

JIPECR, 1998; Martin, 1994), it is stated that IT infrastructure capability influences task assignment in a CR context.

Real-time data updating needs to be supported with real-time data processing (JIPECR, 1998; Martin, 1994). As explained in Martin (1994) important real-time data processing capabilities in inventory management applications are real-time load building and capacity planning. Those need to be present in the party managing the retailer's inventory.

If suppliers are involved in decision-making they need to have a compatible infrastructure to establish seamless data communication with retailers. Byrd and Turner (2000) explained that compatibility depends on IT platforms, data formats, and data communication protocol of retailers and suppliers. Differences in those aspects reduce data communication speed between them (McAdam and McCormack, 2001; Byrd and Turner, 2000). Byrd and Turner (2000) and McAdam and McCormack (2001) considered compatibility an aspect of IT flexibility; it is said that IT infrastructure flexibility is one contingency factor in task assignment in a CR context.

As in data arrangement, process outsourcing (the assignment of tasks to supplier), may be a result of bargaining power between trading partners. More powerful parties are able to ask less powerful parties to perform inventory replenishment activities for them. This argument is supported by Vera (1997), based on his study of retailer and supplier relationships in The Netherlands. He found that a number of powerful retailers are convincing suppliers to perform some inventory management in their companies by the threat of losing business opportunities.

The company may also consider delegating the tasks to an Application Service Provider (ASP), or a broker that could provide services for retail inventory management (JIPECR, 1998). It is argued that the factors that influence task assignment between retailers and ASP are similar to those mentioned in the retailer-supplier relationship for inventory tasks assignment. However, if there were no ASP in the industry then the assessment of ASP characteristics would not be conducted.

A summary of factors in the process sub-system is given in Table 3.2. Task characteristics are factors in a retail company because time and knowledge specificity of tasks are perceived by the company.

Table 3.2 Contingency factors that affect tasks assignment

Contingency factors	Operationalisation
Retailer characteristics	
Data characteristics	
Strategic sensitivity of data	Potential of data to reveal strategic information such as sales trend and policy, inventory policy, and pricing and promotional policy
Task characteristics	
Strategic fit	The importance of tasks in achieving business strategy and the strategic importance of data used in the tasks
Knowledge specificity	The level of important knowledge (inventory management, product characteristics and retail operations) required to execute inventory management task in CR practice
Time specificity	The time aspect of acquisition and use of information in inventory management task within CR practice
Other retailer characteristics	
Prior or existing process configuration	Performance of the configuration in realising inventory management-related objectives and/or perceived people resistance to change in the configuration
IT infrastructure capability	IT infrastructure capability to support inventory management tasks (monitor inventory level, generate forecasts and orders, and process order to advise delivery times) in timely manner. The critical points are data communication bandwidth and capability of inventory management application to perform real-time load building and capacity planning.
Data-handling knowledge	Staffs' knowledge of inventory management, product characteristics and retail operations
Relative market power	Retailer power relative to a specific supplier
Supplier characteristics	
Trustworthiness	Perceived suppliers' intention or goodwill to keep the confidentiality of data
Data-handling knowledge	Staffs' knowledge of inventory management, product characteristics and retail operations available among staffs
IT infrastructure capability	IT infrastructure capability to support inventory management tasks (monitor inventory level, generate forecasts and orders, and process order to advise delivery times) in timely manner. The critical points are data communication bandwidth and capability of inventory management application to perform real-time load building and capacity planning.
IT infrastructure flexibility	Compatibility of suppliers' IT platform, data standards, and data communication protocols with those of retailers to make seamless data communication

Table 3.2 Contingency factors that affect tasks assignment (*Cont.*)

Contingency factors	Operationalisation
Industry characteristics	
ASP capability in retail inventory management	The ability of ASP to deliver required services for retail inventory management and their knowledge in handling data from retailers

3.3.3 Contingency factors influencing selection of Information Technology components

The description in this sub-section is for factors that influence the selection of IT solutions (data communication technology and business applications), for implementation of the CR principle. From the literature it was found that six IT characteristics[5] influence the decision to select IT solutions for companies: functionality, flexibility, adoption rate, vendor support, security, and adoption costs. Partners' IT infrastructure, market power and their technical knowledge were also found to be influencing factors in selecting technical solution.

Functionality of a technical solution is the main characteristic that needs to be evaluated before it is used for CR (Suomi, 1994; Stamper, 1989). Functionality is defined as functions or supports provided by the technical solutions for CR implementation. As mentioned by JIPECR (1998) at least three basic functionalities need to be supported in an inventory management application: inventory updating, forecasting and ordering. To support advanced CR practice the technical solution needs to have built-in capability to detect and inform exception in operations and incorporate it in the systems to make real-time load building and capacity planning. Companies that want to practice advanced CR need to consider these functionalities within their IT infrastructure and available solutions in the market.

The IT solution needs to be flexible. Flexibility is defined as the ability of technical solution to easily and readily diffuse or support a wide variety of hardware, software, communication technologies, data, and core applications in the organisation as well as the ability to be redesigned to cope with future development (Byrd and Turner, 2000; Broadbent *et al*., 1999; VICS, 1999; Nelson and Ghods, 1998; Suomi, 1994). Those authors explained that flexibility is determined by compatibility, modularity, and scaleability. Byrd and Turner (1999) defined compatibility as ability of a technical solution to work with different solutions and share any type of information across those solutions They stated that IT platform, data format and data communication protocol that can be supported by the technical solution determine compatibility of the solution with existing solutions in a company. Compatibility also determines connectivity with other companies. If a technical solution supports IT platform, data format, and data

[5] Including those of IT vendors

communication of other companies it can be used to connect with those companies (Broadbent *et al*., 1999). Modularity is defined as the degree of formal design separation within a technical solution (Nelson and Ghods, 1998 p. 234). This characteristic determines how flexible a technical solution to changes (Nelson and Ghods, 1998). Modular technology enables companies to isolate problems, but still maintain a connection with the whole systems. Scaleability is needed in order to expand application of the technical solution (VICS, 1999). This is necessary if companies want to expand the application of CR principle from one category to another category or from a business partner to another one to assess the impact of the application in a larger scale.

However, the extent of the solutions' flexibility depends on the retailers' IT infrastructure flexibility to connect with various business solutions. A solution may not be considered flexible for the company if the company's IT infrastructure is not flexible enough to take the solution. Retailer's IT infrastructure flexibility is defined as the compatibility of the infrastructure with available solutions in the market and also with suppliers' IT infrastructure since technical selection in CR practice is aimed at improving connection with suppliers. As explained above platform, data format and data communication protocol of retailer's IT infrastructure determine compatibility of the infrastructure.

Another characteristic considered in selecting IT solutions is the adoption rate of technical solutions (Davenport, 2000). This characteristic explains the fitness of the solution with the business requirements of a large number of companies in industry. Because of this, it is expected that the solution would fit the company's requirements as well. Vendor support is also considered in the selection process (Davenport, 2000). A lack of support may hinder the decision to adopt the solution. Security is another consideration especially for data communication technology because CR involves sharing of sensitive data between two or more companies (Irvine and Harle, 2002). If those characteristics have been satisfied then cost is the last consideration in selecting the right solution among possible alternatives (Stefansson, 2002; Olson and Chervany, 1980). Many organisations are hesitant to join a data sharing relationship because of the high costs of infrastructure required to perform it (Stefansson, 2002).

Nevertheless, selecting IT applications for CR is more than just analysing these characteristics of technical solutions. It involves factors in the business environment as well, especially the condition of IT infrastructure in business partners. Companies need to consider their partners' IT infrastructure flexibility in order to create effective and efficient communication for inventory management (McAdam and McCormack, 2001). They need to know whether suppliers' IT infrastructure support their IT platform, data formats and data communication protocol. O'Leary (2000) adds two more factors: market power and technical knowledge. He mentions that these factors also play an important role in determining technical solutions to be used for CR. More powerful

parties and/or more technically knowledgeable ones will lead to the selection of a technical solution for CR (O'Leary, 2000).

Table 3.3 summarises the above description. Characteristics of technical solution and vendor are put into industry characteristics since this is the most appropriate group in the research framework.

Table 3.3 Contingency factors that affect technical solution selection

Contingency factors	Operationalisation
Retailer characteristics	
IT infrastructure capability	The ability of IT infrastructure to provide necessary functions for basic and advanced CR implementation (basic: updating, forecasting and ordering; advanced: identify exception and real-time load building and capacity planning)
IT infrastructure flexibility	Compatibility of retailer's IT infrastructure with available technical solutions in the market and suppliers' IT infrastructure (IT platform, data format and data communication protocol)
Relative market power	Retailer power relative to a specific supplier
Technical knowledge	The technical capability to predict future development of applications and hardware and to recommend future standards, applications and hardware
Supplier characteristics	
Technical knowledge	The technical capability to predict future development of applications and hardware and to recommend future standards, applications and hardware
IT infrastructure flexibility	Compatibility of suppliers' IT infrastructure with retailer's IT infrastructure in terms of IT platform, data format and data communication protocol
Industry characteristics	
IT solutions and IT vendor characteristics	
Functionality	Basic and advanced functions offered for inventory management in a CR context
Flexibility	Compatibility, modularity and scaleability of technical solutions
Adoption rate	Rate of diffusion of technical solution compared to other available solutions in the market
Vendor support	Technical support provided by vendor after the adoption
Security[6]	The capability of data transfer infrastructure to transmit data securely from sending party to authorised recipient(s)
Costs	Amount of money spent to adopt and implement the technical solution

[6] Specific for data communication architecture

3.4 The research model

The research model is seen in Figure 3.7. The objectives of this research are to describe actual BIS configuration for CR implementation within select retailers and to identify contingency factors that drove the selection of the BIS configuration. The BIS consists of two sub-systems: data processing and technical sub-systems. Aspects and characteristics within those sub-systems are listed in Table 3.4. Potential contingency factors are summarised in Table 3.5. Those factors are grouped into three main groups. The first group is internal retailer's characteristics made up of three sub-groups: data characteristics, tasks characteristics and other retailer characteristics. The second main group is suppliers' characteristics. The third is industry characteristics that consist of two sub-groups: IT solution and IT vendor characteristics and other industry characteristics. The definition of these factors is also mentioned in the table. The complete influencing relationship between factors and sub-systems is presented in Table 3.6. From the table it can be seen that one factor may have influences on different aspects. Those factors are operationalised in order to have a clear definition in data collection. The operationalisation is described in Table 3.5. In section 3.5 there is a discussion about cultural influence on those contingency factors and how to highlight cultural influence from the research findings.

Empirical research begins by selecting case companies. The main selection criterion is the application of the CR principle within candidate companies. Full description of the criteria is in Chapter 4.

A specific protocol is formulated for the data collection technique within those companies, to present the findings, to analyse them, and to draw conclusions. This protocol is part of the empirical research design described in Chapter 4.

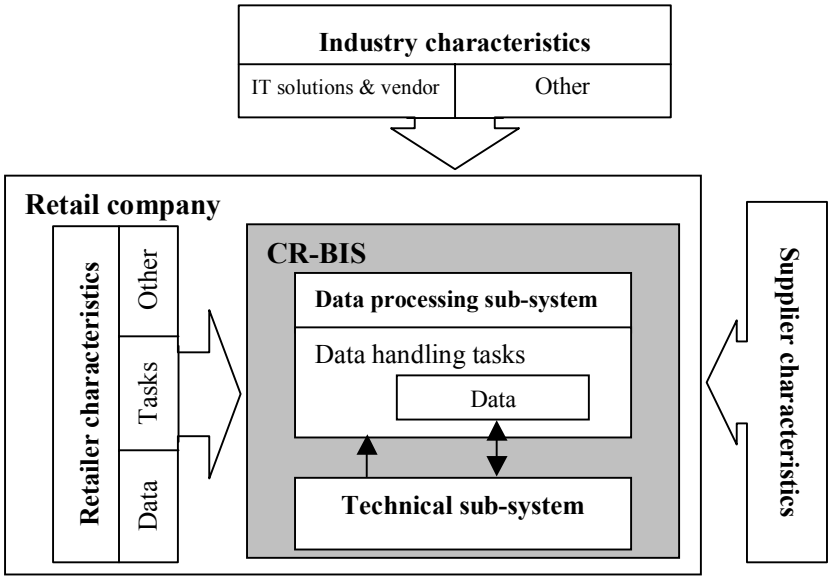


Figure 3.7 Research model

Table 3.4 Sub-systems, aspects, and characteristics within CR-BIS model

Sub-system	Aspects	Characteristics	Options
Data Processing	Business data for inventory replenishment decision-making	Breadth and depth of data to be used in data processing activities	Breadth: sales, inventory, forecast or order data Depth: aggregation (daily, weekly, monthly or other) and number of suppliers involved in the data (one supplier or two or more competing suppliers)
	Data updating task	Actor(s) of the tasks	Actor: retailer, supplier or both
	Data monitoring task		
	Decision-making task		
Technical	Data communication technology	Data communication mechanism	Mechanism: paper-based and non paper-based Non-paper: e-mail or EDI through a private, public or value-added network
	Business application	Functionality	Basic functions: inventory updating and order generation. Advanced functions: real time inventory updating and exception generation.

Table 3.5 Contingency factors that influence CR-BIS configuration

Contingency factors	Operationalisation
Retailer characteristics	
Data characteristics	
Strategic sensitivity of data	Potential of data to reveal strategic information such as sales trend and policy, inventory policy, and pricing and promotional policy
Data accuracy	The accuracy of data in representing the actual situation (accurate and detailed product movement)
Task characteristics	
Strategic fit	The importance of tasks in achieving business strategy and the strategic importance of data used in the tasks
Knowledge specificity	The level of important knowledge (inventory management, product characteristics and retail operations) required to execute inventory management task in CR practice
Time specificity	The time aspect of acquisition and use of information in inventory management task within CR practice

Table 3.5 Contingency factors that influence CR-BIS configuration (*Cont.*)

Contingency factors	Operationalisation
Other retailer characteristics	
Prior or existing process configuration	Performance of the configuration in realising inventory management-related objectives and/or perceived people resistance to change in the configuration
Data-handling knowledge	Staffs' knowledge of inventory management, product characteristics and retail operations
IT infrastructure capability	In data sharing: Availability of advanced product scanning technology that can capture detailed information on products, capability of inventory management application to provide demographics and seasonality information for every item in every store, the capability to send and receive EDI messages so that data can be distributed in accurate and timely manner, and availability of broadband data communication to allow high traffic of data access and sharing. In task assignment: IT infrastructure capability to support inventory management tasks (monitor inventory level, generate forecasts and orders, and process order to advise delivery times) in timely manner. The critical points are data communication bandwidth and capability of inventory management application to perform real-time load building and capacity planning. In technical selection: The ability of IT infrastructure to provide necessary functions for basic and advanced CR implementation (basic: updating, forecasting and ordering; advanced: identify exception and real-time load building and capacity planning)
IT infrastructure flexibility	Compatibility of retailer's IT infrastructure with available technical solutions in the market and suppliers' IT infrastructure (IT platform, data format and data communication protocol)
Relative market power	Retailer's power relative to supplier
Technical knowledge	The technical capability to predict future development of applications and hardware and to recommend future standards, applications and hardware

Table 3.5 Contingency factors that influence CR-BIS configuration (*Cont.*)

Contingency factors	Operationalisation
Supplier characteristics	
Trustworthiness	Perceived suppliers' intention or goodwill to keep the confidentiality of data
IT infrastructure capability	In data sharing: Capability of suppliers' business application to integrate different retailers' data and exceptions from retailers' operations into their actual production and distribution plans using real-time load building and capacity planning functions. The capability includes bandwidth of suppliers' data communication infrastructure to receive a higher volume of real time data from retailers and capability to support EDI communicationom retailers and capability to support EDI communication In task assignment: IT infrastructure capability to support inventory management tasks (monitor inventory level, generate forecasts and orders, and process order to advise delivery times) in timely manner. The critical points are data communication bandwidth and capability of inventory management application to perform real-time load building and capacity planning.
IT infrastructure flexibility	In both task assignment and technical selection: Compatibility of suppliers' IT infrastructure with retailer's IT infrastructure in terms of IT platform, data format, and data communication protocol
Technical knowledge	The technical capability to predict future development of applications and hardware and to recommend future standards, applications and hardware
Data-handling knowledge	Staffs' knowledge of inventory management, product characteristics and retail operations
Industry characteristics	
IT solutions and IT vendor characteristics	
Functionality	Basic and advanced functions offered for inventory management in a CR context
Flexibility	Compatibility, modularity and scaleability of technical solutions
Adoption rate	Rate of diffusion of technical solution compared to other available solutions in the market
Vendor support	Technical support provided by vendor after the adoption
Security	The capability of data transfer infrastructure to transmit data securely from sending party to authorised recipient(s)
Costs	Amount of money spent to adopt and implement the technical solution

Table 3.5 Contingency factors that influence CR-BIS configuration (*Cont*.)

Contingency factors	Operationalisation
Other industry characteristics	
Legal system	A set of legal systems that can provide protection to retailers from data misuse by their trading partners
Independent influential industry bodies	Organisation(s) in industry that bring retailers and suppliers into cooperation and whose members are independent from key players in the industry and whose regulations are influential to the players
ASP capability in retail inventory management	The ability of ASP to deliver required services for retail inventory management and their knowledge in handling data from retailers

Table 3.6 Relevant contingency factors within BIS aspects

Contingency factors	Extent of data sharing	Tasks assignment	Technical solution selection
Retailer characteristics			
Data characteristics			
Strategic sensitivity of data	√	√	
Data accuracy	√		
Task characteristics			
Strategic fit		√	
Knowledge specificity		√	
Time specificity		√	
Other retailer characteristics			
Prior or existing process configuration		√	
Data-handling knowledge	√	√	
IT infrastructure capability	√	√	√
IT infrastructure flexibility			√
Relative market power	√	√	√
Technical knowledge			√
Supplier characteristics			
Trustworthiness	√	√	
IT infrastructure capability	√	√	
IT infrastructure flexibility		√	√
Technical knowledge			√
Data-handling knowledge	√	√	
Industry characteristics			
IT solutions and IT vendor characteristics			
Functionality			√
Flexibility			√
Adoption rate			√
Vendor support			√
Security			√
Cost			√
Other industry characteristics			
Legal systems	√		
Independent influential industry bodies	√		
ASP capability in retail mgt.		√	

3.5 Explaining national culture influence from the research findings

The research model in Figure 3.7 describes the relationship between contingency factors and CR-BIS configuration in a general organisational setting. One objective of this research is to investigate national culture influence on the importance of contingency factors in designing this configuration. To get an impression of possible cultural influences, research was conducted within Indonesia and The Netherlands. The two countries show significant differences in terms of national culture (Hofstede, 1997) and, provide a plausible testing ground for the research.

National culture has a significant impact on CR practice. Kurnia and Johnston (2000) in their study of ECR adoption in European and American companies mentioned that national culture affects people's attitude toward change within organisations. This attitude would later influence commitment to changes needed in CR practice.

With regard to contingency factors, studies report cultural influences, especially in configuration of information systems. Ginsburg (2003) reported that culture had influenced how companies perceived the importance of data in determining the extent of data shared with other companies. The influence of culture on trustworthiness was studied by Elahee *et al*. (2002), Huff and Kelley (1999) and Doney *et al*. (1998). These authors indicated significant influences on the level of trustworthiness and trust building between different groups and companies. Kitayama *et al*. (2003) indicated that tasks assignment in companies was influenced by culture. They found that Japanese workers tend to perform relative tasks that incorporate contextual information, while American workers perform absolute tasks that ignore contextual information (Kitayama *et al*., 2003). Hasan and Ditsa (1999) reported cultural influences on technology adoption and development, which is supported by Garfield and Watson (1998). In their view, culture influenced companies in weighing the importance of technology features (functionality, flexibility, vendor support and others) resulting in different technologies across companies. All of these examples show the influence of culture on contingency factors in designing BIS configuration within organisations.

3.5.1 Dimensions of national culture

Culture is defined as a collective programming of mind that differentiates members of one group from members of other groups (Feng, 2004; Hofstede, 1997; Erez and Earley, 1993). The notion 'collective programming of mind' indicates that there are shared values, beliefs, and norms among the members that form their inherent characteristics and influence their attitude and preferences toward things (Erez and Earley, 1993; Rokeach, 1973). Using this conception, group culture can be considered as commonly shared values or a major pattern of behaviour within a group (Hofstede, 1997). A group can be a nation, organisation, or a small group within organisations. National culture

can be defined as commonly shared values or a major pattern of behaviour within the nation.

National culture is assumed to influence organisational practice and structure. This assumption finds its base in the works of Lawrence and Lorsch (1967), Aldrich (1979), Hofstede (1985), and Nelson and Gopalan (2003).

Lawrence and Lorsch (1967) and Aldrich (1979) take a contingency view and state that organisations need to adapt their practices and structures to national culture in order to survive. As a result of this adaptation process people can find cultural reflection in organisational practices and structures. Hofstede (1985) stated that culture influences organisational practices and structures as long the value orientation of the organisation's founders and dominant elites are shaped by that culture and that the organization practice is created, shaped, instilled, and maintained by those people. Nelson and Gopalan (2003) further shape this argument. They say that organisations adopt culture in their daily practice as long as there is a need to comply with it in order to survive. There are situations when organisations need to deviate from national culture; when they find it important to maintain an independent identity and practice throughout their global operations (e.g. multinational companies and religious organisations), or when they participate in industry relationships that generate values distinctive from the national culture.

According to Hofstede (1997) national culture can be examined in five dimensions: power distance, individualism, uncertainty avoidance, masculinity, and time orientation.

Power distance refers to the extent to which less powerful members expect and accept unequal power distribution within a group. Power may be defined as the ability of one group to influence the intentions and actions of another group (Maloni and Benton, 2000). The power distance characteristic plays a role when power inequality can be created and used to achieve business goals. Hofstede (1997) claims that organisations characterised by high power distances, tend to create and keep inequalities. They create centralized power and tall hierarchies with large differences in salary and status where subordinates are expected to do as they are told (Hofstede, 1997). Inequalities within low power distance organisations are not expected and would be reduced. Subordinates and supervisors are viewed as close members of the organisations. A flatter hierarchy in organizations is expected and the difference in salaries and status is reduced (Hofstede, 1997).

Individualism relates to the cohesiveness of an individual to a group (Hofstede, 1997). This dimension ranges from the individualist on one side to the collectivist on the other. Individualism in cultures implies loose ties; everyone is expected to look exclusively after one's self or immediate family, while collectivism implies that people are integrated into strong, cohesive groups that protect them in exchange for their loyalty (Hofstede, 1997). Feng (2004) elaborates the differences between individualist

and collectivist cultures. To her, social identity within an individualist society is based on the individual contribution, while in a collectivist society it is based on group membership. In an individualist society one is recognised by his/her personal values, whereas in a collectivist society he/she is recognised by the values embraced by his/her groups (Feng, 2004). Expressing one's mind is a virtue in individualist culture, even when confrontational, while it may be considered rude and undesirable in collectivist culture (Feng, 2004). This results in a difference between individualist and collectivist in perceiving the other's intention. According to Huff and Kelley (1999) individualists tend to think positively about other's intention to work with them. Conversely, collectivists tend to be suspicious of people outside of their groups (Huff and Kelley).

Uncertainty avoidance is the attitude toward accepting uncertainties in life (Hofstede, 1997). Hofstede notes that companies with high uncertainty avoidance tend to have more formal rules, require longer career commitments, and focus on tactical operations rather than strategy. Workers expect structure in organizations, institutions, and relationships to help make events clearly interpretable and predictable. Companies with low uncertainty avoidance tend show the opposite characteristics. They tend to have less formal rules, focus on long-term strategy, and expect more freedom in work to make their personal interpretation about the encountered situations (Hofstede, 1997).

Masculinity and femininity refer to how gender-related attributes manifest themselves in social practice (Hofstede, 1997). According to Hofstede masculinity is associated with assertiveness, competition, and toughness, while femininity is associated with an orientation to home and children, people, and tenderness. A society is considered masculine if the social practice is characterised by masculine attributes and feminine if there is combination of masculine and feminine attributes in the practices (Hofstede, 1997).

Time orientation refers to how people frame their actions and behaviour in time. Long-term orientation culture tends to pursue persistence and thrift, with the willingness to subordinate oneself and respect social obligation within reason. Short-term orientation culture tends to expect quick results, has a high concern with 'face', and respects social obligation almost unconditionally (Hofstede, 1997).

The cultural dimensions from Hofstede (1997) are used in this research because they have been studied in relation to the contingency factors identified within this study; Shane's (1995), work about culture and changes in business process configuration for example, Elahee *et al*. (2002) about culture and trustworthiness, and Hasan and Ditsa (1999), about culture and technology characteristics are all included.

3.5.2 Influencing mechanisms of national culture

Rathod and Miranda (1999) and Chen *et al*. (1999) indicate two mechanisms that explain how national culture influences contingency factors in the configuration of

information systems. Those mechanisms are labelled antecedent and moderation. The antecedent and moderation mechanisms of national culture are illustrated in Figure 3.8.

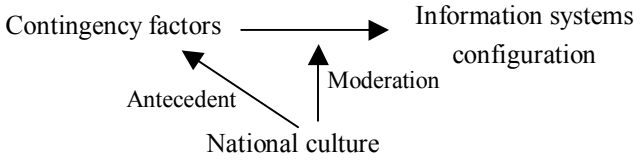


Figure 3.8 Two types of influencing mechanisms of national culture on contingency factors in the configuration of information systems.

The antecedent role occurs when national culture influences the condition of contingency factors (Rathod and Miranda, 1999). This is found when contingency factors' conditions are closely related to the national culture dimensions. For example, trustworthiness is closely related with the individualism characteristic of organisations (Huff and Kelley, 1999) because the nature of trustworthiness and individualism is close; it is about a group perception toward other groups' intentions to work with it. Because of this, trust of the other group depends on the individualism score of the first group. Based on this description, the antecedent effect of national culture is defined as follows:

Definition 5: Antecedent effect of national culture
Antecedent effect of a national culture dimension on contingency factors occurs when the nature of contingency factors is similar to the national culture dimension.

There are circumstances where national culture does not affect the condition of contingency factors. This is because the nature of both is different. For example, none of the national dimensions would affect the condition of IT infrastructure capability directly as it is not directly related with the nature of power distance (power inequality), individualism (perception of others' intention), uncertainty avoidance (attitude toward risk and uncertainty), masculinity (manifestation of gender-related attributes) or time orientation (framing actions and behaviour in time). IT infrastructure capability is more influenced by its own specifications and not by national culture. IT infrastructure is considered capable to support EDI partnership, for example, if it is stated in its technical specification. Although national culture does not affect the condition of contingency factors, it would affect the relative importance of contingency factors in designing information systems (Chen *et al*., 1999). Chen *et al*. (1999) give an example of how national culture moderates the influence of technology capability on the design of technology-based learning systems in Singapore. Teachers' experience in using technology-based learning systems was more important than technology capability in the design of the systems; the systems design would consider teachers' conditions rather

than technology status. This was a result of national culture influence (Chen *et al*., 1999). Another example is when companies do not take suppliers' IT infrastructure into account when determining the extent of data sharing, although the infrastructure is able to perform real time data processing. Instead they pay more attention to other contingency factors, for instance suppliers' trustworthiness. This is because of a cultural influence within the companies where they would consider one contingency factor more than others.

The relative importance of contingency factors is determined by the fit of the factors' influence with the cultural characteristics of an organisation. For example, individualist companies would disregard the importance of legal systems in determining the extent of data sharing with suppliers because they do not need explicit protection in the legal system if they always trust their suppliers. Because of the moderation effect of national culture one may find different contingency factors in different organisations. This can be used to explain why evidence of certain contingency factors is found in one organisation, but not in others. The moderation effect of national culture is defined as follows:

Definition 6: Moderation effect of national culture
Moderation effect of national culture occurs when national culture does not influence the condition of contingency factors but moderates the influence (relative importance) of the contingency factors on information systems structure. The relative importance is determined by the fit of the contingency factors with cultural characteristics of an organization.

Regarding the research model, it is stated that national culture gives antecedent and moderation effects to contingency factors in the configuration of CR-BIS as seen in Figure 3.9.

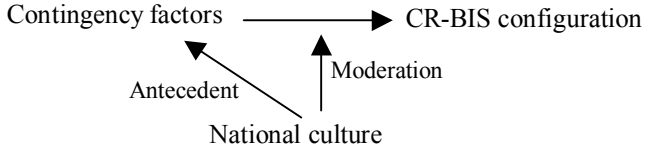


Figure 3.9 Antecedent and moderation effects of national culture on contingency factors and their influence on CR-BIS configuration

3.5.3 Elaboration of national culture effects in this research

As this study is conducted in Indonesia and The Netherlands, an examination of determinant national culture dimensions between the two countries is necessary. For this purpose, national culture assessment in Indonesia and The Netherlands from Hofstede (1997) is used. The data from his study is presented in Table 3.7.

Table 3.7 National culture assessment in Indonesia and The Netherlands
Source: Hofstede (1997)

Dimension	Indonesia		The Netherlands	
	Score	Conclusion	Score	Conclusion
Power distance	78	High	38	Low
Individualism	14	Collectivist	80	Individualist
Uncertainty avoidance	48	Weak	53	Weak
Masculinity	46	Feminine	14	Feminine
Time orientation	N/A	N/A	44	Short-term

Note: N/A: not available

In his study, Hofstede (1997) assigned a value from 0 to 100 for each national culture dimension. The significance of the value for each national culture dimension is determined using specific criteria. According to the study, Indonesia and The Netherlands show significant differences in power distance and individualism. Indonesia is characterised by high power distance and collectivist cultures, while The Netherlands is characterised by low power distance and an individualist culture.

The two countries show similarities in uncertainty avoidance and masculinity. They have a weak tendency toward uncertainty avoidance and a tendency toward femininity. Although Indonesia scored higher on the masculinity dimension than The Netherlands the result is not significant enough to be considered masculine (Hofstede, 1997).

Hofstede (1997) asserts that Dutch culture indicates a tendency toward short-time orientation. This dimension, however, has not been studied in Indonesia. It is not within the scope of this study to obtain a time-orientation score for the Indonesian culture. However, based on the researcher's experience with Indonesian culture, it is argued that Indonesian culture also tends to show short-term orientation. Indonesian people tend to demand quick results and try not to lose face in front of other people, both characteristics of a short-time orientation culture (Hofstede, 1997).

Based on the above description, only power distance and individualism are expected to show differences between Indonesia and The Netherlands. The investigation will be conducted along these dimensions because the objective is to identify differences in terms of cultural influence on contingency factors and their influences. The term national culture used in the rest of this thesis refers to those dimensions. The antecedent and moderation effects of the dimensions are elaborated in the next sub-sections.

Antecedent effect of national culture

Power distance has an antecedent effect on data sensitivity because power inequality between retailers and suppliers is caused by the possession of proprietary sales and

inventory data by retailers (Dussart, 1997; Collins, 1997; Verra, 1997). This data provides insights about consumer behaviour and preferences toward certain products. Retailers use the data to improve their knowledge about consumer demands and formulate better strategies to address changing consumer demands. They would be able to improve their profitability and use this situation to bargain with suppliers (Bell *et al*., 1997; Rousey and Morganosky, 1996). Because data gives an opportunity to improve the market bargaining position and consequently create power inequality, its sensitivity is influenced by power distance characteristics within the retail companies that own the data.

Companies with low power distance characteristic tend to reduce this inequality. They appreciate the importance of suppliers' knowledge in handling the data. In their opinion they would be able to use the data optimally if they incorporated suppliers' knowledge about products and delivery processes into data handling. This attitude reduces the sensitivity of data as opposed to the attitude of high power distance companies. The implication is that proprietary data sensitivity in companies with a high power distance characteristic is higher than in those with a low power distance characteristic.

As individualism influences a group's perception toward others' intentions (Feng, 2004; Huff and Kelley, 1999) it also influences retailer's perceptions toward suppliers' trustworthiness. Suppliers' trustworthiness would have different conditions in collectivist and individualist cultures.

Huff and Kelley (1999) conducted a study on the influence of individualism on trustworthiness. They found collectivists often view outsiders differently. They are likely to be more sceptical of outsiders because of the perceived difference in values (Huff and Kelley, 1999). Collectivists have a high degree of distrust until strangers have proven their trustworthiness (Huff and Kelley, 1999). In the context of this study, suppliers' trustworthiness is considered low by retailers within a collectivist culture. They are more cautious in their behaviour and require more time to develop trust with suppliers. On the other hand, individualists are more likely to suspend their distrust until the stranger has proven untrustworthy (Huff and Kelley, 1999). They begin with a higher level of trust, followed by less cautious behaviour. The trust level is adjusted according to the outcomes of their relationship with the stranger (Huff and Kelley, 1999). In the context of this study, it is expected that retailers with an individualist culture will consider their suppliers trustworthy. It follows that suppliers' trustworthiness is high in an individualist culture. The antecedent effect of national culture in this research is:

Power distance

Power distance gives an antecedent effect to data sensitivity because it creates power inequality between retailer and supplier. Data is highly sensitive in a high power distance context and not in a low power distance context

Individualism

Individualism gives an antecedent effect to suppliers' trustworthiness because trust is determined by one's perception toward other's intentions, the nature of the individualism characteristic. Suppliers' trustworthiness is high in individualist culture, but low in collectivist culture.

Moderation effect of national culture

The other contingency factors create a moderation effect from national culture because none are related directly to power distance or individualism. The moderation effect of those factors is manifested in the consideration or ignorance of the contingency factors' influences on CR-BIS configuration by companies. Because there are three aspects of CR-BIS configuration, the discussion of the moderation effect is grouped into three sections. Different combinations of power distance and individualism characteristics in organisations are considered in each section.

Moderation effect of national culture on the extent of data sharing

Combination of power distance and individualism cultures results in certain effects within the data aspect. Companies with high power distance and a collectivist culture consider data sensitivity and suppliers' trustworthiness important contingency factors in determining the extent of data sharing, because they need trustworthy suppliers to handle sensitive data. They consider industry bodies, legal systems, and relative market power as instruments to protect them from data misuse by dishonest suppliers.

Moderation effect of high power distance and collectivist culture on data sharing

High power distance and collectivist culture in companies raise the importance of data sensitivity, suppliers' trustworthiness, industry bodies, legal systems, and relative market power in determining the extent of data sharing with suppliers.

Different evidence would be expected from high power distance and an individualist culture. Since suppliers' trustworthiness is perceived as high in individualist culture, this would not be important in sharing sensitive data. Instead, one can expect to find evidence of other contingency factors (data accuracy, data handling knowledge, and IT infrastructure capability). The same evidence could be expected in the combination of low power distance and an individualist society, because data sensitivity is low and suppliers' trustworthiness is high. Similarly, it could be expected in low power distance and a collectivist culture. Within this situation the influence of low suppliers trustworthiness caused by a collectivist culture would be irrelevant since companies do not consider data sensitive. Other contingency factors would be more important in this situation. Because those combinations result in similar contingency factors their influence is combined:

Moderation effects of other combinations of power distance and individualism characteristics on data sharing

Other combinations of power distance and individualism characteristics (other than high power distance and collectivist,) raise the importance of data accuracy, data handling knowledge, and IT infrastructure capability in determining the extent of data sharing in both retailer and supplier.

All expected moderation effects from the combinations of power distance and individualism culture in data sharing are listed in Table 3.8.

Table 3.8 Expected moderation effects from combinations of power distance and individualism in data sharing

Power distance	Individualism	Expected moderation effect based on theory
High	Collectivist	Data sensitivity, suppliers trustworthiness, industry bodies, legal systems, and relative market power
High	Individualist	Data accuracy, data handling knowledge, and IT infrastructure capability
Low	Individualist	Data accuracy, data handling knowledge, and IT infrastructure capability
Low	Collectivist	Data accuracy, data handling knowledge, and IT infrastructure capability

Moderation effect of national culture on tasks assignment

Combination of high power distance and collectivist culture would raise the importance of data sensitivity and suppliers' trustworthiness in task assignment. Exercising market power can be considered to ensure lawful use of data in this situation. Consequently, relative market power would be important. Because strategic fit of tasks is determined by data used in the task, it is important for companies with this combination of national culture. The moderation effect of high power distance and collectivist culture on tasks assignment is stated below.

Moderation effect of high power distance and collectivist culture on task assignment

High power distance and collectivist culture in companies raises the importance of data sensitivity, suppliers' trustworthiness, strategic fit of tasks, and relative market power.

Similar interactions between data sensitivity and suppliers' trustworthiness caused by other combinations of power distance and individualism characteristics as described in data sharing configuration can be expected in task assignment. One may expect to find evidence of contingency factors other than data sensitivity, suppliers' trustworthiness, strategic fit of tasks, and relative market power in companies not

characterised by high power distance and collectivist culture. This is because either data is not sensitive or because suppliers are considered trustworthy. Consequently, evidence of knowledge and time specificity of tasks, prior or existing process configuration, data handling knowledge of retailer and supplier, IT infrastructure capability of retailer and supplier, suppliers' IT infrastructure flexibility, and ASP capability in retail inventory management is expected. Moderation effect of other combinations of power distance and individualism characteristics is stated below.

Moderation effects of other combinations of power distance and individualism characteristics on task assignment

Other combinations of power distance and individualism characteristics (other than high power distance and collectivist) raises the importance of knowledge and time specificity of tasks, prior or existing process configuration, data handling knowledge of retailer and supplier, IT infrastructure capability of retailer and supplier, suppliers' IT infrastructure flexibility, and ASP capability in retail inventory management in task assignment between retailer and supplier.

The list of important contingency factors for task assignment in different conditions of power distance and individualism cultures is presented in Table 3.9.

Table 3.9 Expected moderation effects from combinations of power distance and individualism in tasks assignment

Power distance	Individualism	Expected moderation effect based on theory
High	Collectivist	Data sensitivity, suppliers' trustworthiness, strategic fit of task, and relative market power
High	Individualist	Knowledge and time specificity of task, prior or existing process configuration, data handling knowledge of retailer and supplier, IT infrastructure capability of retailer and supplier, suppliers' IT infrastructure flexibility, and ASP capability in retail inventory management
Low	Individualist	Knowledge and time specificity of task, prior or existing process configuration, data handling knowledge of retailer and supplier, IT infrastructure capability of retailer and supplier, suppliers' IT infrastructure flexibility, and ASP capability in retail inventory management
Low	Collectivist	Knowledge & time specificity of task, prior/existing process configuration, data handling knowledge of retailer and supplier, IT infrastructure capability of retailer and supplier, suppliers' IT infrastructure flexibility, and ASP capability in retail inventory management

Moderation effect of national culture on technical selection

Power distance in companies highlights market power influence in selecting technology for CR applications (O'Leary, 2000). Companies with high power distance tend to consider their relative market power in selecting technology for CR application. They want to extend their influence to business partners by dictating the technology selection process (O'Leary, 2000). The opposite is expected in low power distance culture. Because inequality is not expected companies with this culture tend to ignore the influence of relative market power in technology selection.

Individualism is considered to influence companies in considering factors other than inherent characteristics of technology (Hasan and Ditsa, 1999). In technology selection, companies from individualist cultures tend to focus on their own requirements while collectivist cultures tend to take other factors into account. The focus on self-requirement makes the individualist critical of inherent characteristics of technologies. Their main concern is whether technology covers the required functionalities, flexibility, and other requirements, including suitability with their budget. In short, companies from individualist cultures give more weight to the inherent characteristics of technology when selecting technology for CR-BIS configuration. Collectivist cultures tend to provide a balance between those factors and the characteristics of their partners. They also tend to value their business partner's technical knowledge in selecting technical solutions. Overall, companies from collectivist societies consider all factors that influence technology selection, or at least consider factors other than just inherent characteristics of the technology.

Moderation effects of power distance and individualism on technology selection

Power distance in companies influences the importance of relative market power in technology selection, while individualism influences the importance of contingency factors besides the inherent technology characteristics.

Different combinations of power distance and individualism culture within companies results in different evidence of contingency factors in technology selection. The individualism characteristic plays a critical role here because it determines whether companies consider factors other than inherent technology characteristics. Because of this, evidence of relative market power can be expected only in high power distance and a collectivist context. One will not find evidence of relative market power in an individualist culture since this culture would be likely to ignore factors other than inherent technology characteristics. For simplicity the moderation effects of all combinations of power distance and individualism culture on technology selection are listed in Table 3.10.

Table 3.10 Expected moderation effect of individualism in technical solution selection

Power distance	Individualism	Expected moderation effect based on theory
High	Individualist	Inherent characteristics of technology (functionality, flexibility, adoption rate, security, vendor support, and costs)
High	Collectivist	Relative market power, inherent characteristics of technology (functionality, flexibility, adoption rate, security, vendor support, and costs), and at least one other factor.
Low	Individualist	Inherent characteristics of technology (functionality, flexibility, adoption rate, security, vendor support, and costs)
Low	Collectivist	Inherent characteristics of technology (functionality, flexibility, adoption rate, security, vendor support, and costs) and at least one other factor in technical selection (excluding relative market power)

3.5.4 Summary

National culture influence on contingency factors is divided into two: antecedent and moderation. The antecedent effect takes place when national culture influences the condition of contingency factor; a moderation effect takes place when national culture moderates influence of contingency factors in configuration of each aspect of CR-BIS. A summary of contingency factors that receive antecedent and moderation effects in each aspect of CR-BIS is listed in Table 3.11.

Key hypotheses related to antecedent and moderation effects of national culture:

Antecedent effect of national culture

1. Data sensitivity is high in a high power distance context and low in low power distance context.
2. Suppliers' trustworthiness is high in individualist culture and low in a collectivist culture.

Moderation effect of national culture on data sharing

1. High power distance and collectivist culture in companies raises the importance of data sensitivity, suppliers' trustworthiness, industry bodies, legal systems, and relative market power in determining the extent of data sharing with suppliers.
2. Other combinations of power distance and individualism characteristics (other than high power distance and collectivist) raise the importance of data accuracy, data handling knowledge and IT infrastructure capability both in retailer and supplier in determining the extent of data sharing.

Table 3.11 Contingency factors' relationship with power distance and individualism dimensions

CR-BIS aspect	Contingency factors affected by antecedent role	Antecedent national culture	Contingency factors affected by moderation role	Moderating national culture
Data	Data sensitivity	Power distance	Data accuracy, data handling knowledge, IT infrastructure capability, relative market power, legal system, and independent influential industry bodies	Power distance and individualism
	Suppliers' trustworthiness	Individualism		
Task	Data sensitivity	Power distance	Strategic fit of task, knowledge and time specificity of task, prior or existing process configuration, relative market power, data handling knowledge, IT infrastructure capability and flexibility, legal system, independent influential industry bodies, and ASP capability in retail management	Power distance and individualism
	Supplier trustworthiness	Individualism		
Technology	None	None	IT infrastructure capability and flexibility, relative market power, technical knowledge, and technical solution characteristics	Power distance and Individualism

Moderation effect of national culture on task assignment

1. High power distance and collectivist culture in companies raises the importance of data sensitivity, suppliers' trustworthiness, strategic fit of tasks, and relative market power.
2. Other combinations of power distance and individualism characteristics (other than high power distance and collectivist) raise the importance of knowledge and time specificity of tasks, prior or existing process configuration, data handling knowledge of retailer and supplier, IT infrastructure capability of

retailer and supplier, suppliers' IT infrastructure flexibility, and ASP capability in retail inventory management in task assignment between retailer and supplier.

Moderation effect of national culture on technology selection

1. Power distance in companies influences the importance of relative market power in technology selection; individualism influences the importance of contingency factors beside the inherent technology characteristics.

The above framework will be used to highlight cultural influences within each case study. The antecedent effects of power distance and individualism on data sensitivity and suppliers' trustworthiness are observed first, followed by the expected moderation effects within each aspect of CR-BIS compared to the actual research findings. The objective is to uncover influences of national culture in this study. If there is a discrepancy between expected national culture influence and the actual research findings we will observe the collected evidence to seek an explanation. The evidence is used to conclude the extent of cultural influence on contingency factors' conditions and their influence on CR-BIS configuration in the case study.

CHAPTER 4 CASE STUDY DESIGN

4.1 Selecting an appropriate research method

4.1.1 Basis for selecting research method

Because of the many choices of methodology, research design can be problematic and confusing. Remenyi *et al*. (2000) and Denzin and Lincoln (1998), say that the selection process should be begin with elaboration of ontological and epistemological parts of the research. Although this may give researchers a comprehensive understanding of the topic and a valid research method, it is arguably a difficult task. Because the terms are hard to understand and elaborate, a study and elaboration may take a long time and even result in a direction that puts the researcher far from the expected answers to the research problem.

Another approach is to evaluate the research problem itself to figure out what knowledge is needed to answer the problem. The type of knowledge gathered will then be compared with the characteristics of available research methods to find a suitable match. This approach is discussed in Falconer and Mackay (1999), Verschuren *et al*. (1999), Krathwohl (1998), and Robey (1996).

Verschuren *et al.* (1999) state that a thorough evaluation of the research problem will indicate the type of knowledge needed to answer the problem. Knowing this enables researchers to identify a suitable method. Since any type of research method may be qualified as a tool for generating the knowledge requirement then it is important to evaluate the practical condition to know whether a method will work (Mingers, 2001). The practical condition is known from pilot case studies in Indonesia and The Netherlands. This approach (knowledge type identification and practical condition evaluation); will be used in determining the research method in this study.

4.1.2 Types of knowledge in literature

According to Verschuren *et al.* (1999) there are five types of knowledge: descriptive, explanatory, predictive, evaluative, and prescriptive. Descriptive knowledge is a description of a certain object, situation, event or development. Explanatory knowledge is an explanation of how or why the object, situation, event or development, originates or takes place. Predictive and evaluative knowledge are on a higher level. By this, one is able to predict and/or evaluate the future state of the object given its current state. This may be achieved if one's knowledge is substantial (Verschuren *et al*., 1999). On the highest level, one is able to give an instruction or guideline in dealing with the object. This is called the prescriptive knowledge.

4.1.3 Knowledge contribution of the research

The research problem is restated below in order to identify the knowledge aimed in this research:

"How do retailers in Indonesia and The Netherlands configure BIS for practising the CR principle and what are the factors that drive them to select those configurations? To what extent do cultural differences affect these factors and their influences on BIS configuration for CR practice?"

From the research problem it is argued that this study is aimed at providing descriptive and explanatory knowledge about Business Information Systems (BIS) configuration of select retail companies in Indonesia and The Netherlands in relation to Continuous Replenishment (CR) implementation. The descriptive section is intended to outline BIS configuration in those companies and, more importantly, changes that occur in the configuration due to the companies' intention to advance CR practices. Those changes may describe the companies' approaches in implementing the CR principle. The resulting configuration will be analysed in order to explain influential contingency factors and cultural influences during the design process. The explanation states the companies' reasons for using a certain configuration and the extent of culture influences in the companies. Those are the types of knowledge pursued in this research. An appropriate research method for generating this knowledge is elaborated in the following paragraphs.

4.1.4 Selected research method

According to Yin (1984) a suitable research method for descriptive and explanatory research is a case study[7]. Case studies can generate deep and rich information about an actual situation, which is important to build comprehensive descriptive knowledge. Case studies are also suitable for explanatory knowledge because it is possible to make close interaction between researcher and the unit of analysis enabling the researcher to examine the unit using different data collection techniques. This results in stronger and more valid explanations.

Other research methods might be applicable to meet the above criteria. For example, survey research is able to describe the situation of a company from information gathered through a questionnaire. It is also possible to form explanations based on statistical analysis of the data. A careful examination of the practical situation

[7] Yin used the question words "What?" and "Why?" to represent descriptive and explanatory knowledge respectively. According to him those questions are suitable for case study research (please refer to Yin, 1984)

is needed to conclude whether case study is the most effective method. The decision to use case study was supported by the fact that there were few companies recommended by ECR Indonesia and ECR Netherlands at the time of study. Conducting survey research was not considered effective because small data population makes statistic tests less useful. The case study method can cope well with this situation. It allows data analysis from a small number of data sources or when an exact causal relationship is unknown (Krathwohl, 1998). Krathwohl (1998) states that it allows qualitative analysis of the data. The analysis technique is described in section 5.3.

It can be concluded that case study as research method is an appropriate approach for the execution of this research. The series of case executions (serial or parallel case studies), and the time factor in data collection (longitudinal or historical case studies), need to be decided. This will be described in the following section.

The unit of analysis, case selection criteria, data collection technique, data presentation technique, data analysis, and method of conclusion withdrawal, will be described afterward. This can be found in case study protocol in section 5.3.

4.2 Characteristics of the case study

The characteristics to be explained in this section are the series of case executions and the time factor in data collection.

4.2.1 Series of case study execution

The case studies have been conducted in parallel; the output of one case is treated independently from the output of other cases. In other words, the output of one case is not used to adjust the research model or method to be used in the other cases. By doing this it is possible to make a fair comparison between cases.

4.2.2 Time factor in data collection

An historical case study was conducted due to the following reasons:

1. The possibility to change configuration in the short term:
   Due to many factors to be considered in changing the BIS configuration it is argued that it may take a long time before change can be applied to the existing configuration. This argument makes longitudinal case study less favourable.
2. The possibility to contrast the BIS configuration before and after CR implementation:
   The select companies are qualified as case companies because they are practising the CR principle when the research was conducted. A historical case study enables the researcher to contrast BIS configuration before and after CR implementation. The advantage of this comparison is that one may identify critical

changes in BIS configuration that allowed CR implementation. This is not possible with a longitudinal case study technique.

One potential problem with historical case study is the absence of key people able to explain the changes and reasons behind them. This problem did not exist in this research because the key people were still available. Another problem is that key people may not recall changes that happened in the past. Fortunately, the CR practices within the case companies are recent and there was not too much trouble for the key interviewees to recall past configurations and the reasons for using them.

4.3 Case study protocol

The protocol contains information on the unit of analysis in this study, the criteria for selecting retail companies, data collection technique, data presentation technique, data analysis technique, and the method for deriving conclusions from the analyses.

4.3.1 Unit of analysis and company selection criteria

The unit of analysis is Business Information Systems (BIS) in the select retail companies (including their stores and Distribution Centres)[8] used in the implementation of Continuous Replenishment (CR) within those locations. The BIS structure analysed is described in Chapter 2. The retail companies involved in this study meet the following criteria:

1. The companies are implementing the CR principle or have experienced CR practice. The companies should be CR implementers to learn their approach in implementing CR. It is possible that companies have stopped performing the CR principle because of one or more factors. Companies in this category are included in the study because they can tell how they managed to implement CR and why they stopped. The CR principles mentioned in Chapter 2 are used to assess the status of implementation in the retail companies.
2. The companies operate in the grocery sector. This sector is suitable for CR implementation as it has relatively stable demand.
3. Familiarity with the CR concept and the presence of conscious effort to change BIS configuration to implement the CR principle. Recommendations from ECR Nederland and ECR Indonesia on qualified retail companies were followed and the CR practice within those companies was checked against the criteria.

[8] When a Distribution Centre did not support store replenishment, it is only stores' BIS configuration that are described.

4.3.2 Data collection technique

A preliminary data collection strategy was formulated and tested in pilot case studies in The Netherlands and Indonesia for revision. Initial procedures of interviews, observation, and document studies were specified. In summary it was intended to conduct semi-structured interviews, non-participant observation, and document study.

A semi-structured interview was chosen to give room for interviewee's feedback on the research model and contingency factors to make the research model more applicable. Non-participant observation[9] was applied because it was not reasonable to be involved in the process of inventory replenishment due to a lack of internal procedure knowledge. Time was not available to learn the procedures completely. The positive side is that this enables the researcher to concentrate entirely on observation. It was intended to study the organisation chart and job description, company policies and procedures for inventory replenishment, business contracts with suppliers, computer networking diagrams, and reports on inventory management measures. The organisation chart was needed to define the process owners and the scope of their responsibilities. The company's policies and procedures were needed for details on replenishment activities. A business contract was required to identify whether there was an explicit agreement between retailers and suppliers in managing the retailer's inventory (type of data access allowed, procedures of data handling etc.). A networking diagram was needed to map the allocation of IT resources that support inventory replenishment activities and to see how those resources were used. Inventory management reports were needed to show whether changes in BIS configuration toward advanced CR implementation impact inventory performance.

The objectives of the pilot case were to know:

1. Whether the research model is comprehensible,
2. Whether the list of contingency factors is sufficient,
3. Whether the operationalisation of research concepts and variables were appropriate,
4. Whether data collection procedures can be used.

The CR concept was the most difficult concept for interviewees to comprehend at that time. The original definition has been modified into Definition 1 in Chapter 2. The list of factors and their operationalisation were given minor revisions to improve clarity.

The semi-structured interview allowed the researcher to get detailed information about the companies, the replenishment process, policies within the companies, relationships with suppliers, and IT policies. Interviews with external parties such as ECR Nederland, ECR Indonesia, EAN Nederland, EAN Indonesia, Aprindo (Indonesian

[9] See Krathwohl (1998) pp. 249-252 for detailed description of observation technique.

Retailers and Merchants Association), AC Nielsen, and other management consulting companies led to recommendations on research method improvements and recommendations of potential companies for the study. The researcher explained his goals to the subjects of observation[10], did a brief observation and conducted some interviews. Reasons to use this technique include the working environment in the store, limited space for observation, and the high work load of retail staffs and suppliers' representatives.

Data collection with document study is performed by studying organisation charts, business policy on replenishment procedures, computer networking diagrams, and applications for inventory management because these are the accessible documents. These documents provide information about changes in BIS configuration for CR implementation.

Based on the results, it was decided to use the following techniques for data collection:

1. Semi-structured interviews, intended to describe the general BIS configuration for CR implementation within the companies, to assess the influence of pre-determined contingency factors, and to get new factors. The list of questions and key interviewees are in Appendix 1 of this chapter.
2. Non-participant observation, intended to describe the actual practice of inventory replenishment within retail stores and to record opinions of the process owners about methods and organisation.
3. Document study of organisation charts, inventory replenishment policy, and IT networking diagrams and functionalities.

4.3.3 Data presentation, analysis and conclusion withdrawal

Eisenhardt (1989) and Miles and Huberman (1984), mention two types of analysis in a qualitative case study: within-case and cross-case analyses. In each type of analysis there are two parts to be considered: data presentation (the descriptive part) and an explanation of the presented data (the explanatory part, which is the analysis itself). The following paragraphs describe data presentation and analysis techniques for within- and cross-cases analyses.

Within-case analysis

Data presentation

General information about the company and how the research was done are presented at the beginning of each case study. The general information includes the year of

[10] Retail staff and suppliers' representatives involved in inventory replenishment activities in the retail store

establishment, the retail format, the organisation structure, number of Stock Keeping Units (SKUs), and the year of ECR membership. This general information will be supplemented by other relevant information when available. The research process states the period of the case study, interviewees, observation sites, and accessible documents at the time of the study.

Changes in the unit of analysis (i.e. BIS configuration) are investigated by identifying important changes in the sub-systems that may affect the quality of CR implementation within the case companies[11]. The changes are identified by using the Critical Incident Technique (CIT) principle developed by Flanagan (1954). There are two principles in conducting CIT. The first one is to stipulate the initial collaboration with domain experts to define the general aims of the study. The second one is to identify a critical incident from its influence on the systems under study. It is only an incident that strongly influences the systems (either positively or negatively) that will be considered. Information on the incidents is gathered from knowledgeable persons in the company and the level of criticality is judged by researchers (Flanagan, 1954).

Using this technique, case narration is advanced by presenting critical incidents in companies that influence BIS configuration for CR implementation in the companies. The incidents are supplied by the interviewees and judged by the researcher for impact on the CR implementation quality of the companies. BIS configuration in this situation is described using sentences or diagrams. IDEF0 (Integration Definition for Function Modelling) diagram is used to describe activities in process sub-systems and a simple computer networking structure[12] is used for describing technical sub-systems. IDEF0 was chosen because it enables a detail description of process execution. In addition, this diagram was used by VICS to represent process execution in CPFR (Collaborative Planning, Forecasting and Replenishment) programs. A detailed explanation of symbols in IDEF0 diagrams are provided in Appendix 2. The symbols in computer networking diagrams are explained in Appendix 3. The case study will be summarised at the end of case study description. A figure that depicts all incidents and a table that highlights changes in BIS configuration will be presented.

Data analysis

Data analysis is divided into three parts. The first is analysis of CR implementation status and the approach taken to improve CR practice within the case companies. The second part is analysis of contingency factors that influence CR-BIS configuration and the third part is analysis of culture influences in the case study.

The first part is conducted to know how the companies were able to adopt the CR principle and how the quality of CR implementation has improved in those companies.

[11] CR quality is improved when there is improvement in CR-BIS sub-systems.

[12] Consists of symbols of computing and communication devices and arrows that are commonly used in a simple network diagram.

In addition, it will be checked whether the company is ready for advanced CR practice. This is done by evaluating their BIS capability to support the requirements of advanced practice. As mentioned in Chapter 2, the following capabilities are required for advanced CR practice:

- Ability to capture detailed product movement
- Ability to generate accurate and timely data
- Ability to communicate the data in timely manner and to allow increments in data traffic due to more intense data access and sharing with business partners.

The second part is conducted to find important contingency factors in the business context that influence the selection of a particular BIS configuration in the company for implementing CR principle. This part is challenging because the statement of important contingency factors may come from different sources due to triangulation in data collection. In this respect, two problems may arise: conflicting opinions from interviewees and/or different perspectives from different data collection methods.

Guidance from Kumar *et al*. (1993) is used to overcome the first problem. The authors say that when there is no perceptual agreement among key informants then researchers might use one of the following approaches:

1. *Latent trait approach*, in which the disagreement is solved by modelling the independent responses of interviewees as reflective indicators of a latent construct using structural equation techniques. The equation consists of construct error, method error, and random error. The identification of errors enables the researcher to improve their research design to find common agreement among the interviewees.
2. *Aggregation approach*, in which the disagreement is solved by taking into account the position, knowledge level and other aspects of interviewees since different positions may create different perspectives and different knowledge levels may create differences in the depth of analysis.
3. *Consensus approach*, in which the respondents share similar positions on the topics in which they don't agree, state their arguments, and then make an objective consensus from the discussion and arguments.

The second approach was chosen because of the following reasons:

1. It is difficult to formulate a proper equation of errors as contingency factors in this study are assumed to be independent. Thus, it is relatively difficult to use the latent trait approach.
2. Due to different time allocations of the interviewees, it is not easy to find a consensus among them, making the consensus approach less effective.

In conducting the second approach arguments on particular topics from people or functions within organisations that are more knowledgeable about the topics are given more weight to draw conclusions on important contingency factors.

A strong emphasis on interview outcomes addresses the second problem. This is because people in formal interview sessions are more knowledgeable than people in informal sessions; an interview with a logistics manager is more valuable than the one with retail staff during the observation session. In addition, another data collection technique, document study, cannot give information about contingency factors in CR-BIS configuration.

The third part, i.e. analysis of cultural influence in the case study, is conducted to know whether cultural influence based on theory in section 3.5 can be justified in the case study. The expected influences as suggested in Table 3.9, Table 3.10 and Table 3.11 are checked against the case study findings. Specifically, it is examined whether the antecedent and moderation effects of cultures can be found in the case study. Cultural analysis is started by investigation of the antecedent effect of culture (i.e. power distance and individualism) on contingency factors' condition (i.e. the condition of data sensitivity and suppliers trustworthiness). The analysis is continued by investigation of the moderation effect of culture on contingency factors' influences in data, task, and technical aspects of CR-BIS configuration. The expected moderation effect of culture and the actual research findings are put side-by-side in a table. Explanation will be sought for any discrepancies in the comparison.

Cross-case analysis

Data presentation

There are three tables for cross-case analysis. The first table contains companies' information, year of ECR membership, year of CR application, and CR implementation approach in the companies. The second table contains information on CR-BIS configuration and influential contingency factors in each sub-system. The third one contains the results of cultural investigation in each case.

Data analysis

The main objectives of cross-case analysis are:

1. Comparing and investigating differences in the quality of CR implementation in the companies and their implementation approach (using information in the first table),
2. Comparing and investigating differences in CR-BIS configuration between companies (using information in the second table),
3. Comparing and investigating differences in contingency factors that influence CR-BIS configuration (using the second table),
4. Comparing and investigating cultural influence between cases.

From the investigation it is expected that the following questions can be answered:

1. Whether similar approaches are used by the case companies in adopting and enhancing CR implementation,
2. Whether the quality of CR implementation differs significantly between case companies,
3. Whether similar factors can be found across the case companies,
4. Whether there is a foundation to justify expected antecedent and moderation effects of culture on contingency factors and their influences on CR-BIS configuration.

4.4 Case study quality

According to Yin (1984), there are four dimensions that determine the quality of a case study research: construct validity, external validity, internal validity, and reliability. The following paragraphs explain how those dimensions are handled in this research.

4.4.1 Construct validity

This validity is achieved by establishing correct operational measures for the concepts studied. This has been addressed in Chapters 2 and 3, in which explicit definitions of CR, BIS, and contingency factors are given. In addition, the precise operationalisation of factors is also given in Chapter 3. Those have been checked by industry experts in the pilot case study.

4.4.2 Internal validity

Internal validity concerns findings on causal relationships between sub-systems and factors, i.e., whether those findings are valid or not. To demonstrate internal validity the researcher always refers to data in tables, figures or paragraphs when stating arguments. Those data sources are presented in a systematic way so that readers can trace the line of reasoning in this thesis. A systematic way is also applied in building arguments and conclusion. The researcher always starts with small arguments in a form of cross-case findings that are supported by empirical data. Those findings are then combined to build a conclusion. It is argued that this will help the readers to find supports for the arguments and conclusions presented in this thesis.

4.4.3 External validity

This is done by establishing the domain within which the findings can be generalised. The obvious domain is the cases presented in this thesis. This means that the findings are valid for the case companies. External validity is also pursued by making reference to other relevant studies. It will be examined whether similarities can be found.

4.4.4 Reliability

Reliability is high when the study can be repeated and result in the same output. To obtain high reliability the researcher describes the research process and case study protocol clearly so that others can execute similar field research with similar outputs. This includes methodological information that comes at the beginning of each case study description. From this information readers know the interviewees, the length of the study in the company, and the data sources so that they can re-apply the protocol in an unambiguous way. Additionally, the researcher follows the case study protocol strictly so that the findings will reflect the research questions.

CHAPTER 5 CASE STUDY AND ANALYSIS

5.1 Case study in Company A

5.1.1 Methodological information

The study of Company A was conducted in two periods: from October 2002 to January 2003 and from September 2003 to October 2003. An update was obtained in May 2004.

Semi-structured interviews were conducted consecutively with the logistics manager, merchandise manager, and IT manager. Additional interviews with these managers were conducted when necessary. The observation took place in two stores (one in Jakarta and another one outside Jakarta), and the main DC. The store manager, store supervisor, and some suppliers' sales representatives were interviewed during observation in stores. The organisation chart, IT platform and diagram, inventory replenishment policy, and supplier selection procedures were accessible during the case study.

5.1.2 General information of Company A

Company A is one of the top five grocery retailers in Indonesia. Its headquarters is located outside Jakarta. The business was started in Jakarta in 1958 from a small apparel store and was developed into a department store after years of operation. The company expanded its line of businesses to the supermarket sector in 1995. The two divisions (department store and supermarket) were managed under one roof before they became separate units in 2002.

The vision of the supermarket division is to be the number one multi-format retailer in Indonesia[13]. To realise this, the division has revamped the marketing and merchandising programs to be more efficient and reflect consumer preferences, improved recruitment and training programs, strengthened relationships with suppliers, and reorganised its stores. At the time of the study, the supermarket division had 65 stores. The number has shrunk to 54 in 2004 due to the company's active reorganisation. The stores are supplied directly by suppliers and their own Distribution Centre in Balaraja. Most of the items are supplied directly from suppliers. The merchandise manager explained that product supply from the DC only counted for 10% of supermarket products because it is focused on the operation of department stores.

The organisation structure of the supermarket division is depicted in Figure 5.1. At the top is Chief Executive Officer (CEO). There are six directors under CEO supervision: marketing director, planning & development director, store operations

[13] Consists of supermarket and hypermarket formulas.

director, Information Technology (IT) director, finance & accounting director, and risk management director.

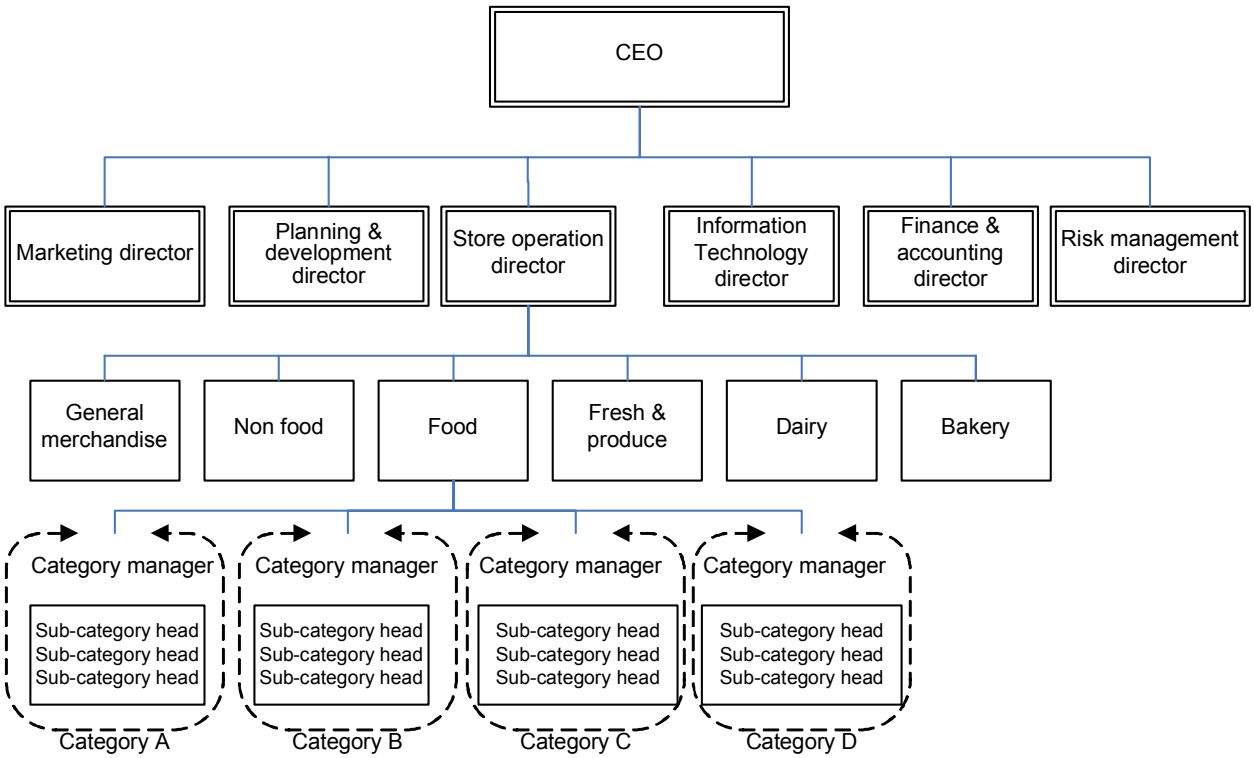


Figure 5.1 Organisation chart of Company A

The store operational director is responsible for the merchandising and logistics operations of stores. There are six categories of merchandise: general, non-food, food, fresh produce, dairy, and bakery. Each is managed by a category manager. The category manager is assisted by a number of supervisors. There are around 11,000 SKUs managed by the company. Among these are items with a private label called "Value Plus", which offers high quality products at lower prices.

5.1.3 Critical incidents in BIS configuration of Company A

Two incidents took place before the supermarket division was operated in 1995. These need to be mentioned since they impact CR-BIS configuration in the later operation of division.

Super Bazaar application for inventory management was used (1993)

The apparel store had become a large department store and needed better support for inventory management. The company replaced its proprietary inventory management application with the Super Bazaar (SB) application in 1993. The usage was initially dedicated to department store operations before the company extended its business line

to the grocery sector. When the supermarket division began, SB was also used for inventory management in supermarkets.

The application offered the following functionalities:

- Download data from POS server
- On hand inventory checking
- Create Purchase Order (PO) for routine items
- Input inbound and outbound item movement
- Product return to vendor

The first function was not utilised because the company did not have POS servers at that time. Sales data was stored in a cash register machine. At the end of the day, the Electronic Data Processing (EDP) function of the company collected the data from individual cash register machines by pulling the data into a master cash register machine. The output was aggregated sales data in a text file format. EDP function sent this file to the Head Office using a dial-up connection and to the shop manager's computer in the store (see Figure 5.2). The SB application was installed on this computer. The shop manager used the application to monitor stock levels. From this information, he would determine the items that would be ordered and created POs. Orders were sent to suppliers using e-mail or fax. Details of updating and monitoring process are presented in IDEF0 diagrams in Figure 5.3.

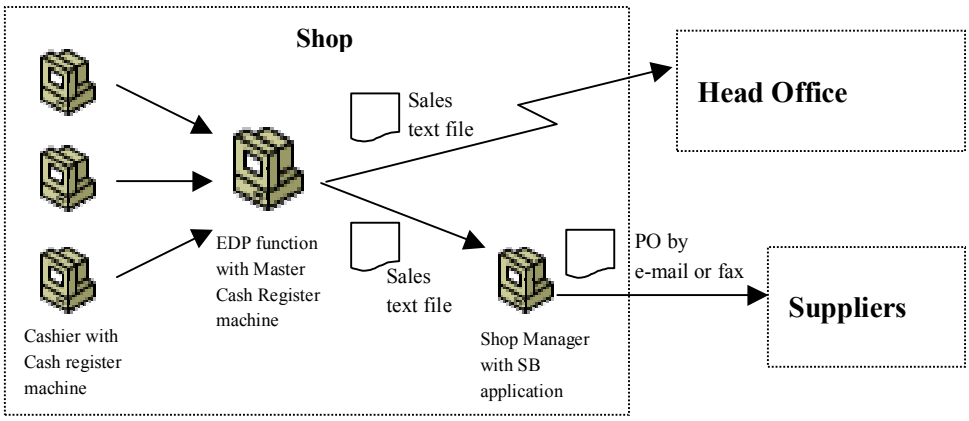
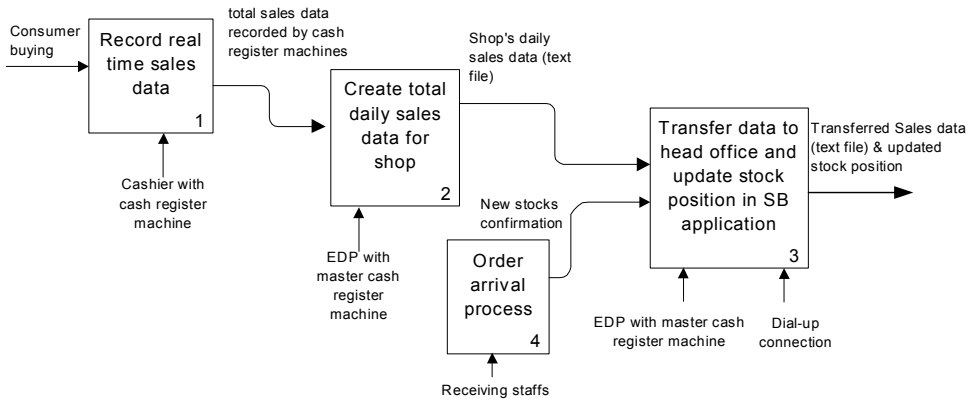
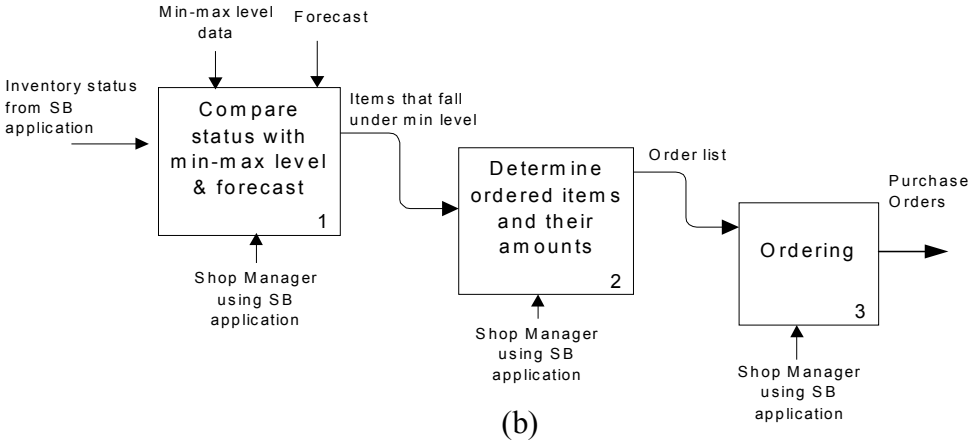


Figure 5.2 Data communication in Company A in1993[14]

[14] Please refer to Appendix 3 for computer symbols



(a)



(b)

Figure 5.3 Inventory updating (a) and monitoring (b) in 1993

Cycle count activity was necessary to complement those activities. It is conducted by retail staff periodically for all products, to check their physical availability in store and to update computer data if there is a mismatch. It was possible that computer data did not match real condition because of shrinkage, loss, or damage.

All inventory management activities in Company A within this period were handled by the company itself. The orders were sent to supplier companies because the Distribution Centre was not ready to support store replenishment at that time. Information for suppliers was only about out-of-stock items and amounts to be ordered, which goes through POs. POs were sent according to supplier visit schedules and supplier lead-time.

The implementation of the SB application is critical because it improved the technical capability of Company A for inventory management. This includes the capability to check inventory status and to update that status immediately. It also

improved data accuracy because data could be keyed into the application without manual interference. Previously, this needed to be converted manually to fit the proprietary application format.

Stock Keeping Unit (SKU) system replaced product group system (1994)

Product group was the lowest level of product classification in SB application. This system allowed smaller and simpler product databases, but could not determine the exact consumer demand because of the inability to identify a single product really needed by consumers. Because of this the company was not able to determine an optimal product composition in purchase orders.

The Stock Keeping Units (SKUs) system was proposed to solve this problem. An SKU is a single physical item that has specific characteristics and demand hence needs to be identified as a unique single item in the database. The SKU system was approved and replaced the product group system.

The introduction of the SKU system increased data accuracy and hence reduced cycle count frequency. The reduction was done gradually until the system was fully reliable. After the new system was completely installed, it was decided to conduct a cycle count every 6 months.

The contribution of the SKU system to CR implementation is its accuracy of product identification for matching product assortment with consumer demand. Accurate product identification is very important for CR implementation because it has a considerable impact on replenishment effectiveness and efficiency. The details of inventory management tasks were not affected by this new system. The only significant difference is the frequency of cycle count activity.

Supermarket operation started (1995)

The supermarket operation was started in 1995. The new division used the SB application and SKU systems from the department store operation. Replenishment of the supermarket store could not be made from the company's DC because of commitments to use DC for the department store operations. Consequently, supermarkets' orders were sent directly to suppliers as described in Figure 5.2.

POS application was implemented, bar code and scanner were used (1996)

A Point of Sales (POS) application was implemented in the supermarket in 1996 to replace the proprietary application used in cash registers. The registers themselves were replaced by personal computers. This POS application was developed by an American company, 'Innovative'. The application enabled quicker sales and stock updates. The data was sent to a POS server in store that would refresh the stock level once the monitoring function was activated. To complement this, the company put bar code labels on all SKUs and equipped cashiers with handheld scanners connected to their

personal computers. This project was initiated in the Jabotabek area (Jakarta, Bogor, Tangerang, and Bekasi) in 1996 and since 1997 has been implemented in all supermarkets.

This event brought a slight change in the inventory updating process as can be seen in Figure 5.4.

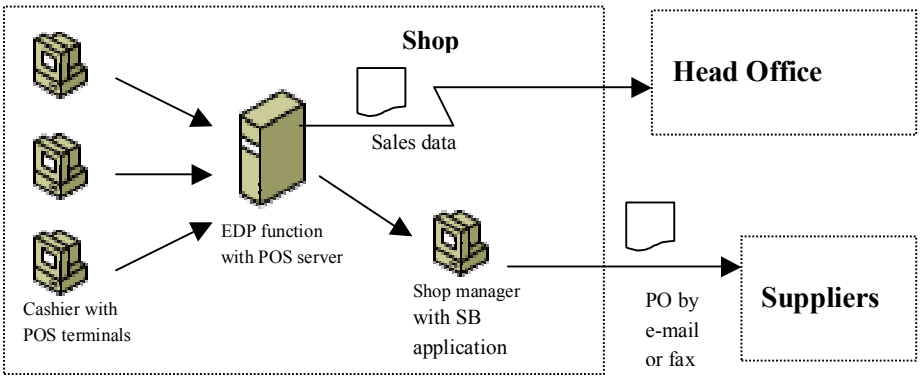


Figure 5.4 Workflow after POS implementation in 1996

POS application eliminated the need for manual aggregation by making a direct connection between cashier computer and POS server. Transaction data is uploaded to the server in batches to minimise data traffic. At the end of a day, the EDP function transmitted data from the POS server to the SB application and another POS server in the Head Office. The shop manager monitored stock levels and released POs to suppliers when needed. The details are shown in Figure 5.5.

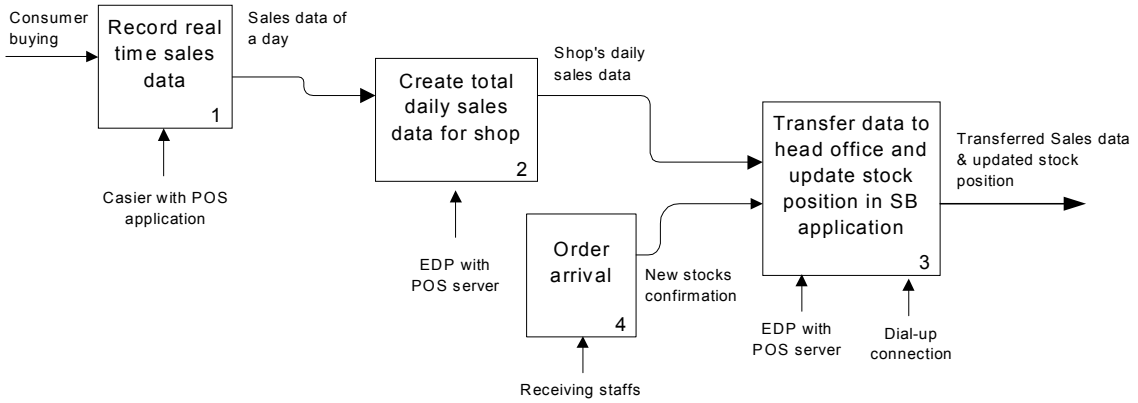


Figure 5.5 Changes in data updating and PO release after POS implementation

The shop manager still held the authority to release orders. His/her knowledge was required to determine the amount and time of orders to suppliers. The flow of data monitoring and product ordering remained the same (see Figure 5.3 (b)). The company relationship with suppliers in terms of inventory management assignment was not changed. All inventory management activities were still performed by Company A. The process became faster however, due to the possibility to make direct data transfers from cashier computer to the POS server and to make timely monitoring of stock level.

Retek replaces Super Bazaar for inventory management (1998)

Inventory management in supermarkets is improved by the implementation of Retek Merchandising Systems®. This application was developed by the American firm Retek, Inc.. It is a business solution that incorporates three functional areas: Business Foundation Management, Merchandise Management, and Merchandise Financial Tracking.

The Merchandise Management function within the solution supports day-to-day operations of Company A. The key features are supports for contracting, purchasing, pricing, replenishment, and inventory perpetual movement and tracking. The replenishment function offers the possibility of auto-replenishment, in which POs are automatically released once the system recognises out-of-stock items. This feature was not available in SB. Automatic replenishment was made by setting minimum and maximum values for each SKU. Order transmission was still done manually by pressing a special key in the application, but the shop manager's involvement in making orders to suppliers was eliminated. This demarcated the beginning of CR implementation in the company. The system was able to produce purchase orders based on actual demand and stock information without manipulation from shop manager. In addition, Retek also provides the capability to detect discrepancies between forecast data and actual sales data. This enables the company to adjust their plan properly. The ability to detect exceptions is a requirement for advanced CR practice.

The systems diagram is shown in Figure 5.6. The EDP function did not update the SB application since it was completely replaced by a Retek PC client. They sent data to a Retek server in the Head Office. The server consolidated the data and formulated an efficient way to release orders. Once an order was released, a notification was forwarded by the Retek server to the client computer in the store. This eliminated the need to update data at the receiving stage in stores. The process details are described in Figures 5.7 and 5.8. The DC was able to support store replenishment for a small percentage of the total items. The largest percentage of products was still replenished by suppliers.

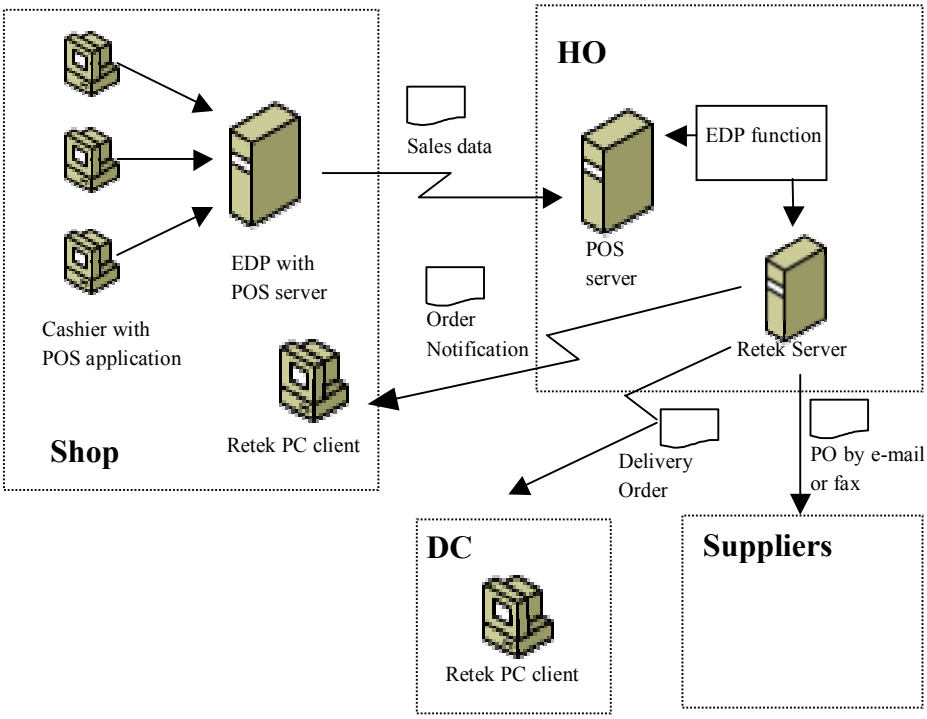


Figure 5.6 Retek application for inventory management

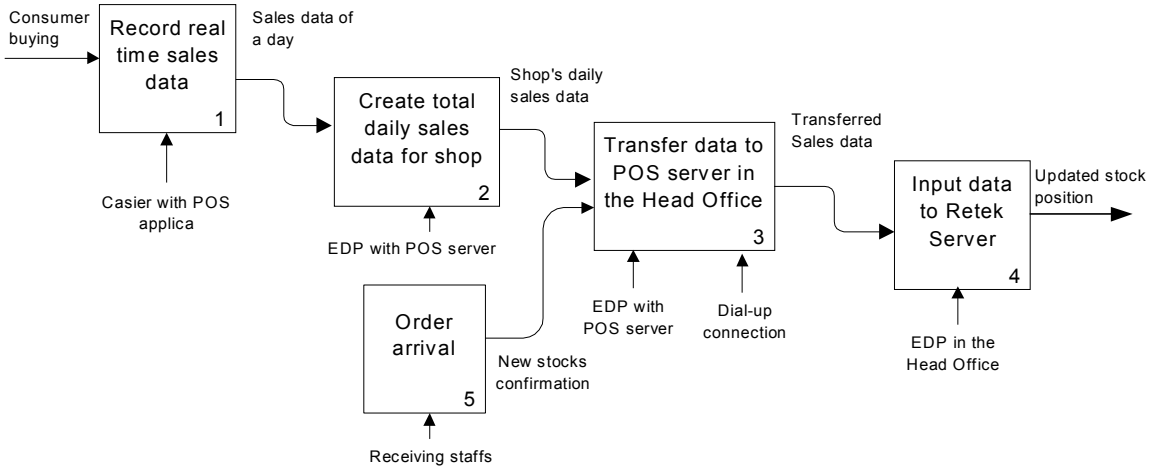


Figure 5.7 Data updating activities after Retek implementation

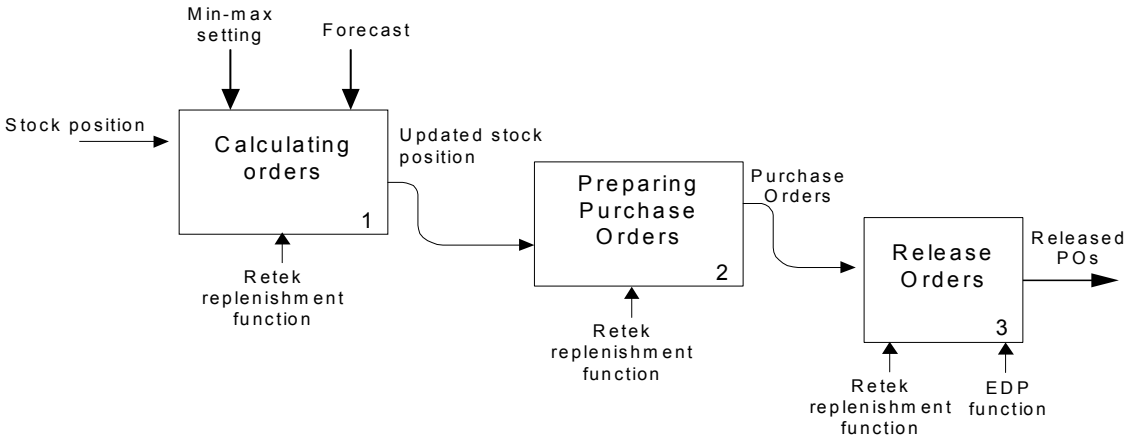


Figure 5.8 Data monitoring and ordering process by Retek

Retek online (2000)
The Data communication structure in Figure 5.6 was redesigned into Figure 5.9.

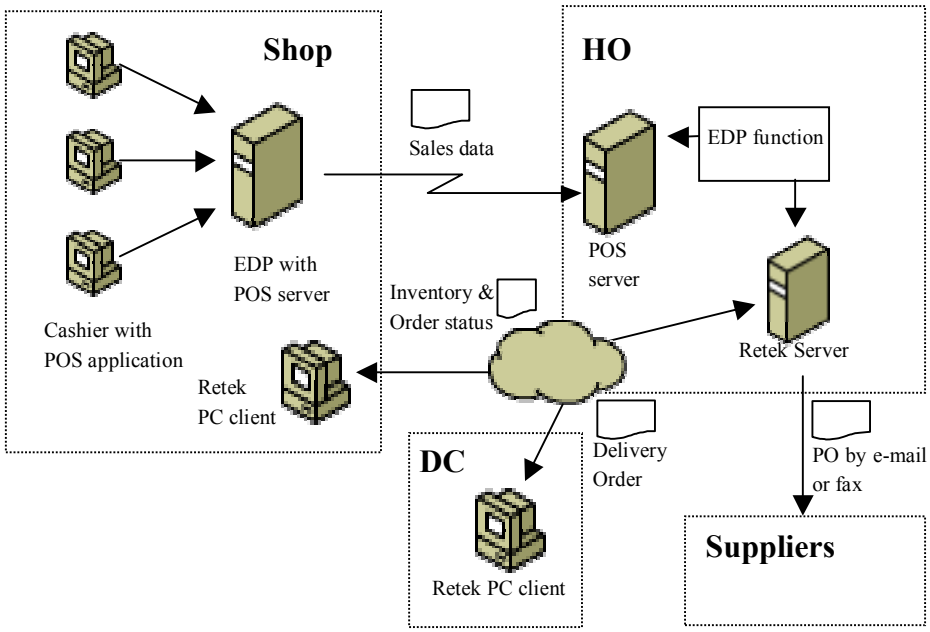


Figure 5.9 Online connections with Retek server in the head office

The Retek server came online and connected all Retek clients in shops and the DC. The server was the data server to all clients. For the shop it provided information on shipping schedules from the DC or suppliers; for the DC it provided information about shop orders to be filled. The centralised data systems enable more accurate data

because the authority to change and update products is now assigned to merchandisers in the Head Office. Moreover, merchandisers were able to check order fulfilment by the DC and suppliers so that the service level was improved. Shops and the DC accessed the data through a web connection, available 24 hours a day. This required shops and the DC to be more active in downloading information from the server. Activity flows in data updating, monitoring, and ordering were not changed. Order communication with the supplier was still done by e-mail or fax.

Auto-replenishment function by Retek cancelled (2003)

It was discovered that the ordering process was no longer accurate. The inaccuracy was caused by poor data maintenance especially the min-max setting of inventory as well as information on actual inventory in shops. There were a large number of SKUs to be managed and merchandisers were not able to maintain the min-max settings regularly. As a result, the setting was outdated and replenishment orders became inaccurate. In addition, cycle counts were not done properly in shops, resulting in poor actual inventory information. This resulted incrementally in stockpiles and higher inventory holding costs for the company. The management team decided to stop the automatic replenishment function and review replenishment procedures. The ordering responsibility was transferred back to the shop managers and again conducted manually.

Portable Data Terminal was used for inventory monitoring (2004)

Besides reviewing the min-max setting of products in-store, the Head Office also instructed shop managers to perform manual checking of actual inventory at stores to improve data accuracy. Shop managers delegated this monitoring task to store supervisors. They performed a manual cycle count in stores and directed necessary actions to avoid out-of-stock conditions. To increase the speed and accuracy in the monitoring activity, the Head Office equipped them with Portable Data Terminals (PDT). This equipment has the ability to scan product codes and upload this data to a POS server for further processing. Using this device, supervisors scanned product codes and determined order amounts once the product was known to be out-of-stock. The workflow is shown in Figure 5.10. POs in the Retek systems are then released by the EDP function in the Head Office. Arguably, this restarted the CR principle application in the company because the shop manager's involvement was no longer needed. Instead, he supervised the running of the systems.

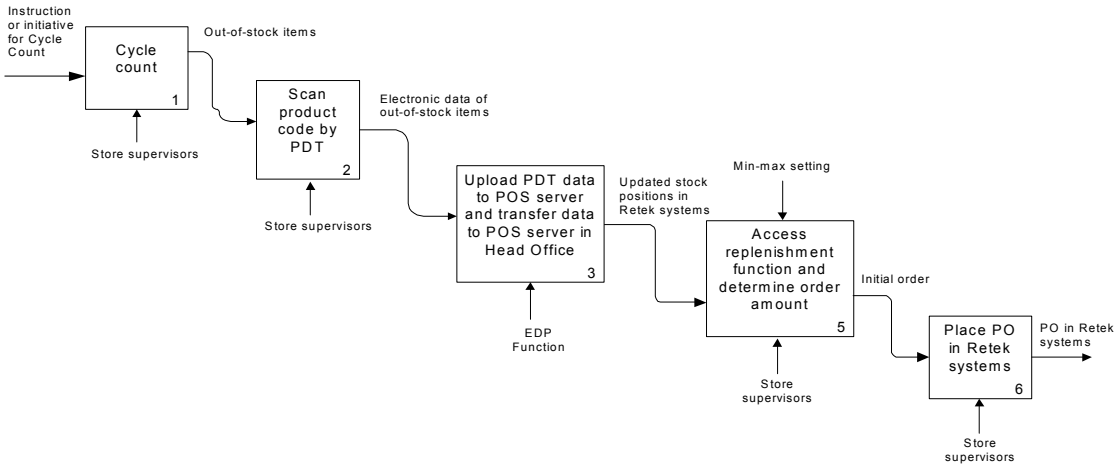


Figure 5.10 Inventory monitoring with PDT

5.1.4 Analysis of the progress of CR implementation in Company A

The critical incidents that affect CR implementation in Company A are summarised in Figure 5.11.

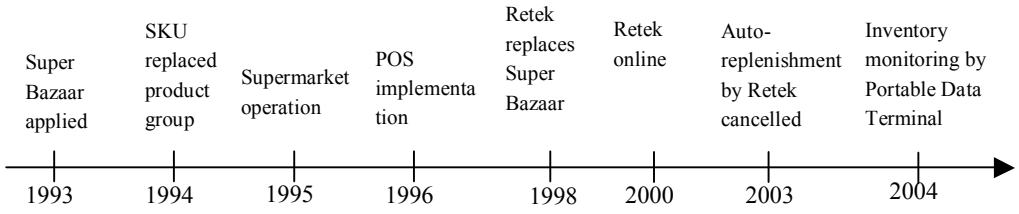


Figure 5.11 Critical incidents impacting BIS configuration of Company A

Company A conducted a significant improvement in their technical systems capabilities. It began with implementation of the Super Bazaar (SB) application. Although the application could not perform automatic store ordering, it gave valuable support to the company in managing their inventory replenishment activities. SB provided basic capabilities that the company needed to practice CR. Those are the ability to give updated stock data and determine the items for re-ordering. Using these basic capabilities the company should have been able to practice CR, but since there was involvement from shop managers in determining orders, the company could not. The involvement was necessary at that time to cope with changes in the market. The company did not have sufficient knowledge about possible changes and therefore they needed to give more freedom to shop managers to adjust store operations.

The company also made significant improvements by implementing the POS application. The application enabled automatic data transfer from POS terminals to the

POS server, which enabled the company to perform quick data analysis. The company should have been able to do this but they did not change data analysis practices. According to the IT manager, this was due to a limitation in data communication bandwidth. There was a barrier in doing real time data transfer and update. The alternative was to transfer data in batches. Additionally, transferring data in real time was not an attractive development for the company due to the fact that their suppliers were not ready to support this activity. If they wanted to react quickly, then a quick response by suppliers was necessary. However, most of their suppliers did not have the capability and IT infrastructure to respond quickly.

The company's decision to replace SB with Retek was also important for CR practice. Company A considered implementing the CR principle at that time because they were able to automate system monitor and inventory requirements calculation from sales and inventory data without any involvement from shop managers to fine tune replenishment orders. The auto-replenishment function from Retek had the ability to update stock data and compare it against predefined settings in order to identify out-of-stocks items automatically. Orders were prepared for those items and the systems were accurate in determining the order amount. This is why the company did not need shop manager's involvement in preparing purchase orders. From that time the company was able to match replenishment orders with actual consumer demands.

Unfortunately, the implementation of CR principle had to be stopped in 2003. The reason was that the company, especially store managers, did not put adequate efforts into maintaining data accuracy and inventory settings. Technical development has created a technology-dependent situation in the company. They believed that technology would deliver accurate data and formulate accurate orders for them. Thus, they decided not to perform cycle count frequently. They were not aware that grocery items, especially perishables, are prone to inaccuracy. This indicates bad execution of auto-replenishment systems implementation in the company.

Their decision to review data accuracy and inventory settings was appropriate. The new monitoring procedure in 2004 helps the company to improve data accuracy. Using Portable Data Terminals the companies could manage to closely monitor product availability and exceptions in operations. This indicates that the systems were capable to support advanced CR practice. However, the reliability of the system might be low due to involvement of human factor that can get tired, cannot be present all the time to monitor product availability and other things that can reduce systems accuracy and response. This needs to be improved because if they continue the manual process for stock monitoring then they may have the same problem in the future as it is not as reliable as a computerised process. In addition they need to perform two actions. First, they need to improve the systems from the beginning, i.e., from product coding and data capture at the POS terminal. They have to check whether a single item has a unique code and explain to cashiers to scan products carefully because it happened that cashiers

ignored small differences between items (for example taste difference among the same soft drink). Second, they need to improve data analysis. The company did not perform daily data analysis. They kept the inventory settings and assumed that those settings do not need revision. They need to analyse changes in sales and stock level more frequently and update their planning. By doing this they will improve their response to fluctuations in operations.

CR implementation in Company A can be categorised as RMI (Retailer-Managed Inventory) because the company does all inventory management activities. When ECR Indonesia was founded in 2000 the company had applied this practice for 2 years. ECR Indonesia run various projects managed under three steering committees: the supply side group, demand side group and enabling technology group. The CR project was one of the first group programs. The company decided not to participate in CR implementation project of ECR Indonesia but rather in a Category Management (CM) project managed by the second group. It was stated that the reason was because the company thought that CR practice at that level was enough for them. It was more important for them to apply CM because this would help them increase their sales performance. They were in a tight competition with the market leader and increasing sales performance was an important thing. Additionally, they declare that they were not ready to implement an advanced CR application because they were not confident their suppliers' could handle more data. They said that they needed more time to evaluate their suppliers' capability and trustworthiness in keeping the data. They feel CM could be a good medium for that since it also involves data sharing with suppliers and they will be able to evaluate suppliers' performance. Furthermore, data requirement in CM is not as detailed as in CR. This reduces the effects of data misuse by suppliers. The company claimed that CR practice would be progressed to SMI level for particular products. Before reaching that level they plan to conduct JMI practice with suppliers. This plan is illustrated in Figure 5.12. The company will select suppliers for this cooperation.

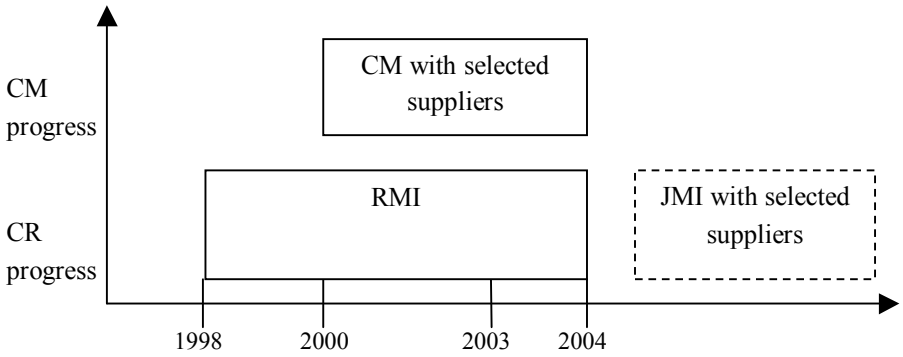


Figure 5.12 Company A's plan to improve CR quality

5.1.5 Contingency factors analysis in Company A

The critical incidents in Figure 5.11 brought changes to the CR-BIS of the company. Those changes are summarised in Table 5.1.

Table 5.1 Changes in CR-BIS configuration of Company A

Year / Sub-system	1995	1996	1998	2000	2003	2004
Data processing	Sales, inventory, and forecast data was used to determine orders. No proprietary data was shared with suppliers. Decision-making for inventory replenishment was held by shop managers	No significant changes	Automatic replenishment was possible. Shop managers' involvement was eliminated. Decision-making for replenishment was transferred to Head Office (centralisation of replenishment function)	No significant changes	Automatic replenishment stopped due to data inaccuracy and outdated inventory settings. Decision-making authority was given back to shop managers	Using Portable Data Terminal to capture real-time data. CR principle reapplied. Shop manager acted as supervisor to the process execution
Technical	Super Bazaar was the inventory management application (running basic functions of inventory management). Dial-up connection between different parties involved in inventory replenishment. Combination of paper-based (fax) and non paper-based (e-mail) was used to communicate orders with suppliers using public network.	No significant changes	Retek replaced Super Bazaar as inventory management application in shop.	A web-based EDI connection replaced dial-up connection (using a value-added network of Indosatcom)	No significant changes	No significant changes

From the table it can be seen that the company did not share any data with suppliers. Data updating was done automatically by transferring data from POS terminals to the POS server. Inventory monitoring was done by Retek. Due to data inaccuracy, this is now done manually until the company is able to improve the system's reliability. The company used a packaged application for inventory management. The application had the ability to monitor stock levels, create purchase orders automatically and detect and generate operational exceptions. In essence the application had the ability to support advanced CR practice. They also have capable data communication systems. Their systems are ready for an Electronic Data Interchange (EDI) relationship. Factors that influenced the company in designing their CR-BIS are elaborated in the following section.

Contingency factors that influenced the extent of data sharing with suppliers

The company was not sharing any proprietary data with suppliers when the research was conducted. Replenishment-related documents from the company to its suppliers are Purchase Orders that contain information on product name, code, and amount. The interviewees state the reasons for limiting data sharing with suppliers were:

1. Data sensitivity

Sales and inventory data is sensitive because the data may reveal information such as the company's operational status and performance and more importantly, the company's strategy. Suppliers can learn the company's inventory policy and sales strategy from this data. Although this is the importance of data sharing in CR context, the company was afraid suppliers might use it for their own benefit. Reduction in product supply might not be intended to help the company reduce inventory cost, but rather to increase the suppliers' bargaining position. According to the interviewees, suppliers' bargaining power is already high without data sharing. Data sharing would arguably strengthen suppliers' bargaining position further. Overall, sharing sensitive data in that condition was not beneficial for the company. A worse situation can occur if the suppliers use this information to negotiate with the company's competitors. Knowing the company strategy, suppliers may persuade the company's competitors to buy their products and apply the same strategy in order to survive in the market. This would eventually put the company in a difficult position in the market.

2. Data formality and quality

The notion of sensitivity was questioned after conducting in-store observation. It was noticed that suppliers' were able to get information on product's availability in the company's outlets. This is done by their sales representatives who work in store to promote suppliers' products. The sales people collected information on availability and performance by recording daily sales in pre-formatted datasheets. This information is sent to suppliers' back office for analysis. This finding was very interesting because the

information was arguably similar with the information contained in the company's database related to similar objects. If data can be accessed by this way then the notion of sensitivity would not be appropriate. This conflicting finding was brought to the interviewees' attention. Their explanation was that the data collected by the sales representative is informal and of low quality. A data is said to be formal if it is written in a specific format or kept in the company's database in electronic form. The company policy forbids suppliers to collect formal data. There was no policy regarding the activity of the sales people because the data is arguably informal. The second reason may give a better explanation why the activity is allowed. The collected data does not have high quality. Data is considered to have high quality when it is accurate, timely, complete, and detailed. The collected data does not have the last two characteristics because the sales people were limited. The limitation comes from their main duty to do promotion and to visit different stores in a week. When performing promotion they will lose opportunities to collect data and when visiting other stores they will not be able to collect data from the first store. This results in incomplete and vague data. The interviewees argued that this kind of data would not significantly benefit analysis. Based on this, the company allowed the sales representatives to collect informal data. In return, the company may get assistance in monitoring product availability because it is also the suppliers' concern to keep their products on stocks in the retail shops.

3. Suppliers' trustworthiness

Also related is suppliers' trustworthiness. The interviewees state that the company could not conduct intensive data sharing with suppliers because they are not trustworthy. Past cases prove this, though the company did not mention suppliers by name. They said the proof came from reliable sources in their business network. Based on this, the company decided not to share data with suppliers until there is a mechanism to ensure trust.

4. Existing IT infrastructure in retailer and suppliers

The IT manager stated one obstacle in extending the data sharing relationship was limited bandwidth to support increased data traffic to and from the data server that would be caused by intense data access and transfer activities with suppliers. Furthermore, in general the suppliers' IT infrastructure (i.e. business application for inventory management) was not able to monitor real-time stock level. Hence, it would be inappropriate if Company A opens more data to suppliers.

5. Credibility of industry-level organisations

Limitation in data sharing was also caused by unreliable retail organisations in the industry. The company argued that those organisations should be able to provide protection for retailers' data or give sanctions to suppliers who take unlawful action with the data. However, this expectation could not be fulfilled at that time. The

company mentioned that organisations on the industry level were not reliable yet. The organisations they quoted were ECR Indonesia and Aprindo (Assosiasi Pengusaha Ritel Indonesia[15]). The first organisation is young and their focus at that moment was bringing key industry players into the organisation to make it more reliable and respectful in making policy. Industry-level policy and regulation on data sharing for ECR implementation can be formulated more easily when this is achieved. The second organisation was not able to give protection because this was not their responsibility. Their function was to bridge communication between retailers and government so that the government policy may favour all parties in the industries.

The company considered sensitivity, formality and quality of data and suppliers' trustworthiness, IT infrastructure capability (precisely data communication bandwidth), and credibility of industry-level organisations as important factors in determining the extent of data sharing with suppliers. They did not consider data accuracy, data handling knowledge, business applications and data communication technology, and legal systems as important factors. Although they have accurate data, they will not share it with suppliers because of sensitivity issues. They knew that big suppliers like Unilever and P&G have valuable knowledge about products needed to help Company A in managing their inventory. As explained in previous paragraph, Company A has capable business application and data communication technology to support advanced CR application and hence is not considered by the company as a significant contingency factor. The strategic sensitivity of the data however, was more important for Company A in deciding the extent of data sharing. The company also realised that the Indonesian government has set a legal system to protect a company's confidentiality, but say that this would not encourage them to share more data with suppliers because misuse cannot be detected quickly and the legal process usually takes a long time. Thus, it is better for them to not share data with suppliers.

Contingency factors that influenced task assignments

In general, it is said that activities to update and monitor sales and stock data and make decisions based on this data, are performed by the company. On special occasions, the company may ask suppliers' assistance to monitor product availability in store. This is done if they didn't have enough resources to perform inventory monitoring, especially after the system failure in 2003 where the company was forced to conduct manual inventory monitoring more frequently. Although suppliers' assistance was present in inventory monitoring, but this cannot be categorised as a JMI practise because the suppliers' role is very limited to monitoring product availability on shelves. In a JMI practice, the responsibility also covers product availability in the store's stock room. In

[15] Indonesian Retailers and Merchants Association

addition, suppliers did not give any advice to retailers for inventory management. That is why the practice was not considered a JMI practice.

Regarding this situation, the interviewees agreed that data sensitivity, supplier trustworthiness, IT infrastructure in the company and suppliers, strategic fit of inventory management tasks, and time specificity of monitoring task are the contingency factors in deciding task assignments with suppliers. The explanation of the first three factors is similar with the one in the data sharing section. The strategic fit of inventory management tasks becomes important because sensitive data is used in the tasks. The monitoring task is time sensitive because of the need to monitor physical availability of products and to react quickly when products need to be ordered. The time specificity of this task increased when the company decided to stop automatic replenishment in 2003. The frequency of product monitoring rose after that time and it was not possible for suppliers to do this because of limited resources. They could not check product availability in each shelf in the store. Their sales people were busy with promotion activities.

Knowledge specificity is not an important factor in task assignment. Although the company knew their suppliers had product knowledge and were able to learn how to manage inventory in retail companies, this did not yield wide involvement of suppliers in inventory management.

Prior or existing business process configurations are not the reason why Company A did not initiate advanced CR practice with suppliers. The Company said they were willing to implement a new concept, but not advanced CR practice because it required the company to share proprietary data with suppliers. Data handling knowledge is not an important factor either since suppliers possess important knowledge of product and inventory management.

The market power of Company A cannot be used as a reason why the company did not initiate advanced CR practice. The Company was among the top five retailers in Indonesia. Using this position they might be able to ask suppliers to perform inventory management for particular products, but did not. The company explained that they would not use their power for something with no value to them. Asking suppliers to manage their inventory would be a counterproductive decision because of the opening of sensitive data.

The capability of an Application Service Provider (ASP) for retail management could not be assessed because there is no company that provides this service to Indonesian retailers. This is also applicable to other companies in this study.

Contingency factors that influenced technical solution selection

Data in Table 5.1 shows a change toward web-based data communication. The event that led to this stage was the Retek application. Retek is a web-enabled application and supports web-based transactions. This feature was used for internal data communication

between shops, the DC, and the Head Office and would be extended toward external data communication with trading partners. It was stated that choosing the Internet as the medium for data communication is one of the company's plans to build a web-enabled IT infrastructure. The purpose is to be able to find and compare offers from suppliers worldwide. This would enable the company to find the best offers for their assortment. Additionally, the Internet helps the company reduce communication barriers with suppliers worldwide because of its openness[16]. The ability to connect with different suppliers is the flexibility characteristic of a technical solution. It is concluded that the Internet was chosen because of its flexibility needed to support the company's plan. Although the Internet has a relatively lower security factor in data communication, the need to have a wider selection of suppliers is more important. In the future all data communication will be executed via Internet.

Regarding the Retek selection, the company said that in addition to the ability to support web-based transactions, the application was chosen because of the following aspects:

1. Compatibility with SUN platform

Since 1990 the company has used the SUN platform for development of their IT infrastructure. Consequently, all technical solutions must comply with this platform.

2. Functionality

Functionalities were checked once the application was known to be compatible with SUN platform. The main concern was whether the application was able to support basic business process requirements as provided by Super Bazaar. Required advanced functions were the ability to perform automatic inventory replenishment and support the company's plan for a web-enabled IT infrastructure.

3. Adoption rate

It was asked whether it was only Retek that was able to provide those functionalities since there were many alternative solutions in the market. The IT manager explained that Retek was chosen not only because of the functionalities, but because it was proven that the application had been adopted by a large number of big American retailers. The company sent key managers to the US to study the reasoning behind this situation. Their study confirmed that the high adoption rate was caused by reliability to perform the provided functionalities.

4. Connectivity

Retek was flexible in the sense that it supports any type of electronic data communication with suppliers. The files can be downloaded for data communication by

[16] Defined as ease of communicating different data formats.

e-mail or transferred among members in the communication channel via the Internet. It also supports conventional Electronic Data Interchange (EDI) connection with business partners.

The first and the fourth points are flexibility characteristics of Retek because they indicate Retek was able to be installed on the existing platform. Therefore, flexibility of technical solution will be used to represent those characteristics. The first characteristic implies that the retailers' IT infrastructure was only able to accept applications compatible with it. In other words, the existing infrastructure had a limited flexibility to accept technical solutions. Because of this, the retailer's existing IT infrastructure flexibility will be checked in the contingency factors table to indicate a significant factor that influences technical sub-system configurations. The fourth characteristic was also an indication that suppliers' IT flexibility was an important consideration in selecting a technical solution for the company. The second contingency factor indicates that the existing retailer's business application did not have capabilities needed to support advanced inventory management practice and future web-based transactions and hence retailer's IT infrastructure capability is one of significant contingency factors in technical selection.

Limitation in the company's IT infrastructure flexibility to accept different technical solutions, suppliers' IT infrastructure flexibility, and flexibility, functionality, and adoption rate characteristics of existing technical solutions were the main factors behind the adoption of the solutions.

Market power and technical knowledge were not important in the technical solution selection because the solutions were not intended to support the supply chain process. Thus, the influences of those factors were negligible. Vendor support and cost of technical solutions were not important. Retek Inc. did not have a technical support representative in Jakarta. So in terms of vendor support, this application is not considered excellent. The application was also expensive compared to other solutions in the market. The managers said that the most important aspect when selecting an application is whether the solution can meet the company's requirements.

5.1.6 Cultural influence in Company A

It was indicated by the informants that suppliers could reveal crucial information such as the company's operational status and performance and the company's strategy from the company's proprietary data. They do not believe that suppliers have good intention to keep the data safe and confidential. It was doubted by them that reduction in product supply by suppliers was intended to help the company reduce inventory cost. Rather it was intended to increase the suppliers' bargaining position. Based on these findings it is concluded that data is considered as highly sensitive and suppliers trustworthiness is considered low in this case. This is the foundation of the expected antecedent effects of

high power distance and collectivist cultures in this case. However, the expected moderation effects of high power distance and collectivist cultures are not fully consistent with the actual research findings. The expected moderation effects were explained in section 3.5 in which evidence of particular contingency factors are expected to be found in case study according to cultures within the case study. The actual research findings are the actual evidence found by the researcher in the case study. As seen in Table 5.2 and 5.3 the expected moderation effects of high power distance and collectivist cultures on contingency factors' influences on the extent of data sharing and task assignment are not inline with the actual findings. Suppliers' IT infrastructure capability was considered important in determining the extent of data sharing with suppliers. This is not the expected moderation effect of culture in data aspect. In task aspect strategic fit of task, time specificity of task, and IT infrastructure capability were found to be important contingency factors although they are not expected.

Table 5.2 Expected moderation effect and case study findings of contingency factors influencing data aspect of CR-BIS configuration in Company A

Expected moderation effect based on theory	Case study findings
Data sensitivity, suppliers trustworthiness, industry bodies, legal systems, and relative market power	Data sensitivity, suppliers trustworthiness, independent influential industry bodies, legal systems, and suppliers' IT infrastructure capability

Table 5.3 Expected moderation effect and case study findings of contingency factors influencing tasks aspect of CR-BIS configuration in Company A

Expected moderation effect based on theory	Case study findings
Data sensitivity, suppliers trustworthiness, industry bodies, legal systems, and relative market power	Data sensitivity, suppliers trustworthiness, strategic fit of task, time specificity of task, and IT infrastructure capability

The expected moderation effect is supported in the technical selection. As expected, collectivist culture influences the company to consider other factors than technical solution characteristics alone. The company's IT infrastructure capability and especially their suppliers' IT infrastructure flexibility were considered important in this case (see Table 5.4). It was mentioned that matching the technical solution with suppliers' situations is necessary in order to help the company broadening their supplier base.

Table 5.4 Expected moderation effect and case study findings of contingency factors influencing technical aspect of CR-BIS configuration in Company A

Expected moderation effect based on theory	Case study findings
Inherent characteristics of technology (i.e. functionality, flexibility, adoption rate, security, vendor support, and costs) and at least one other factor in technical selection	Functionality, flexibility, and adoption rate of technical solutions, retailer IT infrastructure capability and supplier IT infrastructure flexibility

Because of discrepancies between the expected moderation effect and the actual case study findings, there is no foundation to confirm the influences of high power distance and collectivist cultures in this case. The deviation from the expected moderation effect is caused by interference of other culture. Since the company's top management consisted of American expatriates there is interference of low power distance and individualist cultures associated with American culture.

5.1.7 Summary

The company was practising RMI at the time of the study. The implementation was interrupted by a data inaccuracy problem in 2003 and solved by improving the monitoring procedure. After that time, the company paid considerable attention to data accuracy. Besides applying CR, the company also applied CM practice with selected suppliers. The objectives were to improve their sales performance and evaluate suppliers' abilities in handling data. The latter is very important for the advancement of CR practice in the company. It was expected that CM practice can be used as a way to improve trust with suppliers so that CR practice can be advanced. The company planned to practice JMI with selected suppliers, perceived to have sufficient infrastructure.

Influential contingency factors in the CR-BIS configuration of Company A are listed in Table 5.5. Data sensitivity was the main factor influencing the extent of data sharing. Sensitivity of data is determined not only by its type, but also the formality and quality of the data. Those characteristics need to be included when explaining the influence of data sensitivity in data and process sub-systems. Another influential contingency factor is suppliers' trustworthiness. The company did not trust their suppliers' capability to handle the data. The main concern was that the data would be shared with competitors. The other factors are data communication bandwidth of the company, their suppliers' inventory management application in general to monitor updated data in real time, and credibility of industry associations to bridge the relationship between the company and their suppliers.

Influential factors in task assignments were strategic fit and time specificity of the inventory monitoring task. The task became important because execution involves strategic data. Other factors that influence the task assignment were the capabilities of IT infrastructure in both the company and their trading partners (data communication

bandwidth in Company A and real time inventory monitoring capability in suppliers' inventory management application), data sensitivity, and supplier trustworthiness.

Influential factors in selecting a technical solution were the company's IT infrastructure capability and flexibility, suppliers' IT infrastructure flexibility and functionality, flexibility, and adoption rate characteristics of the adopted technical solutions.

Evidence of antecedent effects of high power distance and collectivist cultures on data sensitivity and suppliers trustworthiness respectively is found in this case. However, it is stated that available evidence cannot be used to confirm the expected moderation effects as the case study findings show a deviation from the expected moderation effects. Because of this, the influence of culture in this case cannot be determined.

Table 5.5 Contingency factors' influences in Company A

Contingency factors	Extent of data sharing	Tasks assignment	Technical solution selection
Retailer characteristics			
Data characteristics			
Strategic sensitivity of data	√	√	
Data accuracy			
Task characteristics			
Strategic fit		√	
Knowledge specificity			
Time specificity		√	
Other retailer characteristics			
Prior or existing process configuration			
Data-handling knowledge			
IT infrastructure capability	√	√	√
IT infrastructure flexibility			√
Relative market power			
Technical knowledge			
Supplier characteristics			
Trustworthiness	√	√	
IT infrastructure capability	√	√	
IT infrastructure flexibility			√
Technical knowledge			
Data-handling knowledge			
Industry characteristics			
IT solutions and IT vendor characteristics			
Functionality			√
Flexibility			√
Adoption rate			√
Vendor support			
Security			
Cost			
Other industry characteristics			
Legal systems			
Independent influential industry bodies	√		
ASP capability in retail mgt.			

5.2 Case study in Company B

5.2.1 Methodological information

The case study was conducted in two periods. The first period lasted from November 2002 until February 2003 and began with an interview with the logistics manager accompanied by the public relations manager. The public relations manager helped explain the organisational structure and condition of the company at that time. The interviews with the IT manager and merchandising manager took place in January and February 2003 respectively. Interviews with those managers were conducted again in order to collect more data. The second period of the case study was conducted in September 2003 to get updates on the BIS configuration for CR implementation by the company.

Observation was conducted in two stores, one at the company's headquarters (North Jakarta) and one in Gongseng, East Jakarta. Store manager and staff were interviewed during the observation. The company had three DCs. The one in the head office was visited and information was gathered from the logistics manager. Company profile, organisation chart, logistics networks, and inventory replenishment procedures were studied. Financial and logistics reports were not accessible due to confidentiality.

5.2.2 General information of Company B

Company B is a mini market chain that started in November 1988. Before 1997, all stores[17] were owned by the company. In 1997, the company started franchise systems, in which the company franchise their mini market formula to any individual in Indonesia. At the time of the study, the company had 800 stores, 55% of them owned by Company B and the rest owned by franchisees. Company B had 9700 employees at the time of the study with the following composition:

- Distribution Centre: 993 personnel
- Head Office: 1,147 personnel for administrative functions and 603 personnel for non-administrative functions
- Shops: 6,987 personnel

The organisation is structured in the diagram in Figure 5.13. The board of directors consists of a President Director and six directors for Information Systems (IS), Merchandising, Finance, Business Development, Human Resource and Service, and Operation. Among those, the IS, merchandising, and operation directors are the most relevant to this study.

[17] There were 230 stores at that time.

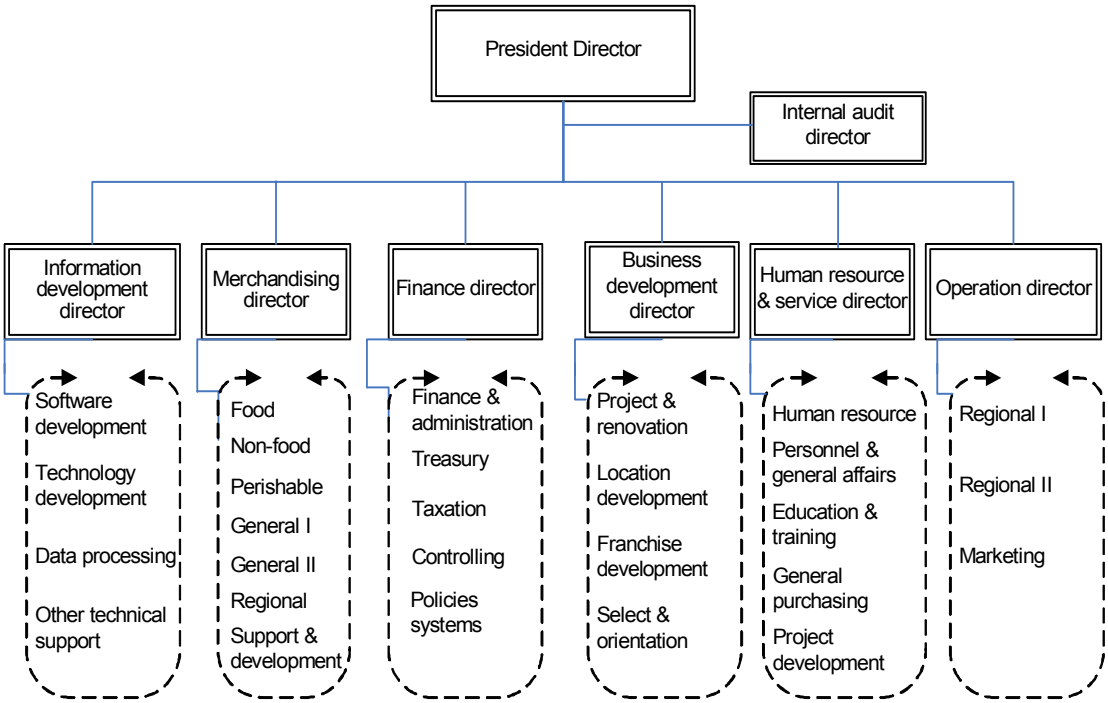


Figure 5.13 Organisation structure of Company B

The IS director is responsible for software development and technology development for data processing as well as technical support in daily operations. The merchandising director is responsible for managing assortments in each category and developing a supplier base for those categories. There are four general categories: food (e.g. milk and baby food), non-food (e.g. hair care and cosmetics), perishable (fruits, poultry, and bakery), and general merchandise (e.g. clothes and apparel). These accounted for 3,300 SKUs in total at the time of the study. The products are supplied from three Distribution Centres (DCs) that cover different regions. There are three regions in total: Region I covers Jakarta, Bogor, Tangerang and Bekasi, Region II covers Bandung and Jogjakarta and Region III covers Surabaya. They are managed by the operations director.

5.2.3 Critical incidents in BIS configuration of Company B

Five incidents were critical to CR implementation in the company. These are described in the following paragraphs. Please note that the names of all business applications used in the text are the real names.

POS and DC Inventory Management applications applied (1990)

Two years after the company was established in 1988, the IT department developed Point of Sales (POS) and DC Inventory Management applications. Those were the first 'home-made' applications. The POS application was developed to support inventory management activities in stores. It provides the capability to update sales data and inventory data in the database accordingly. Store managers identified out-of-stock items from the inventory report. Delivery Orders (DOs) were sent to the DC by fax. The same process occurred in the DC, but with the support from the DC Inventory Management application. The difference with the POS application is the ability to identify out-of-stock items automatically. The EDP function in the DC used this information to release POs to suppliers; the amount was determined from inventory min-max settings in the database. The DC manager was responsible for this activity and ensuring that orders arrived on time. Figure 5.14 shows networking configuration at this time. The details of these activities are presented in Figure 5.15 and 5.16.

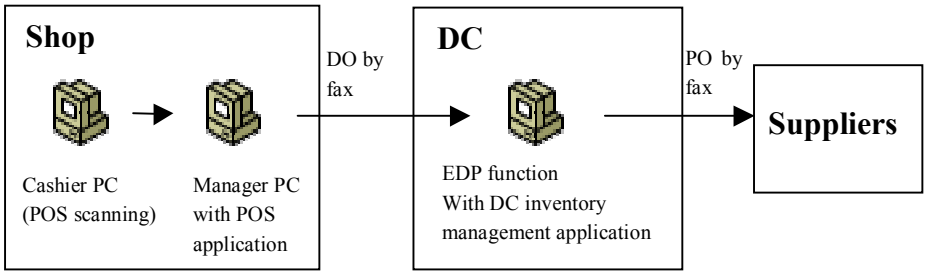
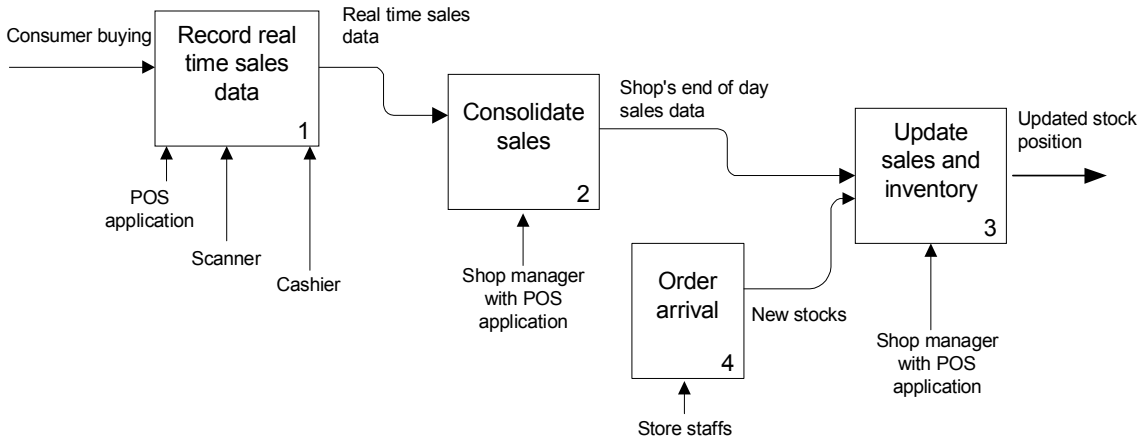
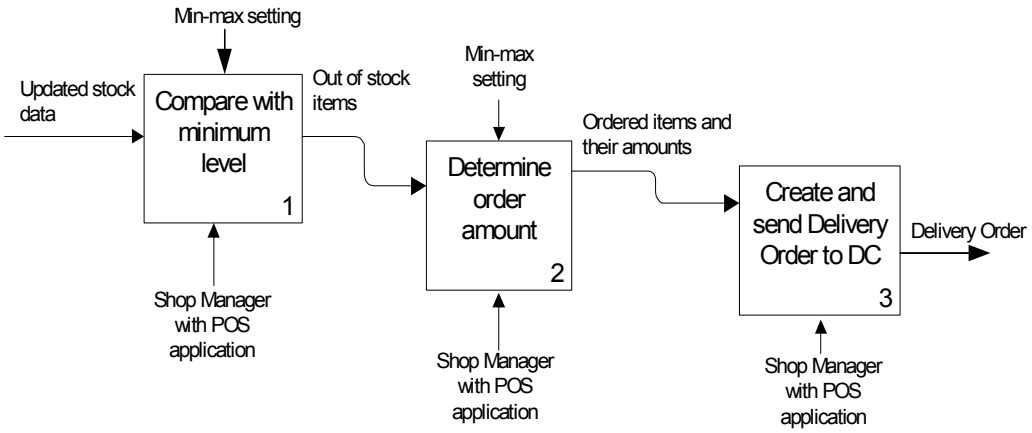


Figure 5.14 Data communication in 1990 after POS implementation

In this period, the principle of CR has been applied in the DC because, as shown in Figure 5.16, there was no involvement of the DC manager to change the amount of replenishment orders. The amount is calculated by a specific formula set by the merchandise manager in the head office. This setting was revised periodically to fit the development of sales in the stores and the company's plan to sell new products. The DC manager ensured that order fulfilment by suppliers arrived on time. One may assume that implementation of a DC inventory management application enabled the company to adopt the CR principle in the DC. However, it was RMI practice since no suppliers' were involved.

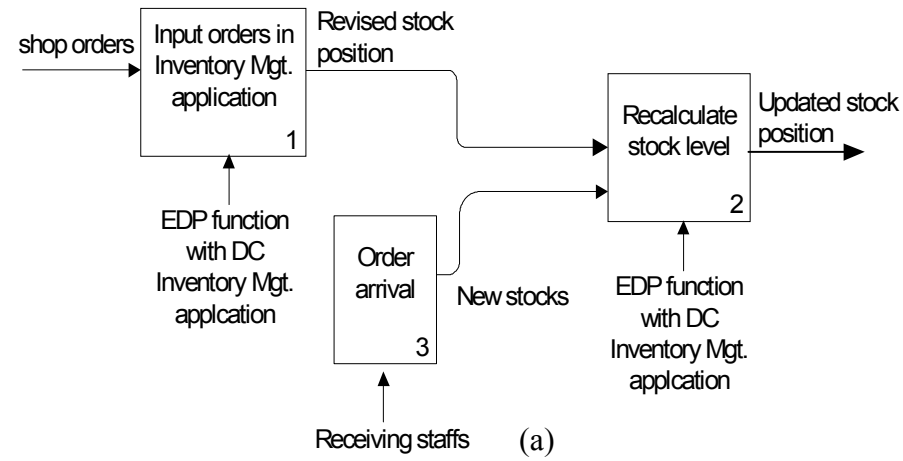


(a)



(b)

Figure 5.15 Data updating (a) and stock monitoring and ordering in shop (b)



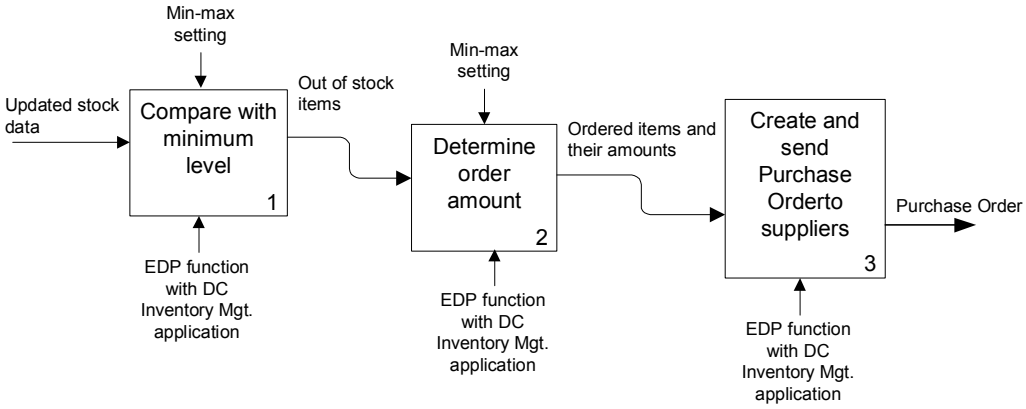


Figure 5.16 (a) Data updating and (b) stock monitoring and ordering in DC

Ordering Systems application was applied (1993)

IT department improved shop ordering processes by launching Ordering System applications for shops. This application automated the ordering process by automatically recognising out of stock items, determining the amount to be ordered, and preparing Delivery Order documents for ordering to the DC. After this was installed, the shop manager no longer held the authority to change the amount of an order. To do that, he had to consult the merchandise manager in the head office. E-mail replaced fax. CBN, an Internet Service Provider in Jakarta, was selected as the e-mail provider. However, fax-based order communication was still needed to send orders to small suppliers. Figure 5.17 depicts this arrangement. Basically, there was no change in networking; it was only an improvement in the shop ordering process as described in IDEF0 diagrams in Figure 5.18.

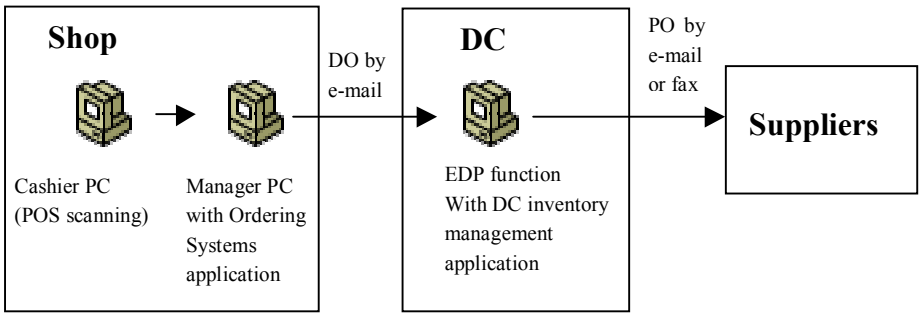
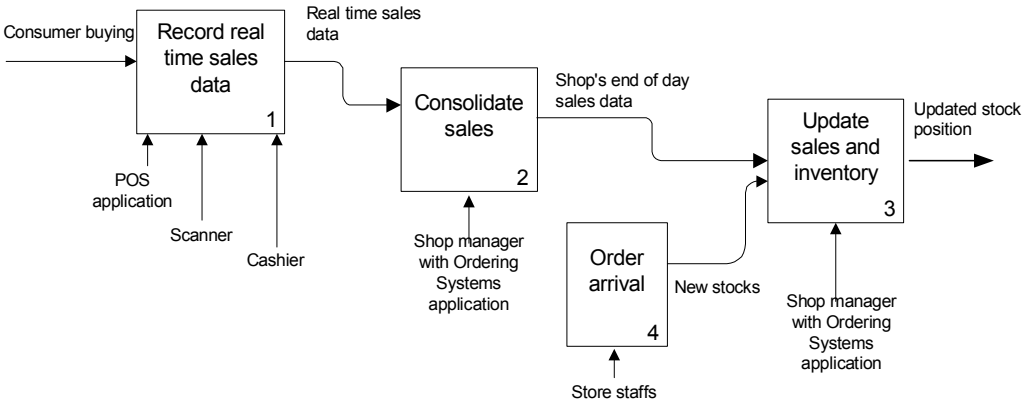
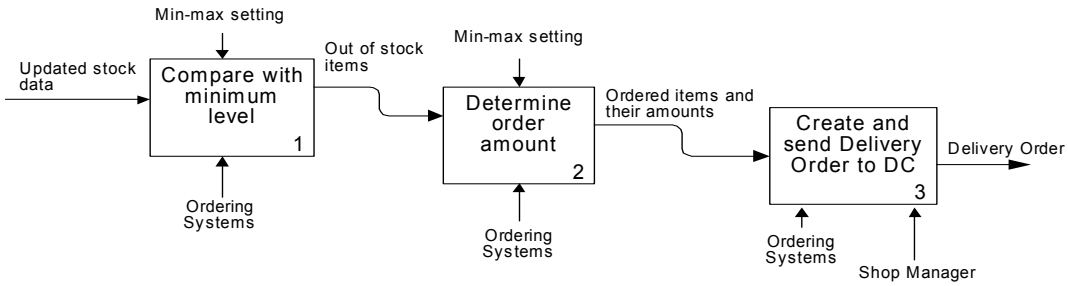


Figure 5.17 Data communication flow after POS implementation in 1993



(a)



(b)

Figure 5.18 Details of data updating (a) and stock monitoring and ordering in shop (b) after Ordering Systems implementation

This development did not change inventory management activities in the DC. Neither did this change the relationship between the company and suppliers in inventory management. The activities were still performed by the company without any involvement from suppliers. Nevertheless, this is very important for CR adoption in the company; it had extended the CR application to the store level.

Merchandising Systems application was applied (1995)

The number of stores and the product assortment were increased. The company built two more DCs to support inventory replenishment. They thought that it would be efficient to combine orders from those DCs. They could find an optimal order for the whole system and the best suppliers for their needs. To achieve their goals the company developed Merchandising Systems developed by their IT department. As expected, this helped the company determine the optimal amount of orders for the entire system and find the best suppliers. After the implementation of this application, ordering for the DC was done from the head office. This indicates the merchandiser's involvement in ordering process. A diagram in Figure 5.19 describes the connection between the shop, DC, head office, and supplier during this time.

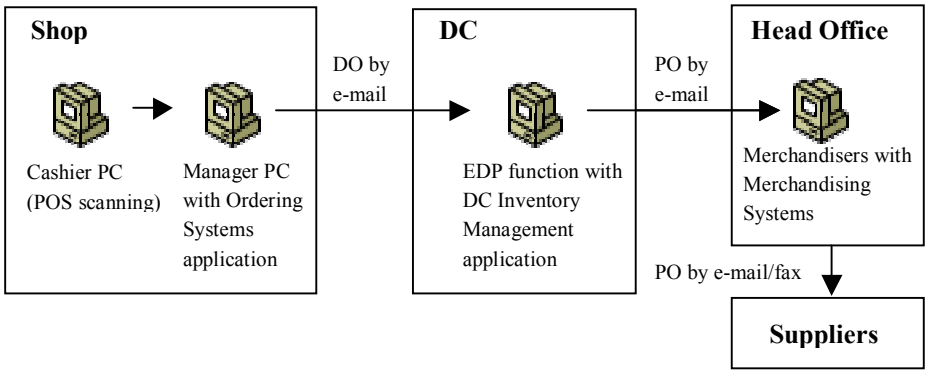


Figure 5.19 Data communication flow in 1995 using Merchandising Systems

The change in ordering process for the DC is shown in the following figure; shop ordering remained the same. The importance of this occasion to CR implementation in Company B is that it brought CR practice into a higher efficiency level, although still on RMI level.

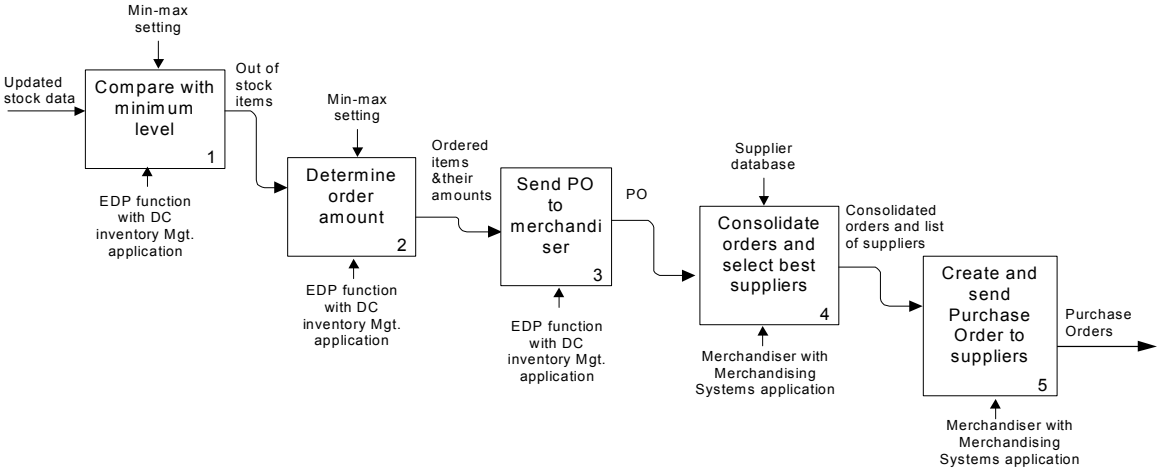


Figure 5.20 Replenishment decision was shifted to merchandiser

Inventory database modified to enable daily ordering (1997)

There was a change in the Ordering System application due to changes in the delivery schedule from DC to shops. Previously, delivery to a shop had a fixed schedule. After DC capacity was enlarged and transportation facilities added, delivery could be made daily. The logistics manager declared that even if the order was a single item, they would deliver it. This may sound inefficient, but he explained that the large number of stores make this practice efficient. The new practice required a change in inventory database. The lead-time settings for all items needed to be changed to enable daily deliveries. This allowed Ordering Systems to release orders every day and enabled Company B to improve CR practice. Improvements in the logistics infrastructure arguably enabled them to sustain continuous product flow from DC to stores and reduce inventory level in stores.

File Transfer Protocol (FTP) connection between shop and DC (2003)

Company B installed an FTP server in the head office that enabled stores and the DC to directly put their orders into the systems without having to be reformatted. Before, this was not possible because the file in e-mail was not ready to be fed into the system. They need to be reformatted before processed. This took time and reduced the accuracy of orders. After FTP was installed the company had a standard format for data transfer. This enabled them to reduce process time and increase accuracy. In addition, stores and the DC do not have to maintain their databases individually. This is now done by IT staff in the head office. This centralisation allows for better data accuracy in the system. Also, merchandisers were able to improve the efficiency of the total system due to better visibility in store and DC data. This occasion is very important for CR implementation in the company because of the improved response time and accuracy of the systems. Figure 5.21 gives an illustration of this. Shop orders are not sent to the DC but to an FTP server in the HO. This will be downloaded by the EDP function in the DC to prepare delivery to shops. After delivery is planned, the EDP function creates a shipping notice (SN) to the server that can be downloaded by the shop to see the order status; they also released a PO for DC replenishment. Monitoring and ordering processes in the shop and the DC are slightly changed. These are shown in Figure 5.22. The change is that store and DC do not send their orders directly to the DC and merchandisers respectively, but to an FTP server.

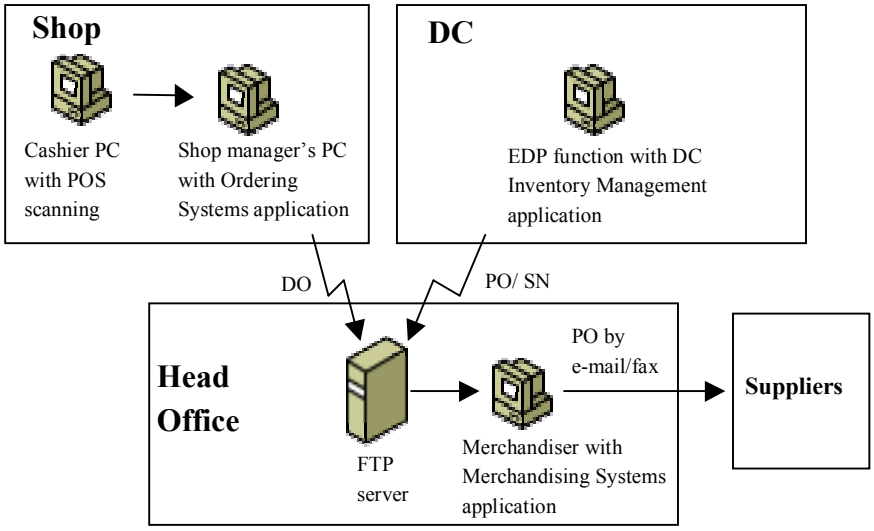
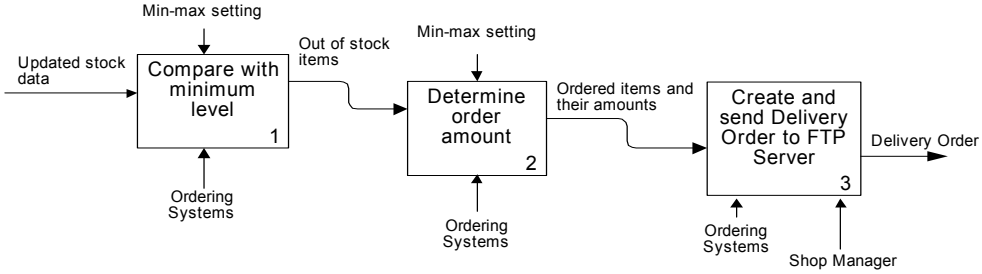
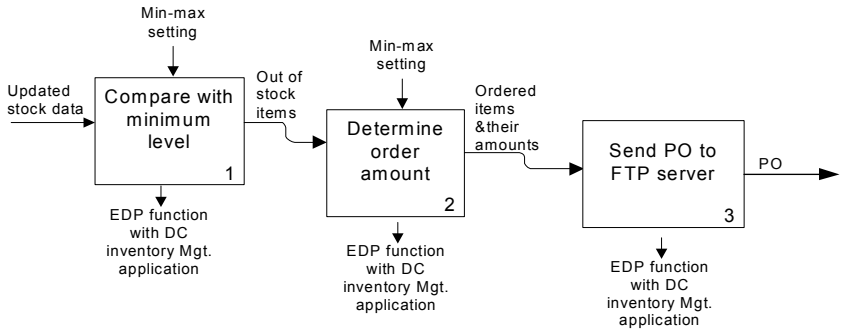


Figure 5.21 FTP connections between shop, DC and HO



(a)



(b)

Figure 5.22 Pooled ordering systems in shops (a) and DC (b) by FTP server

5.2.4 Analysis of the progress of CR implementation in Company B

The critical incidents are summarised in Figure 5.23.

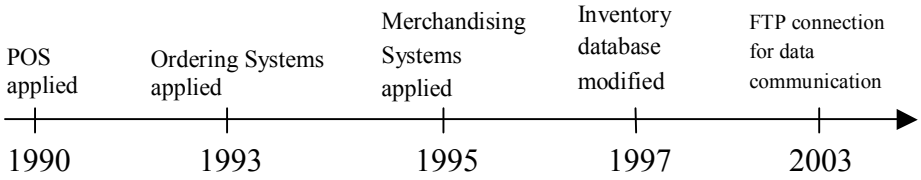


Figure 5.23 Critical incidents that affect BIS configuration of Company B

The CR concept was introduced by supermarket operators worldwide. This doesn't mean the principle is limited to supermarket operators. It is proven in the second case of this study. Although Company B is a mini market operator, they were also motivated to implement CR. The figure above shows the company progressively improving their technical capabilities to support CR practice. These include the implementation of the POS application and the DC inventory management application in 1990 and improvement in data communication technology in 2003.

The implementation of DC inventory management in 1990 is considered the starting point of CR adoption. Store orders were directly entered by the EDP function to the systems to allocate products to those stores. Afterward, they planned replenishment orders for the DC. It is interesting to see that the company decided to start CR implementation in the DC. Although this may give bigger savings, the risk of failure is higher because the DC system is far more complex than the store systems, especially in the context of Company B.

The logistics manager stated that by implementing the CR principle in the DC, which essentially minimised intervention in the DC, the company was able to react quickly to store requirements. The operation of the company's mini markets was highly customised in the first eight years of operation because store managers needed to learn and adapt to specific consumer demand in his area. This resulted in highly fluctuating orders from store and required a quick reaction from the DC. To succeed, it was important to minimise intervention in DC fulfilment so that products would be available all the time. Although the process was done manually by the EDP function, it was not intended to change the amount of order.

In addition to the above explanation, the logistics manager mentioned that CR application at the store level was not possible because the store manager's involvement was needed to cope with changing consumer demand in his area. After longer operating times, the company was able to learn the requirements of their consumers. It was then able to reduce the store manager's involvement in ordering. Furthermore, demand

analysis was better because the company had sufficient and representative data for analysis of store requirements. That is why CR application at the store level took longer. The CR practice in stores could only be found after 1993 when the company implemented Ordering Systems application. The practice was RMI type and was still practiced at the time of this study.

This data indicates that CR application in the company started before the ECR concept was introduced in the USA in 1993. The quick implementation of the CR principle in Company B is proof that the basic replenishment principle had been introduced and practiced by retail companies before the concept was formalised in ECR. It is interesting to know why ECR is introduced if companies have already adopted the principle. There must be another message brought by the concept. During ECR introduction, the concept was intended to eliminate adversarial relationships between retailers and suppliers that caused inefficiencies along the supply chain. ECR encourages retailer and supplier to work together to manage inventory along the chain so that they could reduce waste in the supply pipeline. This is another message in ECR that is expected to be adopted by retail companies. Companies are encouraged to involve upstream partners to manage their inventory.

This message was not realised by Company B. The company did not involve suppliers. There were factors behind this decision, elaborated in section 5.2.2. Nevertheless, the company is paving the way to a higher level of CR practice. To realise this objective, they plan to start CM cooperation with suppliers in the short term. According to the manager, this could be the beginning of a tighter relationship between the company and their suppliers. They would be able to evaluate the suppliers' performance in handling their data and CM performance could determine how far the company can go with their CR practice.

There were two important aspects of the systems that need to be improved by the company to practice advanced CR implementation: expandability and openness of their data communication technology and capability of their inventory management application. Based on observation of the technical sub-system, it was found that the systems were designed for a relatively small-scale business environment and based on proprietary standards. This limits the expandability and openness of the systems to allow them to include more products in CR practice and to communicate with various suppliers. In addition to those limitations, there is a missing functionality in the business application, i.e., the ability to identify exceptions from actual POS data and forecasted demand and incorporate those exceptions in the current replenishment process. This ability is required to quickly adapt systems so that replenishment decisions fit actual conditions. Moreover, their data communication link with suppliers needs to be replaced with a more open and reliable network.

Despite these limitations, it is expected that advanced CR practice will be witnessed in the DC level in the future if CM practice is successful. Application of advanced CR practice on the store level was not economical because the company had enough resources to manage those small stores. Extra efforts from suppliers on the store level would be a waste. It is more valuable to involve suppliers on the DC level because the number of stores and SKUs is increased and inventory management in the DC becomes more complex. Suppliers' involvement may give considerable value to this activity. This statement was confirmed by the interviewees. They agreed that DC inventory was too big to support CR practice in store. They thought that suppliers might be able to help them reduce the number of inventory in DC. The company's plan for CR advancement is illustrated in Figure 5.24.

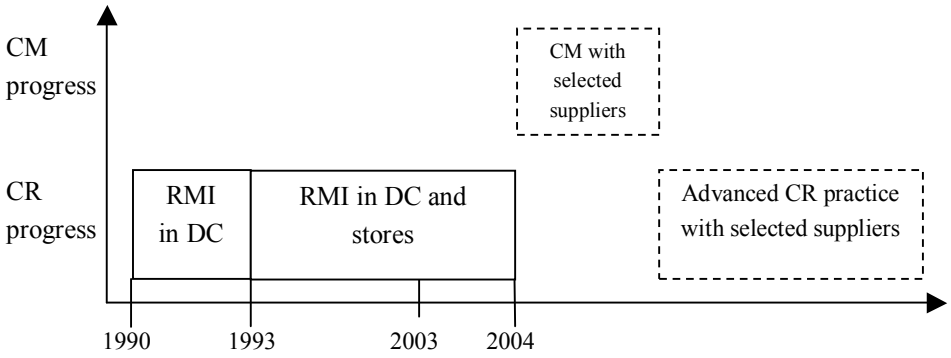


Figure 5.24 Company B's plan to improve CR implementation quality

Overall, the approach of the company in improving CR practice was technology oriented; technology was adopted to improve the effectiveness of the systems. Even though it is technology oriented, it does not create a technology-dependent situation in the company. The development was user-driven; users are aware of systems development and know what can and cannot be expected. The company has a policy not to approve system development if a store does not require it, or when the IT department thinks that a store or DC is not ready for the development.

5.2.5 Contingency factors analysis in Company B

Changes in CR-BIS configuration of the company are summarised in Table 5.6. The company is practising RMI, meaning all inventory management tasks are carried out by the company. This also means there is no data sharing with suppliers. The company used proprietary applications for inventory management. Those applications have been improved to support the CR practice. Internal data communication is improved, but external data communication with suppliers is still performed conventionally. Factors that influenced the company to choose this configuration are elaborated in the next paragraphs.

Table 5.6 Changes in CR-BIS configuration of Company B

Year / Sub-systems	1990	1993	1995	1997	2003
Data processing	Sales and inventory data used in determining orders. Shop manager's knowledge important to determine final orders. Data transfer done according to DC lead time. No proprietary data shared with suppliers. DC administrator responsible to release orders for DC replenishment.	Shop manager's involvement was eliminated and replaced with auto replenishment of Ordering Systems application.	DC staffs' involvement in determining replenishment order for DC eliminated. Their role replaced by Merchandising Systems application.	Order data transferred everyday.	No significant changes
Technical	POS application was the inventory management application in shop. LAN and dial-up connection using a public network were the data communication mechanisms to connect different parties involved in inventory replenishment. The latter was used to communicate orders with suppliers	Ordering Systems replaced POS application for inventory management. It enabled auto replenishment in shop.	DC replenishment managed by Merchandising Systems application.	Changes in inventory settings in database to allow daily delivery from DC to stores.	FTP server was installed. All internal data communication is done through the server. A public network was still used.

Contingency factors that influenced the extent of data sharing with suppliers

The following factors were mentioned by the managers as contingency factors in data sharing with suppliers:

1. Output stability

The merchandise manager stated that the main reason of not sharing data with suppliers is stability in their sales output. The manager argued that suppliers' expertise would be needed in a situation where sales output is not stable. Unstable output is costly because the systems need a lot of buffer stocks to accommodate high demand fluctuation. In this situation, suppliers' assistance would be valuable to formulate an optimal strategy for inventory management and to quickly react to fluctuating demand. Fortunately, Company B did not experience this and did not require suppliers' assistance in managing their inventory. Three factors explain this situation. First, this is the nature of mini market operation. The company's mini markets operate in smaller areas than supermarkets and that makes sales relatively more stable. Second, stable output was enabled by the company's policy to allow daily delivery from the DC to stores. Last, it is also due to store manager ability to appreciate local trends so demand is more predictable.

2. Value-added

According to their views, suppliers were unable to add significant value to the store operations. They think that existing resources are sufficient to perform continuous data updating and monitoring and reliable enough to formulate decision for inventory replenishment. Additionally, the company argued that their knowledge for data handling is better than suppliers. This is because of the franchise systems they are running. This system creates entrepreneurs with specific knowledge of local consumers. The knowledge cannot be copied easily by suppliers or competitors because of its specificity. However, they said that suppliers might be helpful in managing DC inventory because inventory level in DC is still high to keep product availability in stores.

3. Sensitivity of data

Reluctance to share data is also because of the sensitivity of inventory-related data. This data is related to information on sales and marketing strategy and financial performance. The company worried that if this information was known by suppliers, then they would share the information with competitors to increase their product sales. This is a benefit to suppliers, but definitely a loss for the company. To avoid this, and maintain a good relationship with suppliers, it was decided not to share sales and inventory data.

4. Suppliers' trustworthiness

The reasons above indicate that the company doesn't trust their suppliers with their data. They suspect the suppliers' interest is only to increase their own sales. They did not care about their service level to the company. The logistics manager stated that suppliers did not make a significant effort to improve their service level to the company.

The service level was relatively low, around 65%. Suppliers were able to ignore this due to their stronger position relative to the company. Mini market operators are not as powerful as supermarket operators and do not get high priority in suppliers' fulfilment list.

The description above argues that output stability, data sensitivity, and lack of trustworthiness on the suppliers' side were the factors that limited data sharing. Data accuracy was not significant because the company did not have problems with data accuracy. A small size of stores and adequacy of staffs in store enable the company to maintain data accuracy in store. Suppliers' IT infrastructure capability was also not an issue because the company knows that their suppliers, especially the big ones, have IT infrastructure capable of processing the data. The main problem in suppliers' side was insufficient knowledge to translate the data into meaningful information for store operation. The market power was not the reason why the company did not share data. It did not mean that they had higher market power than suppliers so they could decide with whom they would share data. On the contrary, the manager said their bargaining power was lower compared to big suppliers. The reason why suppliers did not ask for data was that it was from a specific market sector and they could not make valuable outputs from this data. This requires considerable time and resources to analyse the data. Legal systems and industry-level institutions did not influence the company to share more data because they really are concerned with the value of data sharing with suppliers.

Contingency factors that influenced task assignments

The company did not involve suppliers in inventory management activities in shops and DCs. The interviewees state that the factors are the same as they mentioned for data sharing relationship with suppliers with the addition of prior or existing process configuration. This factor explains that the existing process execution for inventory management in the company is satisfactory and suppliers were not able to add value to the existing process execution.

Contingency factors that influenced technical solution selection

The data shows that Company B focused technical development on improvement of data capture and order management activities. Development of data communication media was in second place. According to the interviewees, this is related to their objective of improving data accuracy. Data accuracy needs to be assured from the store level in order to improve the accuracy of the total system.

Selection of communication media was based on the speed requirement. In the research model this is considered a functionalities feature. The IT manager stated that FTP connection between shops, DC and Head Office, enables quicker and more reliable data upload and download. This is very important for daily delivery practice from DC to

shops. This is arguably more critical in this context than in the context of the company's relationship with suppliers, because deliveries from suppliers are not scheduled daily. In addition, not all suppliers were able to support this communication media.

The company decided to use proprietary applications for inventory management in shops and DC. The following factors explain their decision:

1. Cost and functionality

The combination of cost and functionality was the main reason for using and developing proprietary applications. Proprietary applications are arguably less costly and have better functionalities than vendor applications. It was developed from an existing application and there was no need to pay an external consultant since the company had capable human resources. It has better functionalities because the company is familiar with the entire system and able to determine how the application should be developed.

2. Technical and process knowledge

The company had sufficient technical knowledge to develop their business application. This knowledge was developed by a selective recruitment, training and process orientation. Through process orientation, new people were brought into the company's business routines. This process knowledge made a good addition to the technical knowledge in developing the business application. The knowledge of process execution contributed toward high functionality of the developed application. Only when the company thinks their knowledge is insufficient will they consider buying external solutions or paying a consultant to assist them in developing the applications.

3. Existing IT infrastructure

The company used specific business applications because they had invested in a specific infrastructure upon which the application was to be developed. So far, this infrastructure had been able to support the company's business requirements. This was because the company was managing relatively small SKU numbers (3300 SKUs) and mini market operation is relatively simple. There might come a time when the company will have to replace this infrastructure because it simply cannot give appropriate support anymore. Based on this description, it can be concluded that investment in specific infrastructure and the capability of the infrastructure to deliver required supports influenced selection and development of a technical solution for the CR application.

The description above shows that the company is bound to their existing knowledge and infrastructure. To some extent, this could make the company become less dynamic and trapped in traditional practices. However, they also keep themselves up to date with new trends in the industry. Proof is the application of an FTP connection. Important to notice is that process or data handling knowledge was not

proposed to influence the technical sub-system configuration, but was significant in the case of Company B. This could be a valuable input to the research model.

Other factors proposed to influence task assignments were not important for the company. Market power did not influence the technical selection because they were applied for internal requirements of the company. Should those be applied for supply chain activities then this factor be influential. The same goes for technical knowledge. Suppliers IT infrastructure was not important either. The company was so internally focused that they did not take their suppliers' IT infrastructure into account when selecting technical solutions. They will consider this factor when they want to select applications for supply chain processes. Because they did not take those factors into account, the flexibility and adoption rate of the technical solutions were not important. Vendor support was not important because the company provided the application themselves.

5.2.6 Cultural influence in Company B

The company was reluctant to share data because it may give information on sales and marketing strategy and financial performance of the company. The company concerned if suppliers share the information with competitors to increase their product sales. The high sensitivity of data and low supplier trustworthiness as indicated by the findings gives support to the expected antecedent role of high power distance and collectivist cultures in this case.

However, the actual findings of contingency factors influencing the extent of data sharing and task assignment are not inline with the expected moderation effects of high power distance and collectivist cultures as described in section 3.5 (see Table 5.7 and 5.8).

Table 5.7 Expected moderation effect and case study findings of contingency factors influencing data aspect of CR-BIS configuration in Company B

Expected moderation effect based on theory	Case study findings
Data sensitivity, suppliers trustworthiness, industry bodies, legal systems, and relative market power	Data sensitivity, suppliers trustworthiness, and suppliers' data handling knowledge

Table 5.8 Expected moderation effect and case study findings of contingency factors influencing tasks aspect of CR-BIS configuration in Company B

Expected moderation effect based on theory	Case study findings
Data sensitivity, suppliers trustworthiness, industry bodies, legal systems, and relative market power	Data sensitivity, suppliers trustworthiness, prior or existing process configuration, and suppliers' data handling knowledge

Data sensitivity and suppliers trustworthiness are not the only important contingency factors that influence the extent of data sharing. Suppliers' data handling knowledge was considered important too in determining the extent of data sharing in this case. It was argued that the company's knowledge for data handling is better than suppliers. This is because of the franchise systems they are running. The system creates entrepreneurs with specific knowledge of local market. The knowledge cannot be copied easily by suppliers or competitors because of its specificity. The deviation in task aspect is even bigger than in data aspect because there are two unexpected contingency factors appear in the case study findings.

Although evidence of expected moderation effect in technical aspect is found (see Table 5.9 below), the overall findings of contingency factors in all aspects of CR-BIS in this case show deviation from the expected moderation effects of high power distance and collectivist cultures. Because of this, the influence of high power distance and collectivist cultures cannot be determined in this case.

Table 5.9 Expected moderation effect and case study findings of contingency factors influencing technical aspect of CR-BIS configuration in Company B

Expected moderation effect based on theory	Case study findings
Inherent characteristics of technology (i.e. functionality, flexibility, adoption rate, security, vendor support, and costs) and at least one other factor in technical selection	Functionality and cost of technical solutions, retailer IT infrastructure capability and retailer technical knowledge

The company's franchising strategy is an explanation to this deviation. The strategy creates low power distance and individualist culture because the strategy put strong emphasis on individual's (i.e. store manager) goals and initiative in developing the company's operations and endorse consultation between head office and store manager in strategy formulation. The combination of the national culture and the culture created by franchising strategy makes it difficult to determine the extent of national culture influence in this case.

5.2.7 Summary

Company B is practising RMI in stores and DCs. The application was started from the DC level in 1990 and followed by stores in 1993. Application in stores was done later because shop managers still demanded flexibility in changing replenishment orders. When the knowledge of consumer demands was improved and the number of stores was significant enough for statistical analysis of this demand, the automation of the replenishment process in store could be realised.

The company developed their own systems to support CR implementation. Their approach to support this policy was to make selective recruitment, training and process orientation so applications can effectively deliver the required functionalities.

The company was planning to advance their CR practice; however, it was not clear to what extent they would change the RMI practice. Before realising this plan they want to evaluate suppliers' performance in using their proprietary data. To achieve this goal they plan to practice CM cooperation with suppliers.

The company needs to improve the expandability and openness of their system to be able to support advanced CR practice. The conventional systems for data communication need to be replaced with an EDI-enabled system. In addition, the company needs to improve the functionality of their inventory management applications so the system is able to identify and accommodate operational exceptions into their existing plan. This is needed to improve their response to changing situations in the operations.

The approach the company used in improving CR quality is technology oriented but does not create a technology-dependent situation because development is always initiated by user requirements. The company has a specific CR-BIS configuration. Factors that influenced the configuration are summarised in Table 5.10. A new relationship was found between data-handling knowledge and the selection of a technical solution. It was argued that data-handling knowledge is useful in fitting the technical solutions to business processes.

The investigation of cultural aspect in this case show that high power distance and collectivist cultures did not have consistent influences on contingency factors and their influences on CR-BIS configuration. Their expected antecedent effects on data sensitivity and suppliers trustworthiness are confirmed, but their expected moderated effects could not be confirmed. Because of this, the extent of cultural influence in this case cannot be determined.

Table 5.10 Contingency factors' influences in Company B

Contingency factors	Extent of data sharing	Tasks assignment	Technical solution selection
Retailer characteristics			
Data characteristics			
Strategic sensitivity of data	√		
Data accuracy			
Task characteristics			
Strategic fit			
Knowledge specificity			
Time specificity			
Other retailer characteristics			
Prior or existing process configuration		√	
Data-handling knowledge	√	√	
IT infrastructure capability			√
Relative market power			
Technical knowledge			√
Supplier characteristics			
Trustworthiness	√	√	
IT infrastructure capability			
IT infrastructure flexibility			
Technical knowledge			
Data-handling knowledge	√	√	
Industry characteristics			
IT solutions and IT vendor characteristics			
Functionality			√
Flexibility			
Adoption rate			
Vendor support			
Security			
Cost			√
Other industry characteristics			
Legal systems			
Independent influential industry bodies			
ASP capability in retail mgt.			

5.3 Case study in Company C

5.3.1 Methodological information

The case study began in January 2003 with a questionnaire to the merchandise manager of the company. An interview was conducted in February 2003. Interviews continued with the Information Technology (IT) manager and logistics manager in the same month. Additional interviews with those managers repeated to collect more data.

Observation was conducted in a store located in the company's headquarters and another store located in southern Jakarta. It was also conducted in the company's Distribution Centre (DC) located near the headquarters. Interviews with store managers, DC managers, supervisors, and suppliers' sales representatives were conducted during the observation.

Organisation charts, lists of product categories, IT and logistics diagrams and inventory replenishment procedures were accessible during the case study.

Data collection activities stopped in March 2003 but were conducted again in September 2003 to update the case.

5.3.2 General information of Company C

Company C is located in one of the satellite cities of Jakarta. The company started in 1989 focusing on the wholesale sector. The business was expanded to a supermarket business in 1990. At the time of the research, the supermarket division had 34 stores in 15 cities in Indonesia.

The supermarket division intends to be the market leader in the middle-down retail market in Indonesia. Market research is conducted periodically to gauge consumer behaviour within this market segment. Based on their study, the company decided to apply a price leadership strategy where product price is the main concern though the company will always maintain good product quality.

The company is among the five largest retailers in Indonesia. It became a member of ECR Indonesia in 2001 and was qualified as a case company for this research. The organisation structure of the company is presented in Figure 5.25.

At the corporate level there is a Chief Operations Officer (COO) who monitors business operations and makes strategic decisions. At a lower level there is the operation director who translates the strategy into operation tactics. These will be instructed to a general manager who applies the tactics to entire regions. Each region is managed by a regional manager responsible for coordinating store operations in his/her region. Each store is managed by a store manager directly responsible for daily operations.

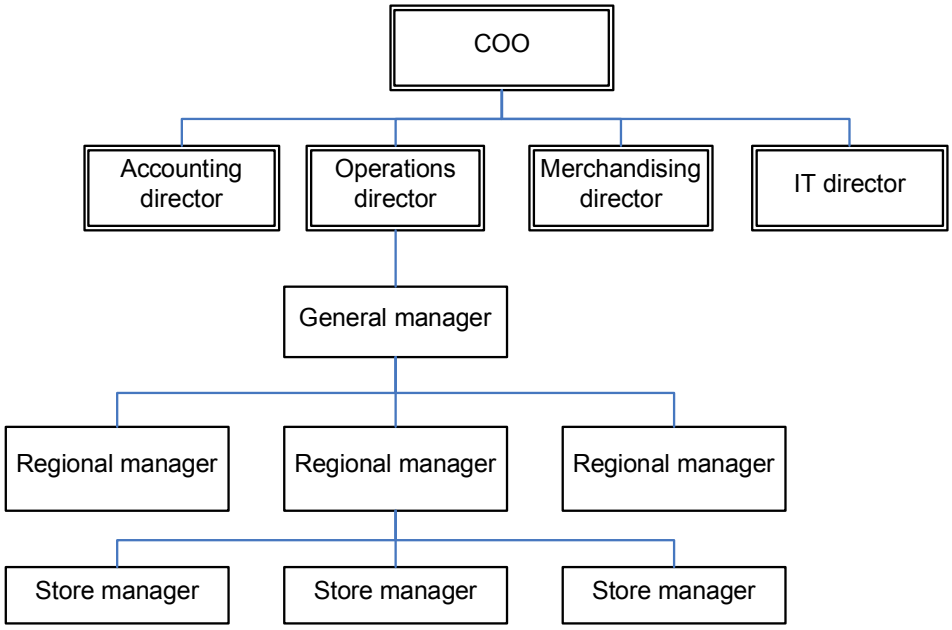


Figure 5.25 Organisation structure of Company C

5.3.3 Critical incidents in BIS configuration of Company C

Nine critical incidents are presented in the following paragraphs that are considered influential to the companies' achievement in CR implementation. Unless stated differently, all applications' names mentioned in the text are real names used in the company.

Data centralisation (1991)

Flexibility given to shops in making item codes was found to be problematic. A product might have different codes and this proved difficult to merchandisers for analysing product performance. This was an internal and external issue because this created difficulty in communicating orders to suppliers. To improve the situation, item codification was centralised at the head office. The merchandise department held the authority to add, eliminate or change product codes so that one product had a universal code for all stores.

This incident is relevant because it reduced confusion in product identification and increased accuracy in item identification and monitoring, which is important in CR implementation.

Implementation of Point of Sales (POS) application (1991)
To manage product out-flows to shops, the IT department developed a Point of Sales (POS) application. Data communication in this period is illustrated in Figure 5.26.

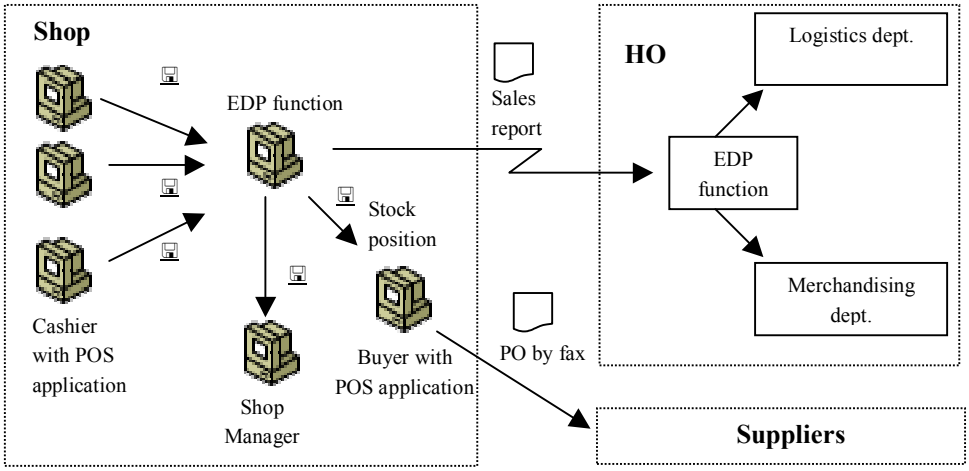


Figure 5.26 Floppy disks were used in data communication

The POS application was based on Clipper language, the official programming language in the company at the time of this research. Product codes were manually entered because there was no scanner. Sales data was downloaded into floppy disks that were distributed by an Electronic Data Processing (EDP) function in the shop to relevant functions within the company to report transaction data, update inventory status, perform inventory monitoring, and send replenishment orders. All were done using POS application. Sales reports were sent electronically to the head office. The buyer was responsible for monitoring updated stocks position in shop. She/he created Purchase Orders (POs) in POS application when inventory reached a minimum level. This level is deliberately determined by the shop manager. The manager used his knowledge about the market to set up this value. The buyer needed authorisation from the shop manager before sending POs to suppliers. Sending POs to suppliers was done by each individual shop using a fax machine. Details of these activities are presented in Figure 5.27 and 5.28 below. The introduction of POS in Company C denoted automation in inventory management and is significant in CR implementation.

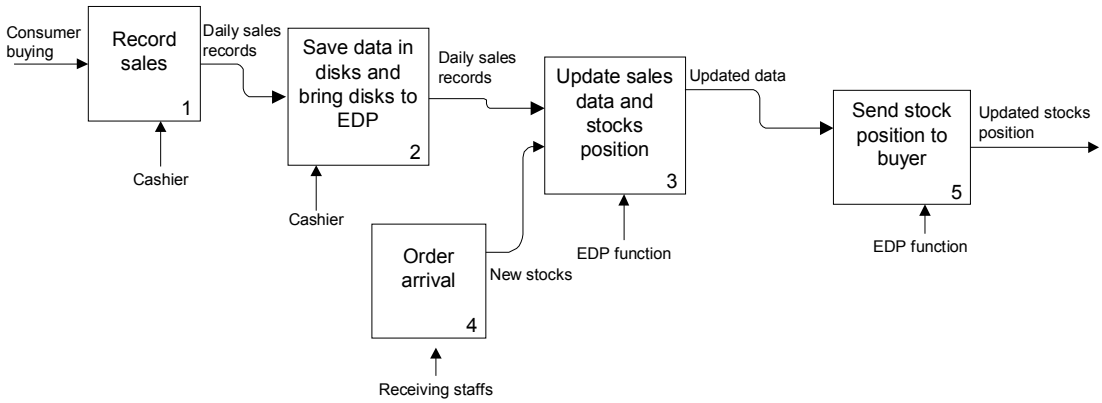


Figure 5.27 Data updating in 1991

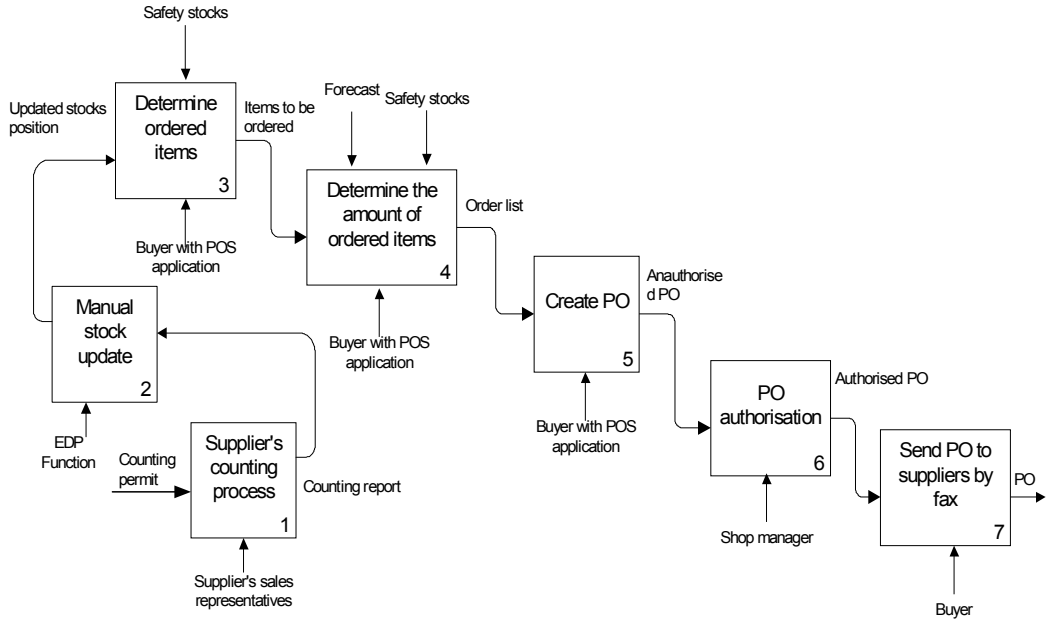


Figure 5.28 Stock monitoring and ordering in shop in 1991

Implementation of LAN for internal data communication (1993)

The use of floppy disks for data transfer was not efficient because it took time to download and upload data using this mechanism. Furthermore, the number of products that might slow the process of data communication using floppy disks had increased. The company decided to implement a Local Area Network (LAN)[18] so that data transfer could be done quickly and reliably. More importantly, the new mechanism helped the company to improve data accuracy. It was possible because data communication through LAN eliminated confusion in data identification due to the exact procedure in

[18] This is not a specific name of the infrastructure in Company C

reading data. Due to its contribution to data accuracy, this is important; data accuracy is critical for successful CR implementation.

Application of Merchandising Systems (MCS) application & DC utilisation (1994)
The number of shops and product variety were increased. To coordinate buying activities the company decided to divide store operations into regions with a buyer in each region to coordinate stores' requirements. The regional buyer received POs from all stores in his region. He would analyse the PO, make necessary adjustments, consolidate the POs, and pass this information to the merchandise department in the head office. The department analysed the stores' requirements and changed the amount of orders when necessary before sending them to suppliers. They also analysed stores' assortment and changed the assortment when needed. In order to support buying and merchandising activities, the company developed a new application: Merchandising Systems (named MCS application). This is a Clipper-based application and functions to manage products, consolidate and create POs, and plan promotion activities. The MCS application became the basis for automatic replenishment in 1995.

The Distribution Centre (DC) was built in this period. After the DC was operational and MCS application were in place, store replenishment was made in three ways: delivery from the DC, delivery from suppliers when the required items were not available in the DC, and transfer from other stores.

Data communication in this period is illustrated in Figure 5.29. The updating process was not altered. It was only the ordering process that was changed. The new ordering process is detailed in Figure 5.30. In general the process detail is similar with Figure 5.28. The only difference is that POs from shops were not sent to suppliers but to a Regional Buyer.

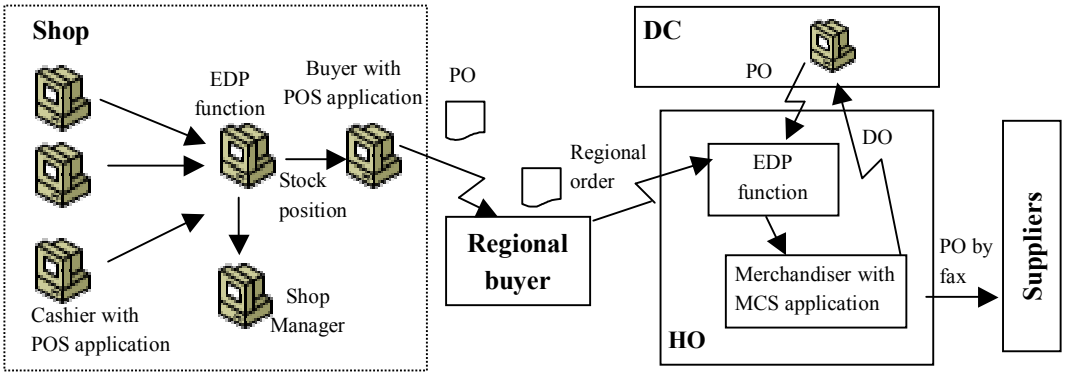


Figure 5.29 Data communication diagram after Merchandising Systems implementation

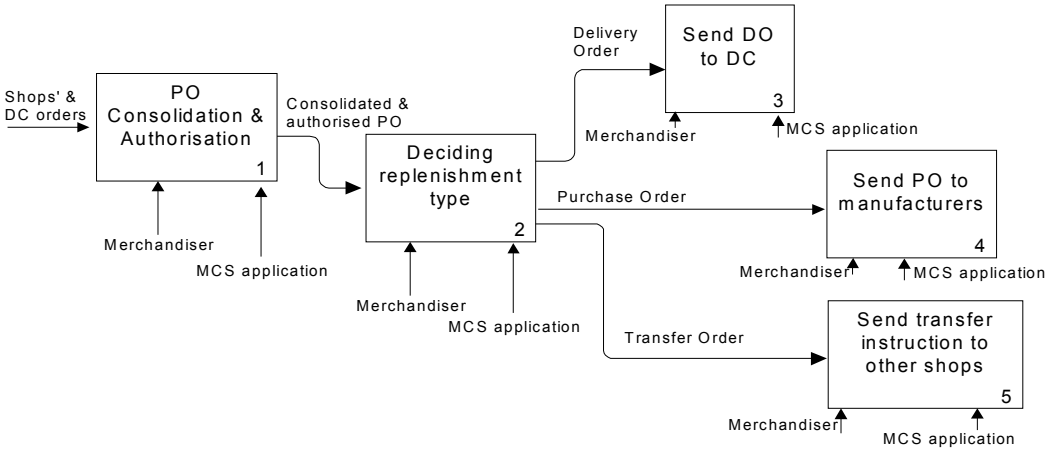


Figure 5.30 Changes in ordering process in 1994

Scanner installation, min-max setting and semi-automatic ordering (1996)

The company made an aggressive move in 1996 when they started to experiment with automatic inventory replenishment. It began with the installation of scanning units in store, which enabled quick data updating for better responses. The guidance for making responses is a min-max setting in the product database (named PKM - *Penentuan Kebutuhan Maksimum*), in which the company assigned a certain value to each product that set the minimum and maximum amount available in the store. The responsibility to determine this setting was transferred from shop manager to merchandise manager for a better overview of product demand. If a product is below its pre-determined minimum, a purchase order was automatically released. Automatic ordering was enabled by Computer Assisted Ordering (CAO) feature embedded in Ordering Systems application used exclusively in the store. The automatic replenishment practice was not straightforward however, because a PO needed to be authorised by the shop manager before it was sent to suppliers to reduce any errors. Therefore, it is called semi-automatic ordering. The practice is illustrated in Figure 5.31. This is very important for the advancement of CR practice in the company as it enables the company to react quickly to out-of-stock potential. Eventually this would provide opportunities to reduce inventory level in stores.

The EDP function uploaded sales and product receipt data into the inventory database. The buyer identified out-of-stock items using the company's ordering systems. A list was generated and POs were automatically released to the regional buyer for further execution.

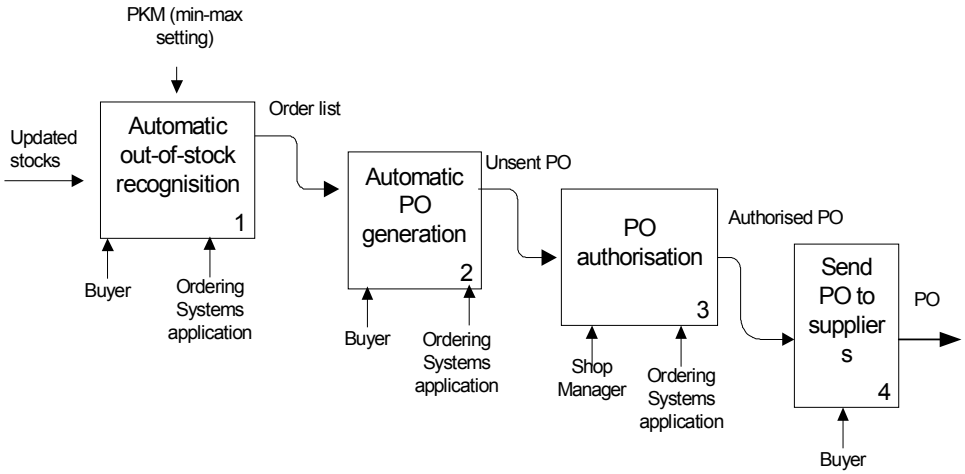


Figure 5.31 Automatic PO generation

Full automatic ordering (1998)

Full automatic ordering systems were applied in 1998 after the company successfully implemented the systems in stores. Authorisation from the shop manager was only needed for special circumstances. Order communication with suppliers was still done by fax. The company thought that communication speed and reliability with suppliers needed to be improved. This was expected to improve suppliers' service levels for the order fulfilment process. The connection is shown in Figure 5.32.

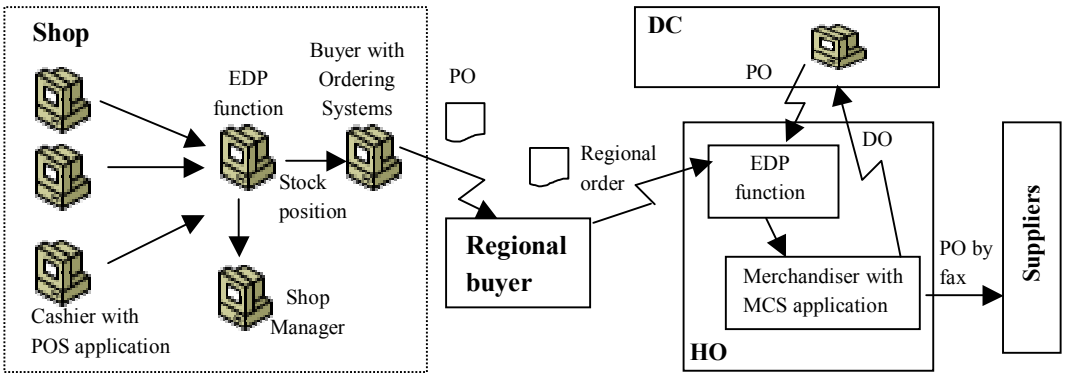


Figure 5.32 Improvement in external data communication link

Internet-based Electronic Data Interchange (EDI) (2001)

The company needed faster media for sending orders to trading partners due to increased trading volume. After studying available alternatives, the company decided to implement Internet-based Electronic Data Interchange (EDI) for communicating orders with suppliers and to communicate data within the company. The arrangement is shown in the following figure.

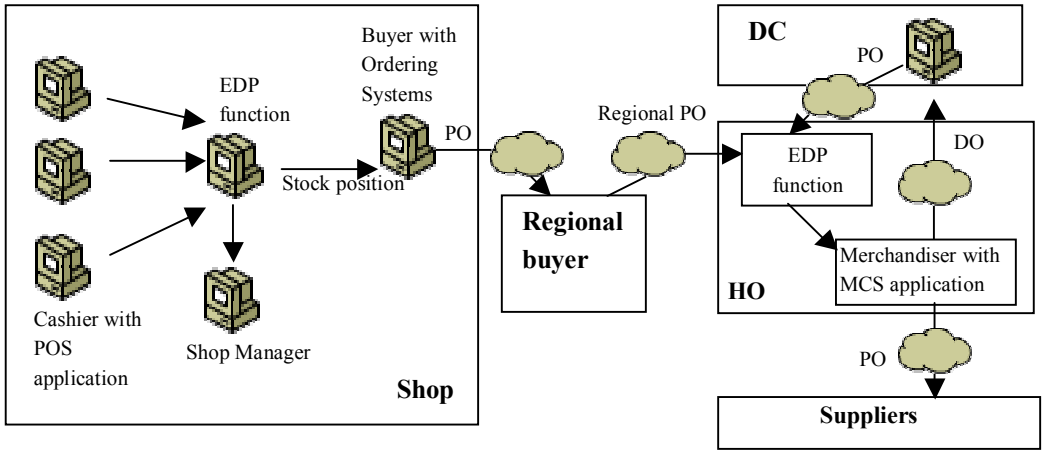


Figure 5.33 Internet-based data communication

Portable Data Terminal (PDT) for stocks monitoring (2002)

The company considered it critical to get accurate and quick information about on-hand inventories, especially those from fast moving items, so that appropriate and timely responses could be made. To accomplish this, the company equipped every division head with a Portable Data Terminal (PDT) that enabled the capture and upload of information on fast moving item's actual inventory status quickly. The data capture was done on out-of-stock items that were found after a product count. This data is uploaded to a data server in store. It is automatically used to recalculate stock positions that became a basis for making orders. By doing this, the company was able to send accurate and real time information on out-of-stock items to merchandisers. The connection diagram is shown in Figure 5.34. The use of PDT changed process details as shown in Figure 5.35.

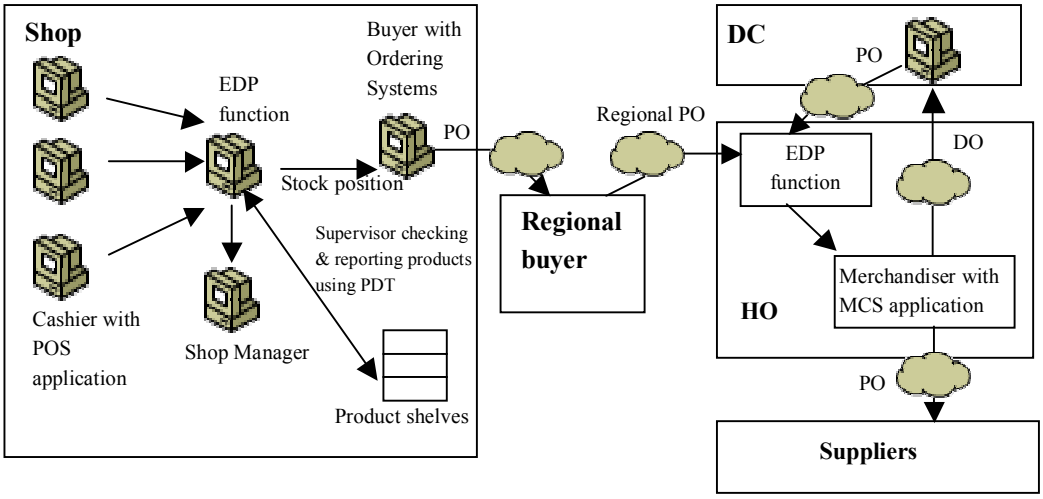


Figure 5.34 Portable Data Terminal used for inventory monitoring

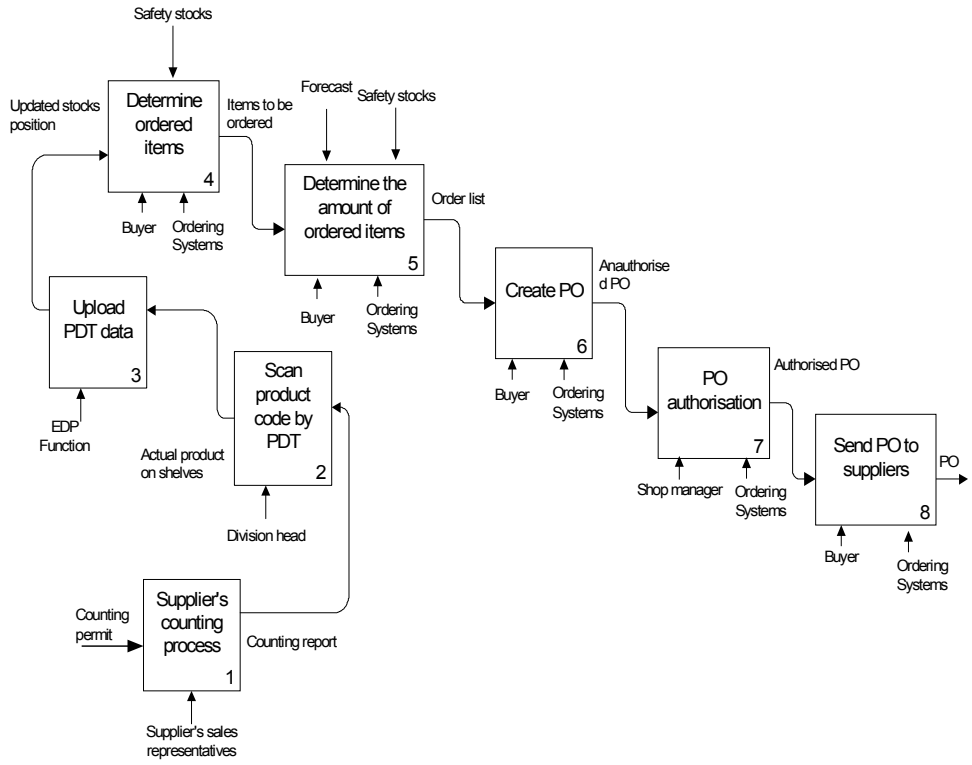


Figure 5.35 Data updating, monitoring and ordering flow with PDT

Application of Oracle Database System (2003)
Shops, product variety and trading partners were growing and the existing product database was unable to support this expansion. The company decided to replace the old system with an Oracle Database System to solve the problem. This application was implemented in the beginning of 2003. Besides flexibility for business expansion, it also extends the company's ability to accept global standards for product identification that require a high capacity product database and provides the company with better security features needed in external data communication. This might be valuable for future CR advancement.

5.3.4 Analysis of the progress of CR implementation in Company C

Critical incidents in Company C are summarised in Figure 5.36. Company C has complied with the CR principle since 1998 when automatic store ordering was implemented. This system eliminated the shop manager's intervention in order release and made continuous data flow from a POS terminal to the order release point. This system was tested in 1996 and considered successful. After that time, the CR principle is practiced by the company without any significant problems. The company was not involved in any project of ECR Indonesia at the time of this study, but were planning to build cooperation with suppliers for CM in the near future.

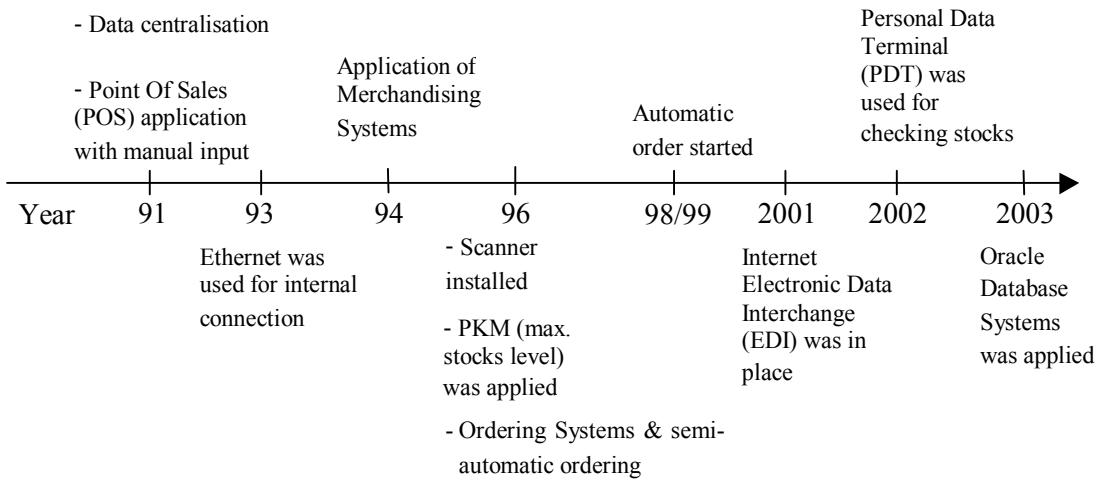


Figure 5.36 Critical incidents that affected BIS configuration of Company C

Success in CR implementation can be explained by the strategy to make a balanced development in the two sub-systems of BIS. In the data processing sub-system the company decided to use actual data as much as possible. This can be seen from their effort to capture real time inventory data by using the Portable Data Terminal. In addition, they changed the data processing activity gradually. This was informed by their decision to make a gradual change from a non-automatic to a fully-automatic process. They carried out a project in order to study the effects of automation in the inventory replenishment process. The automatic system was applied only after the effectiveness of the system was confirmed. The company also made a good decision in standardising product codes, and perform well in maintaining min-max setting of each SKU and the supplier base for optimal ordering. In technical systems, the company used a user-driven approach for developing IT capabilities where there are three different actors: users (stores and DC), the IT division, and the Quality and Assurance (Q&A) division. Users initiate requests for system development to the IT division. This requirement is analysed by the IT and Q&A divisions who decide whether the requirement is necessary. If it is necessary, the IT division designs the system for users. This user-driven approach creates a strong relationship between the IT department and stores/DCs and it can be argued that the total approach of CR development is balanced. This harmonised development is the main reason why Company C is still able to practice the CR principle.

Nevertheless, the practice is still considered primitive (at RMI level), because it does not involve suppliers. Although suppliers' assistance is reported in on-hand inventory monitoring, it is not formally mentioned in the business contract between

Company C and suppliers. In addition, the assistance is not continuously received and the monitoring activity is limited to checking products' availability on shelves.

The CM practice that is planned in the short term would contribute toward the advancement of CR practice. They company would be able to learn how effective data sharing with suppliers is. However, the company did not decide what kind of advanced CR practice they would conduct with suppliers. This plan is illustrated in Figure 5.37.

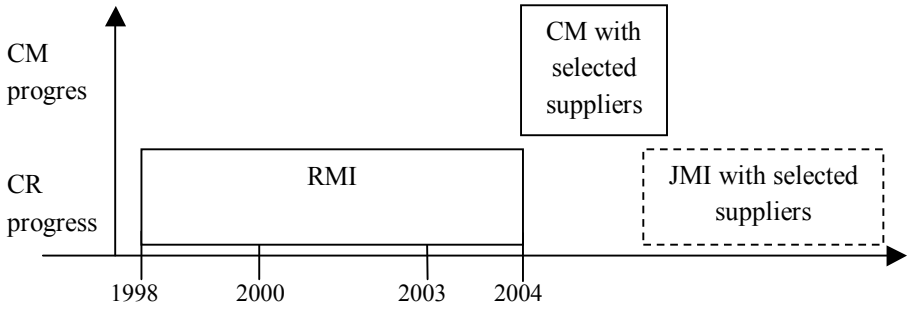


Figure 5.37 Company C's strategy to improve CR implementation quality

The company lacks the capability to identify and accommodate operational exceptions into their plan. This needs to be addressed if they want to practice advanced CR cooperation with suppliers.

5.3.5 Contingency factors analysis in Company C

The company is practising RMI. They do not share any data with suppliers. However, they are planning a CM partnership with those suppliers. This will be used to evaluate suppliers' performance and goodwill. The company perform all inventory management tasks. They used to use a proprietary application to support inventory management but due to development they are starting to adopt a packaged application. The first package is Oracle. The company is planning to adopt another package if the existing proprietary application cannot support their requirements. The overall changes in CR-BIS configuration are summarised in Table 5.11 and Table 5.12.

Table 5.11 Changes in CR-BIS configuration of Company C from 1991 to 1996

Year / Sub-system	1991	1993	1994	1996
Data processing	Standardisation of data code. No formal proprietary data was shared with suppliers. Data updating is done at the end of a day. Orders were prepared by buyers and approved by shop managers (sometime need adjustment).	No significant changes.	DC was utilised to support store replenishment.	PKM was formulated and Semi-automatic ordering systems for both shops and DC were started.
Technical	Data transfer to shop database was done manually using floppy disks. POS application was the inventory management application in shop. Paper-based data communication (by fax) was conducted for external data communication with head office and suppliers respectively.	Data transfer to shop database was conducted through LAN.	No significant changes	Ordering Systems was developed as inventory management application with automatic ordering capability. This replaced POS application use.

Table 5.12 Changes in CR-BIS configuration of Company C from 1998 to 2003

Year / Sub-system	1998/1999	2001	2002	2003
Data processing	Shop and DC orders were fully automated (replacement of human factor). No changes in breadth and depth of data exchange with involved parties.	No significant changes	Use more real time sales and inventory data. Data capture frequency is increased (not only at the end of a day). Portable Data Terminal (PDT) was used to monitor real time inventory.	No significant changes
Technical	No significant changes	Web-based EDI was used for external data communication (using a value-added network of Indosatcom)	No significant changes in inventory management application and data communication mechanism	Oracle Database Systems was installed to support existing inventory management application.

Contingency factors that influenced the extent of data sharing with suppliers

The following factors are the reasons why the company did not share data with suppliers:

1. Data sensitivity

Sales and inventory data is sensitive for the company. Data on the store level is even more sensitive because it contains a lot of information on the company's operations. This information can be used as a source of strategic information. The managers said that it was still risky to share this data with suppliers because it might be leaked to competitors, which would hamper the company's position in the market.

2. Suppliers' trustworthiness

This is related with the first factor. The interviewees mentioned that suppliers' trustworthiness is still questionable in the sense that they will keep the data confidential. Another dimension of trustworthiness is suppliers' ability to deliver better performance. According to the logistics manager, suppliers were not reliable yet. One indicator, according to him, was suppliers' service level. The company have asked their suppliers to improve service level many times, but the realisation was considered slow. Because of this they do not believe that giving more data is a good decision for the company.

3. Quality of data

The above factors, especially the first, contrast with the fact (from observation in stores) that suppliers' sales representatives were able to collect sales record and product availability through rack jobbing action. Initially, this activity was intended to assist Company B in monitoring product availability, but was later found that this was utilised to take records of sales and product availability data and report these findings to suppliers' headquarter for analysis. The point is that data sensitivity might not be enough to explain the limitation in data sharing because what the sales people collected was also sensitive. This activity might be conducted on the products of suppliers' competitors, because those products are side-by-side. The shop manager realised this situation and stated that it was not a big problem for Company C because the activity was not done every day due to different suppliers' visit schedule as well as the fact that the data is not complete due to time limitation of the sales people in the store. The limitation is due to their main duty to do promotion in store. From this consideration, the shop manager argued that suppliers were unable to collect high quality data. It was concluded that quality of data also plays an important role in deciding accessibility. This factor needs to be mentioned with sensitivity of data to make the latter term more meaningful.

Data accuracy was not influential in determining the extent of data sharing with suppliers because data accuracy in the company is good. Data handling knowledge and IT infrastructure in suppliers' side were not big issues either. If the company required their suppliers to have a capable IT infrastructure and sufficient data handling knowledge then they might have to share their data with big suppliers like Procter & Gamble (P&G) and Unilever. It was stated by the managers that P&G was eager to obtain the company's data for better management of their products in the company's outlets, but the company did not give it to them because of sensitivity issues. Suppliers could not use their market power to ask for more data because Company C always asked them to demonstrate the value of sharing with them. The suppliers were not able to do that because they did not have reliable logistics infrastructures as will be described in the task assignment section. Legal systems and industry associations were not effective in encouraging the company to share more data with suppliers. Their argument is clear that suppliers should be able to prove that they will deliver better performance if Company C gives them more data.

Contingency factors that influenced tasks assignment

Inventory management is the responsibility of the company. Data sensitivity, suppliers' trustworthiness and suppliers' performance were the key factors that influenced the company in assigning inventory management tasks. The influences of data sensitivity and suppliers' trustworthiness are discussed in the data sharing section. In addition to these, the managers also mentioned suppliers' performance in fulfilling replenishment orders as a factor that postponed advanced implementation of CR. Looking at the service level of suppliers; they doubt that additional data would create a better situation. On the contrary, it might reduce their performance because data sharing will just increase their workload. This indicates that the interviewees feel the existing configuration is arguably superior to that of JMI or SMI at that moment, because suppliers do not have capable logistics infrastructure.

Despite those reasons, it was found that suppliers were involved in monitoring product availability in store. This is not however, JMI practice. To be considered as such, suppliers need to access the company's data, not only on the shelves but in the stock room as well as be involved in decision making for replenishment. Because of those limitations, the suppliers' involvement in product monitoring cannot be used as an indication of JMI practice.

Contingency factors that influenced technical solution selection

It was interesting to find that the company used floppy disks to distribute data in stores. This was done because of a lack of electronic communication. This mechanism was replaced by a LAN connection in 1993, mainly to improve efficiency and accuracy in data communication. Data communication with suppliers was improved in 2001 by

implementation of Internet EDI. The IT manager mentioned that selection of communication media was mainly based on the requirement for a fast, reliable, and open communication network. By using Internet EDI, the company expected to be able to communicate orders with more suppliers. The first aspect is related to functionality of the media, while the last is related to flexibility. Reliability is an independent factor.

Regarding business applications, the interviewees found the following factors to influential in selecting those applications:

1. Functionality

This characteristic explains the company's reason to develop a proprietary business application. They argued that a high level of functionality could be achieved if the applications were built in the organisation. This is also the reason why the company replaced their legacy database systems with Oracle since the old system could not handle large amounts of data.

2. Available knowledge

The managers said that available knowledge in the company plays an important role in business application development. As long as the intended applications can be realised by the available knowledge, then they would definitely execute the business application development process in-house.

3. Vendor support

This was another reason to select Oracle among available database applications in the market. Based on their evaluation, Oracle provides good support, not only in the implementation process but also after. User support is available from the Oracle technical support and learning centre in Jakarta.

4. Existing IT infrastructure

Current IT infrastructure in supplier companies was highly considered by the company. The IT manager mentioned that the company is trying to establish electronic data communication with all suppliers. The most logical choice at that moment was to adopt an Internet EDI system. The company expected this would enable compatible and reliable communication with their suppliers.

Market power and technical knowledge influences were not present in the technical solution selection in the company because they chose it to fill their internal requirements. The company was not influenced by external parties because they did not know the internal condition and requirements of Company C. Nevertheless, the company also considered their suppliers' IT infrastructure because they want to be able to do more business with suppliers in the future. Adoption rate was not that important for the company. They stated that functionality and flexibility are always the highest

priorities in selecting a technical solution. They also say that they would buy an application that meets their requirement even if it cost them a lot of money. Thus, cost is not an important factor in selecting technical solutions.

5.3.6 Cultural influence in Company C

The expected influences of high power distance and collectivist cultures as antecedent to data sensitivity and suppliers trustworthiness are found in this case. Data is considered highly sensitive because it contains sensitive information about the company's policies. The access of suppliers' representative to data in store is limited to informal data that is considerably less complete than formal data so that there is no chance for them to extract the company's strategic information. The limitation also indicates low trust to suppliers. High data sensitivity and low suppliers trustworthiness are an indication of high power distance and collectivist culture influences as antecedent to those contingency factors respectively.

The actual research findings of important contingency factors in data, task, and technical aspects partly confirm the expected moderation effect of high power distance and collectivist cultures (see Table 5.13, 5.14 and 5.15 below).

Table 5.13 Expected moderation effect and case study findings of contingency factors influencing data aspect of CR-BIS configuration in Company C

Expected moderation effect based on theory	Case study findings
Data sensitivity, suppliers trustworthiness, industry bodies, legal systems, and relative market power	Data sensitivity and suppliers trustworthiness

Table 5.14 Expected moderation effect and case study findings of contingency factors influencing tasks aspect of CR-BIS configuration in Company C

Expected moderation effect based on theory	Case study findings
Data sensitivity, suppliers trustworthiness, industry bodies, legal systems, and relative market power	Data sensitivity, suppliers trustworthiness, and prior or existing process configuration

Table 5.15 Expected moderation effect and case study findings of contingency factors influencing technical aspect of CR-BIS configuration in Company C

Expected moderation effect based on theory	Case study findings
Inherent characteristics of technology (i.e. functionality, flexibility, adoption rate, security, vendor support, and costs) and at least one other factor in technical selection	Functionality, flexibility and vendor support of technical solutions, retailer IT infrastructure capability, retailer technical knowledge, and supplier IT infrastructure flexibility

Although the expected moderation effects in data and technical aspects are supported by case study findings of each aspect the expected effect in task aspect does not.match the actual research finding. Prior or existing process configuration is considered important in this case when determining task assignment between the company and their suppliers. The existing configuration was considered more valuable than the JMI or SMI alternatives at that time.

Because of this deviation the influences of high power distance and collectivist cultures cannot be determined in this case. There is no strong evidence that can be used to explain why the expected moderation effects are not found in this case.

5.3.7 Summary

Company C was practising RMI at the time of the case study. The approach they applied in developing the systems capability to support CR practice was balanced. The company managed to give equal attention to maintaining data accuracy and developing technical capabilities. In order to get closer to suppliers and increase trust, the company was planning to implement CM with selected suppliers. These will be major suppliers considered to have sufficient resources for CM partnership. The company expected to use this partnership to examine their suppliers' capability and trustworthiness in handling the data. Change in CR practice would be determined from the outcomes of this cooperation. Although it was not mentioned explicitly, it is argued that JMI would be practiced with those suppliers because it will provide an opportunity for the company to learn their suppliers' capability and reduce implementation risks to some extent.

The company needs to improve the functionality of their business application to identify exceptions in the actual operations and accommodate these in the running replenishment process. The objective is to be able to react quickly to significant changes in operations. Despite this limitation, the company was able to improve the expandability and openness of their system by the adoption of Oracle and web-based communication.

Contingency factors proposed to influence CR-BIS configuration were tested in the company. The influences are summarised in Table 5.16. Data quality was a new factor mentioned by the interviewees. Since the quality of data is related with its sensitivity, this influence will be represented by data sensitivity.

There is a foundation to confirm the expected antecedent effects of high power distance and collectivist cultures in this case. However, there is no strong evidence that high power distance and collectivist cultures moderate the influence of contingency factors on CR-BIS configuration. Because of this inconsistent result the extent of cultural influence in this case cannot be determined using the measurements performed.

Table 5.16 Contingency factors' influences in Company C

Contingency factors	Extent of data sharing	Tasks assignment	Technical solution selection
Retailer characteristics			
Data characteristics			
Strategic sensitivity of data	√	√	
Data accuracy			
Task characteristics			
Strategic fit			
Knowledge specificity			
Time specificity			
Other retailer characteristics			
Prior or existing process configuration		√	
Data-handling knowledge			
IT infrastructure capability			√
Relative market power			
Technical knowledge			√
Supplier characteristics			
Trustworthiness	√	√	
IT infrastructure capability			
IT infrastructure flexibility			√
Technical knowledge			
Data-handling knowledge			
Industry characteristics			
IT solutions and IT vendor characteristics			
Functionality			√
Flexibility			√
Adoption rate			
Vendor support			√
Security			
Cost			
Other industry characteristics			
Legal systems			
Independent influential industry bodies			
ASP capability in retail mgt.			

5.4 CR implementation progress in two Dutch retailers

Two Dutch retailers are compared with the Indonesian case studies. The two companies were selected upon the application of the CR principle in the companies. CR implementation progress in both companies is reported, but not as detailed as the Indonesian cases. Details of networking diagrams and activities in inventory management are presented when available. Although the information is not as rich as the Indonesian case study, the findings are valuable for a national level comparison.

5.4.1 Methodological information

This methodological information is for both cases. Information was collected through interviews with ECR Nederland, consultants, and scholars who did research on ECR implementation in The Netherlands, as well as a literature study on ECR Nederland's publications, industry reports and dissertations on ECR implementation. In the second case, the researcher interviewed the logistics and IT directors of the company.

5.4.2 CR implementation progress in Company D

Company D is a major Dutch food retailer, which was founded in 1887 and had 670 stores in The Netherlands in 2003. They were managing 18,000 SKUs during that time. They are the national market leader in the food grocery sector. Revenue was $ 4.7 billion in 2001, which counted for about 35% of the total market share of the country.

Stores are supplied from four Regional Distribution Centres (RDCs). The RDCs supply fast moving grocery and non-food items to stores. In addition, the company has a National Fresh Centre (NFC) and a National Distribution Centre (NDC) that supply fresh produce like fruits and vegetables and slow moving items.

This is a new distribution scheme. Before, they had 15 distribution points to supply different product categories to stores. In addition, the company allowed suppliers to deliver products directly to stores. This created inefficiency in the product replenishment process. To improve efficiency, the company redesigned the distribution infrastructure to only three distribution points as described above.

CR implementation progress in this company can be divided into two periods: before and after 1995. The details of each period are presented below.

Pre-1995 CR application

Stores were supplied from 15 distribution points. Although the systems were not efficient, the company had applied the CR principle. The CR practice is RMI; all inventory management tasks were done by the company. The replenishment process had been automated. Data from POS terminals were transmitted to internal computing systems periodically, and monitored to identify out-of-stock items. The company used a proprietary business application for this activity. Store orders were sent twice a week to

the distribution points and suppliers who delivered the products directly to the stores. The connection with suppliers for order communication is illustrated in Figure 5.38. Data communication was conducted by an Electronic Data Interchange (EDI) connection as illustrated in Figure 5.39. They did not share any proprietary data with suppliers during this period.

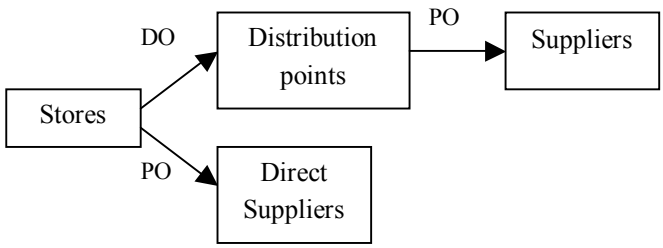


Figure 5.38 Information flow before 1995

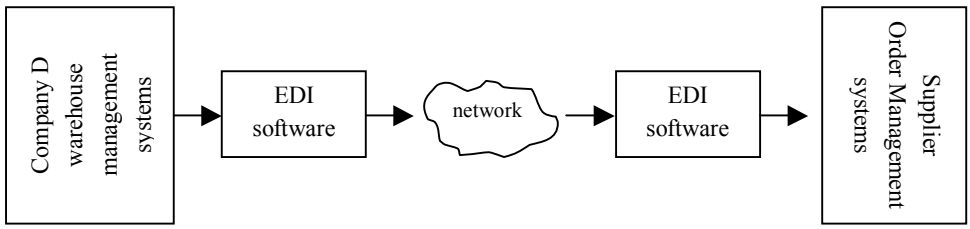


Figure 5.39 Order EDI communication between Company D and their suppliers

Post-1995 CR application

The distribution structure was redesigned to improve operational efficiency. The 15 distribution points were replaced by RDCs, the NFC, and the NDC. Products are categorised into three streams: food, non-food and fresh produce. Within food and non-food there are three categories: fast-moving, slow-moving and premium products. Fast-moving and premium products are supplied from RDCs. Slow moving products are supplied from the NDC and fresh produce are supplied from the NFC.

After the redesign process, the company formulated a specific policy for replenishing stores every day. Stores will receive orders within 18 hours after they are released. To support this program, the company implemented advanced IT to capture actual consumer demand and to analyse changes in consumer behaviour. This will be used to adjust their inventory plan and is applied for fast-moving and premium products. A consequence of this program was that suppliers became responsible for inventory management in RDCs. To support their activity, the company shares the information on inventory levels in the RDCs and shop orders with those suppliers. This enables suppliers to improve their response to the company's requirement.

Even though it was targeted to all suppliers of fast-moving items, it was reported that only 40% of those suppliers joined the program. The rest were still improving their internal capabilities to adopt the program. Thus, after the implementation of the program, the company is practising two types of CR practice: SMI and RMI.

A diagram in Figure 5.40 illustrates the arrangement of SMI in the company. Shops use an Automated Store Ordering (ASO) application that generates shop orders automatically. Shop orders are sent to RDCs and those orders and the RDCs inventory level are sent to suppliers. Based on this information, suppliers formulate an optimal replenishment order for the RDCs. An Advanced Shipping Notice (ASN) is sent by suppliers to make a delivery schedule. To increase delivery efficiency, the company is practicing Efficient Load Unit concept with suppliers. The previous EDI network was still used in this new configuration (see Figure 5.39 for this connection). The company evaluates their suppliers' performance in this program. Suppliers that fail to contribute to the company's overall effectiveness will be excluded from the program.

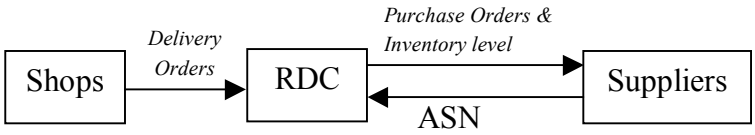


Figure 5.40 SMI application in Company D

Analysis of the progress of CR implementation in Company D

Critical incidents in Company D are summarised in Figure 5.41. Company D had been practising RMI before they decided to apply SMI with selected suppliers in 1995. However, it was not known when they began RMI. SMI was initiated around the same time of ECR Nederland establishment. The implementation was targeted for high-volume, premium and perishable products. Around 0,4 % of suppliers for those product categories have adopted this system. Besides implementing SMI, the company was also practising CM at that time. It was reported that those concepts were applied at the same time and had delivered significant outcomes.

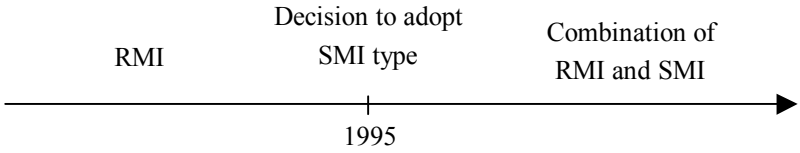


Figure 5.41 Change in CR practice in Company

It was interesting to see how the company was able to implement those concepts simultaneously, in spite of their complexity as stated in the literature. Interviews were conducted with ECR Nederland and industry experts in The Netherlands; it was realized that the company's strong market position was the main enabler of this situation. The company was so strong that no supplier would neglect their request to adopt SMI. The company also had the infrastructure to apply those concepts.

It was surprising to find out that the company decided to limit SMI application to the RDC level. It would be understandable to limit the application to fast moving or premium items, but their reason to limit SMI to the RDC level is somewhat unreasonable knowing their strong market power. They could use this to ask suppliers to manage inventory in their outlets and gain bigger advantages than just adopting the systems on the DC level.

It was known from expert interviews and secondary data that the company was worried that data sharing on the store level would enable their suppliers to enter their market. The data is the source for information on market, consumer behaviour, product behaviour and other important information that build viable market knowledge. Possession of this knowledge would enable suppliers to enter the company's market and hamper the company's position. In order to keep the chain dominance, the company decided not to extend SMI practice to store level.

This argument indicates that market power is effective if it is used to encourage suppliers to adopt SMI at a DC level, but will be deteriorated if it is used to endorse SMI practice at store level since suppliers might be able to build market knowledge to enter the company's market.

The company used a balanced approach in improving CR implementation quality. It is not only applied for making balanced development in the four sub-systems, but also for balanced development between internal system improvements and enhancement of market position so SMI application on the DC level would be effective.

The company's plan regarding CR advancement is illustrated in Figure 5.42. Their plan was to enhance SMI practice on the DC level, specifically to improve logistical efficiency in this practice.

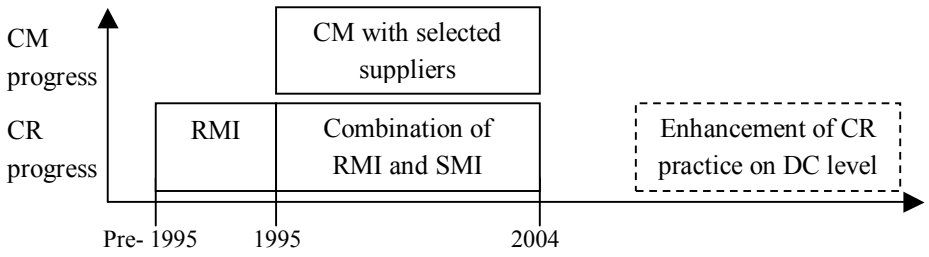


Figure 5.42 CR implementation status in Company D

Contingency factors analysis in Company D

Critical events have changed CR-BIS configuration in Company D and are summarised in Table 5.8. The company now have a combination of RMI and VMI for their inventory management. SMI is practised on the DC level for selected products. SMI suppliers are responsible for maintaining product availability in the DC. They need to react quickly if stock levels are low. To support their function, Company D shares stock levels of their DCs and store orders with those suppliers. They do not share any data with other suppliers. The company use a packaged application for their inventory management. They use a third party EDI connection to communicate inventory-related data and purchase orders with suppliers. The factors that influence them in selecting a CR-BIS configuration are described in the next sub-section.

Table 5.17 Changes in CR-BIS configuration of Company D

Year / Sub-system	Pre 1995	Post 1995
Data processing	Actual sales and inventory data was used as the basis for inventory replenishment. No proprietary data was shared with suppliers. Inventory management at all levels were done by Company D. Shop orders were generated automatically.	Shop orders and inventory level in RDC were informed to selected suppliers for SMI practice with those suppliers. The rests are still managed with RMI style.
Technical	A private network was used for data communication between shops and DCs. Third party EDI network (a value -added network) was used to communicate orders with suppliers. Proprietary business application was used for inventory management	Improvement of data analysis within the inventory management application

Contingency factors that influenced the extent of data sharing with suppliers

Data sharing is limited to the DC level because data on store level is sensitive because it contains the company's strategy and information on market, consumer and product behaviour of the company. The company mention that sharing this data could potentially lessen the company's bargaining position. Suppliers will be able to build market knowledge based on the data. For big suppliers this can be used to enter the company's market and take the company's market share. If this happens, the company would lose their bargaining position. This concern indicates that the company did not believe that their suppliers' have goodwill to not use the data in a way that may hamper the company's position. Both data sensitivity and suppliers' trustworthiness influence the extent of data sharing between the company and their suppliers.

Contingency factors that influenced tasks assignment

Moving from RMI to SMI is a risky decision. Normally companies adopt JMI type before practising SMI. This is done to learn the effects of involving suppliers in inventory management activities and minimise any negative consequences. Despite this, the company decision was considered successful. The company was able to improve suppliers' service levels and generate savings from this practice. Based on the information from ECR Nederland and industry experts in The Netherlands, this is due to the company's bargaining power. The company hold a significant position in the market. They captured 35% of the total market and this is effective enough to encourage suppliers to adopt SMI practice.

However, the practice is limited to inventory management in RDC. Two factors explain this decision: sensitivity of store-level data and strategic fit of inventory management tasks in store level in achieving chain dominance. The sensitivity influence is explained above in discussing data sharing relationships with suppliers. Inventory management tasks on the store level are strategic for the company because the performance of those tasks determines consumer satisfaction that will eventually influence the company's competitiveness in the market.

Contingency factors that influenced technical solution selection

The company used a third party network for data communication with suppliers. The main reason was the cost to maintain a network. By outsourcing, the company was able to eliminate the cost of maintaining and developing the network. There was no significant information on business application for inventory management in the company. It was stated by ECR Nederland that the main concern of the company in selecting business applications for inventory management was functionality.

Cultural influence in Company D

The case study findings provide no support to the expected antecedent effect of low power distance and individualist cultures on data sensitivity and suppliers trustworthiness. Data is considered highly sensitive and suppliers trustworthiness is considered low. This is reflected from the company's reason that store data is highly sensitive to outside parties and that they cannot trust their suppliers to handle the data. This situation is not the expected antecedent effect of low power distance and individualist cultures as described in section 3.5. Based on the theory in that section low power distance and individualist culture are proposed to lower data sensitivity and to increase suppliers trustworthiness.

The case study findings are not consistent with the expected moderation effects of low power distance and individualist cultures in data and task aspect. In data aspect,

data sensitivity and suppliers trustworthiness are considered more important than data accuracy, data handling knowledge, and IT infrastructure capability (see Table 5.18).

Table 5.18 Expected outcomes and case study findings of contingency factors influencing data aspect of CR-BIS configuration in Company D

Expected outcomes of moderation effect	Case study findings
Data accuracy, data handling knowledge, and IT infrastructure capability	Data sensitivity and suppliers trustworthiness

In task aspect, data sensitivity, suppliers trustworthiness, and relative market power are found to be important contingency factors in task assignment between the company and their suppliers (see Table 5.19). The company was able to encourage their suppliers to take responsibility of inventory management in warehouse using their market power. However, the market power might be reduced if they share store data because suppliers might be able to develop their knowledge about consumer market and decide to conduct business directly with consumers if they get this data. Data sensitivity, suppliers trustworthiness and relative market power are not expected to appear in low power distance and individualist cultures. Instead, it was expected to find evidence of strategic fit of task, knowledge and time specificity of task, prior or existing process configuration, data handling knowledge, IT infrastructure capability and flexibility, and ASP capability in this aspect as described in section 3.5.

Table 5.19 Expected moderation effect and case study findings of contingency factors influencing tasks aspect of CR-BIS configuration in Company D

Expected moderation effect based on theory	Case study findings
Strategic fit of task, knowledge and time specificity of task, prior or existing process configuration, data handling knowledge, IT infrastructure capability and flexibility, and ASP capability	Data sensitivity, suppliers trustworthiness, and relative market power

The expected moderation effect of low power distance and individualist cultures on contingency factors' influence in technical aspect is found in this case. As expected, technical solutions characteristics are more important than other contingency factors in selecting technical solutions to be used in CR-BIS (see Table 5.20).

Table 5.20 Expected moderation effect and case study findings of contingency factors influencing technical aspect of CR-BIS configuration in Company D

Expected moderation effect based on theory	Case study findings
Inherent characteristics of technology (i.e. functionality, flexibility, adoption rate, security, vendor support, and costs)	Functionality and cost of technical solutions

Although the expected moderation effect in technical solution is found the overall findings give no indication about the extent of cultural influence in this case. Due to this, it cannot be determined based on the measurements done that low power distance and individualist culture has influence on the CR-BIS configuration in this case.

The deviation from the expected moderation effects is caused by interference of other culture within the company. The company's strong position in the market had created high power distance culture that compensates the influence of low power distance in the company. The source of collectivist culture could not be identified in this case. Accordingly, the deviation could not be explained from individualism dimension.

Summary

The company practiced both RMI and SMI in their inventory management activity. The company prepared their logistics and IT infrastructure for SMI implementation. On the logistics side they combined different distribution points into three kinds of distribution centers. On the technology side, they adopted advanced technology for data capture and analysis to keep up to date with changing consumer demands. They also improved the ordering and data communication technologies for better response times. It is predicted that the combination of RMI and SMI would be the same in the future if the company is still reluctant to share store data with suppliers.

RMI and SMI practices are designated for different product categories. SMI is designed for high-volume, fast-moving and/or premium products. The company was able to realise SMI practice because they had strong position in the market that encouraged suppliers to adopt SMI practice. It is limited however, to the DC level because store data is sensitive. This indicates that market power is effective to some extent only. When it is applied in a situation that may reduce it, the effectiveness of market power would be less. The assessment of contingency factors is provided in Table 5.21.

The extent of low power distance and individualist cultures influences cannot be determined in this case as their expected antecedent and moderation effects are not consistent with the case study findings.

Table 5.21 Contingency factors' influences in Company D

Contingency factors	Extent of data sharing	Tasks assignment	Technical solution selection
Retailer characteristics			
Data characteristics			
Strategic sensitivity of data	√	√	
Data accuracy			
Task characteristics			
Strategic fit			
Knowledge specificity			
Time specificity			
Other retailer characteristics			
Prior or existing process configuration			
Data-handling knowledge			
IT infrastructure capability			
Relative market power		√	
Technical knowledge			
Supplier characteristics			
Trustworthiness	√	√	
IT infrastructure capability			
IT infrastructure flexibility			
Technical knowledge			
Data-handling knowledge			
Industry characteristics			
IT solutions and IT vendor characteristics			
Functionality			√
Flexibility			
Adoption rate			
Vendor support			
Security			
Cost			√
Other industry characteristics			
Legal systems			
Independent influential industry bodies			
ASP capability in retail mgt.			

5.4.3 CR implementation progress in Company E

Company E is a retail support company that started from a small shop in 1888. The first supermarket was operated in 1953. They took over some retail companies and developed a retail formula that became one of the biggest and fastest expanding supermarket chains in The Netherlands. At the time of the study, the company was operating 500 supermarkets and managing around 12,000 SKUs. The supermarkets are served by eight DCs. Five of the DCs are fully utilised and the rest function as back-ups. The retail formula is now franchised to individuals. The company provides the following support for the operation of the retail formula:

- Distribution centre and product delivery
- Promotion
- Wage administration
- Financing of store renovation
- Personnel policy
- Store automation

In their 2002 report, it was stated that Company E had a market share of 15.1 %, 512 supermarkets, 2,000 employees, and generated € 3.5 million revenue during 2001.

The company is considered to have implemented CR principle before 1991 since data from POS terminals was passed to the back office for inventory replenishment. After 1991, there are at least three critical incidents that influenced CR practice in the company.

First Electronic Data Interchange connection with suppliers (1991)

This replaced the paper-based work that had been in place for several years. The EDI connection enabled the company to send order information to suppliers quickly without the need to reformat the data.

In this period all inventory management was carried out by the company. Inventory replenishment decision was centralised in the Head Office. The flow is illustrated in Figure 5.43.

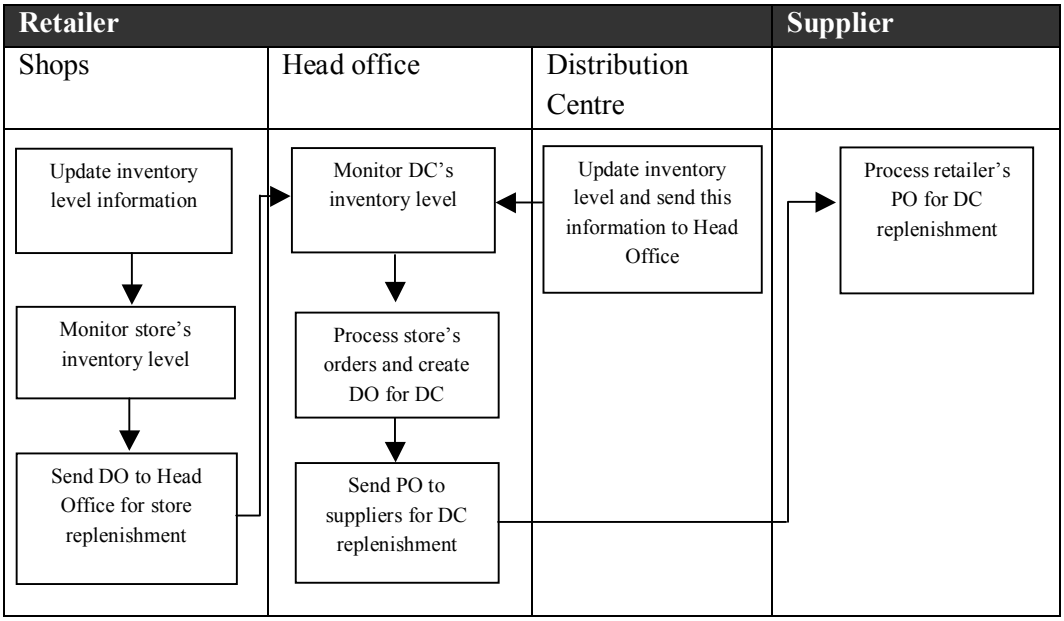


Figure 5.43 Task assignments in 1991

To support inventory management activities, the company used three different applications. In Store Systems was the application for shops' inventory management. A warehouse management application was used for inventory management in DCs. Orders were managed by the Head Office using an order management application developed by a French IT vendor.

Supplier-Managed Inventory (1995)

The company was involved in the CR project of ECR Nederland and developed SMI projects with some suppliers. The SMI was carried out in shops and the DC level. Inventory status in shops and DCs were sent to suppliers. The projects were assessed periodically using predefined performance metrics. Task assignment in this period is illustrated in Figure 5.44.

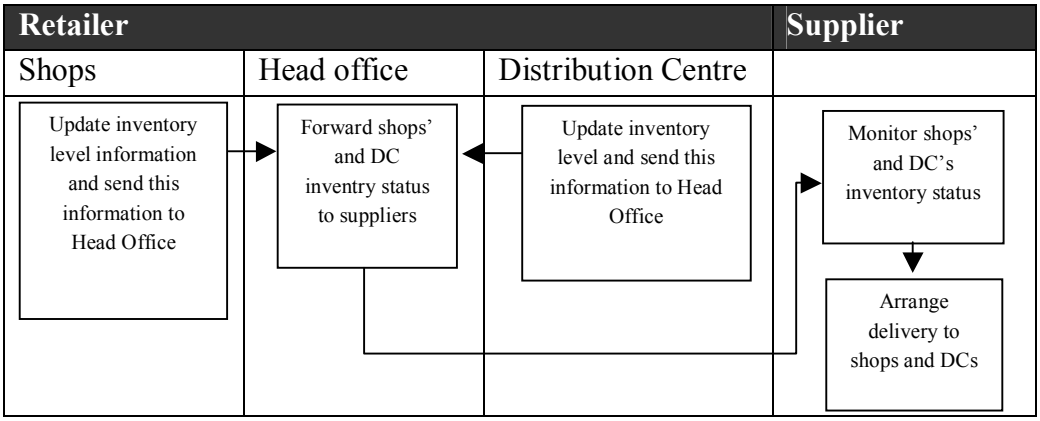


Figure 5.44 Tasks assignment for SMI implementation in Company E

SMI cancelled (1995)
The evaluation returned negative results. The SMI project did not give a significant advantage to the company. The project was ended after four months. The company is now implementing RMI as practised in 1991 and they are now focused on improving internal performance. A new store ordering system, Orion, was on trial during the study. The order management systems in the Head Office would be replaced by another application called Armature. The new application is said to have better functionalities.

Analysis of the progress of CR implementation in Company E
CR practice in Company E has changed twice. This is summarised in Figure 5.45.

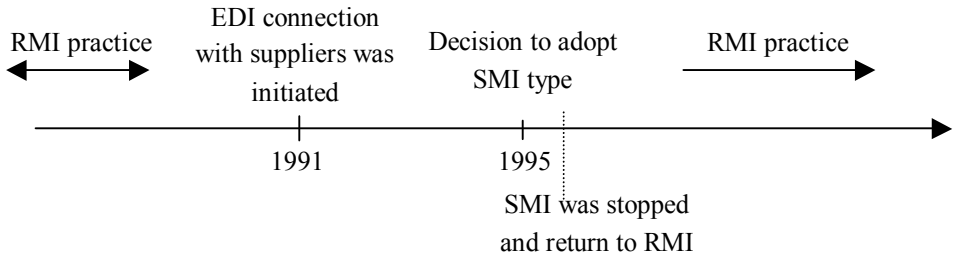


Figure 5.45 Changes in CR practice in Company E

First, they changed RMI to SMI practice in 1995 and then changed it back to RMI after practising SMI for four months. The company's failure to get benefits from SMI practice was due to their inability to push suppliers to deliver what they expected. Suppliers were not motivated to improve their performance because they were focused on another company who was practising SMI at the same time. This company was the market leader and had a strong market power. Using their power, the company was able to encourage suppliers to take the responsibility in managing their inventory at the DC

level. Because suppliers devoted their resources to this market leader they could not give benefits to Company E. The logistics manager of Company E said there was no significant improvement on service level and inventory turn during the implementation of SMI. Because of this they decided not to continue SMI practice with any suppliers. They will keep practising RMI in the future as seen in Figure 5.45.

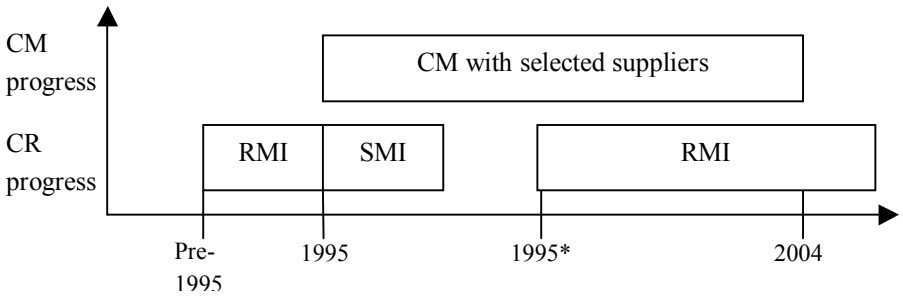


Figure 5.46 Company E's plan regarding CR advancement

The failure of Company E in getting benefits from advanced CR practice was not because of incapable internal infrastructure, but their mistake in evaluating the development in the market. If they were patient enough to wait until suppliers were settled with the new SMI practice with the market leader, then they could have gained the benefits they expected. The managing director of ECR Nederland states that future initiative to practice SMI would not come from retailers but suppliers, because suppliers want to optimise the utilisation of their infrastructure that was prepared to practice SMI with one retailer. Suppliers would ask retailers to join an SMI program to increase the utilisation of the infrastructure.

Contingency factors analysis in Company E

CR-BIS configuration in the company has been changed twice. In 1995 it was drastically changed from RMI to SMI on DC and store levels. The failure to get the expected results turned the company back to RMI practice four months after SMI. Since then, they do not share data with suppliers for CR practice. All inventory management tasks are performed by the company. Nevertheless, the company still maintain CM practice with suppliers. According to them, this cooperation is considered successful. The changes in the CR-BIS configuration are listed in Table 5.22. Influential factors are described in the next sub-sections.

Table 5.22 Changes in CR-BIS configuration of Company E

Year / Sub-system	1991	1995	1995 (4 months after the second period)
Data processing	Actual sales and inventory data was used as the basis for inventory replenishment. No proprietary data was shared with suppliers. Inventory management at all levels was done by Company E. Shop orders were generated automatically by In Store Systems. Decision-making for inventory replenishment order was centralised in Head Office.	Company E performed SMI with select suppliers. They delegated inventory monitoring and ordering decisions to those suppliers. Shops' and DC's inventory status were sent to suppliers. The company responsibility was to update the inventory status and forward this information to those suppliers.	No proprietary data was shared with suppliers because SMI was stopped. The company practice RMI again.
Technical	A private network used for data communication between shops, DCs and the Head Office. Third party EDI network (a value-added network) used to communicate orders with suppliers. In Store Systems was the inventory management application in shop. Order Management Systems was the business application in Head Office to manage shops' and DCs' orders. Warehouse Management Systems was used to manage inventory in DC. Those were outsourced.	No significant changes	No significant changes

Contingency factors that influenced the extent of data sharing with suppliers

Limitation in data sharing is related to a bad experience in 1995 when the company failed to get good results from SMI projects. In this regard, it can be said that the company was better off with the prior business configuration (RMI) than with SMI. Hence, prior business configuration is an influencing factor in this sub-system.

Contingency factors that influenced task assignments

The company experienced SMI in 1995, but ended in failure. Because of this, they decided not to share any proprietary data with suppliers or involve them in the inventory management process. The existing configuration was considered optimal and they decided to keep practising RMI.

The failure was related to the fact that the company applied SMI at the same time as the market leader. In this situation suppliers had to choose because of their limited resources. They eventually decided to give more attention to the requirements of the other company. Company E received insufficient support and the SMI project was a

disappointment. From this argument it may be concluded that market power was significant in determining the success of advanced CR application.

Contingency factors that influenced technical solution selection
The company outsourced all of their business applications for inventory management in store and DC; the IT manager explained that this policy was made because of their focus on business process improvement, not on the technical side. He said that it was not the core capability of the company. From his explanation it can be concluded that technical knowledge in the company was one of the factors that influenced the company's policy to outsource the applications. In addition to this, he stated that by outsourcing, the company was able to reduce software development costs.

In selecting the technical solution from the market, the company used functionality as the main consideration. The selected applications fit the business process requirement of the company at that time. Vendor support was also important. The IT manager stated that a vendor with good support was the most preferred although its application was not widely used in the industry. Reliability, technical support, and security were the main reasons in using the third party EDI service. With improved security technology of the Internet however, it would be possible this new technology to replace the old one for inventory replenishment process.

Cultural influence in Company E
The expected influences of low power distance and individualist cultures as antecedent to data sensitivity and suppliers trustworthiness are found in this case. Data is not considered highly sensitive and suppliers are considered trustworthy in this case.

The moderation effects of culture cannot be determined in this case as research findings do not fit the expected moderation effects based on the theory in section 3.5. Within data aspect, prior or existing process configuration was found to be the only important contingency factors determining the extent of data sharing with suppliers as described above (see Table 5.23). As described in section 3.5, this is not the expected contingency factor in data aspect in low power distance and individualist culture.

Table 5.23 Expected moderation effect and case study findings of contingency factors influencing data aspect of CR-BIS configuration in Company E

Expected moderation effect based on theory	Case study findings
Data accuracy, data handling knowledge, and IT infrastructure capability	Prior or existing process configuration

In task aspect, prior or existing process configuration and relative market power were found to be important contingency factors determining tasks assignment between the company and their suppliers. The company failed to realise an effective SMI

practice because they did not have strong market power at that time that can be used to secure suppliers commitment. Although the presence of prior or existing process configuration was expected to appear in low power distance and individualist cultures the presence of relative market power was not expected.

Table 5.24 Expected moderation effect and case study findings of contingency factors influencing tasks aspect of CR-BIS configuration in Company E

Expected moderation effect based on theory	Case study findings
Strategic fit of task, knowledge and time specificity of task, prior or existing process configuration, data handling knowledge, IT infrastructure capability and flexibility, and ASP capability	Prior or existing process configuration and relative market power

Deviation from the expected moderation effect of individualist culture in this case is also seen in technical aspect. Retailer technical knowledge was found to be an important contingency factor beside the technical solution characteristics in determining technical solutions to be used in CR implementation (see Table 5.25). It is because the company did not have appropriate knowledge to maintain the development of data communication infrastructure and decided to outsource this to an external party. The presence of contingency factors other than the inherent characteristics of technical solutions is not expected in low power distance and individualist culture as explained in section 3.5.

Table 5.25 Expected moderation effect and case study findings of contingency factors influencing technical aspect of CR-BIS configuration in Company E

Expected moderation effect based on theory	Case study findings
Inherent characteristics of technology (i.e. functionality, flexibility, adoption rate, security, vendor support, and costs)	Functionality, vendor support, security and cost of technical solutions, and retailer technical knowledge

Those deviations indicate that low power distance and individualist culture do not have an obvious influence on contingency factors and their influences on CR-BIS configuration within the company. This situation is caused by influence of other culture in the company. The company's involvement in a cooperative purchasing union in The Netherlands had created collectivist culture in the company that reduces the effect of individualist culture. The source of high power distance culture could not be identified. Accordingly, the deviation could not be explained from power distance dimension.

Summary

The current status of CR practice in Company E is RMI. They experienced SMI in the past, but considered RMI better than SMI. The main factor of this failure was insufficient support from suppliers. After that time, the company decided not to share data with suppliers. Factors that influence CR-BIS configuration in Company E are listed in Table 5.26. Regarding cultural influence it is stated that there is evidence to support the expected antecedent effects of culture on data sensitivity and suppliers' trustworthiness in this case. The extent of moderation effects of culture on relationship between contingency factors and CR-BIS configuration in this case cannot be determined using the available method. Research findings are not consistent with the expected moderation effects based on theory. Because of this, the extent of cultural influence on contingency factors and their influence on CR-BIS configuration in this case cannot be determined.

Table 5.26 Contingency factors' influences in Company E

Contingency factors	Extent of data sharing	Tasks assignment	Technical solution selection
Retailer characteristics			
Data characteristics			
Strategic sensitivity of data			
Data accuracy			
Task characteristics			
Strategic fit			
Knowledge specificity			
Time specificity			
Other retailer characteristics			
Prior or existing process configuration	√	√	
Data-handling knowledge			
IT infrastructure capability			
Relative market power		√	
Technical knowledge			√
Supplier characteristics			
Trustworthiness			
IT infrastructure capability			
IT infrastructure flexibility			
Technical knowledge			
Data-handling knowledge			

Table 5.26 Contingency factors' influences in Company E (*Cont.*)

Contingency factors	Extent of data sharing	Tasks assignment	Technical solution selection
Industry characteristics			
IT solutions and IT vendor characteristics			
Functionality			√
Flexibility			
Adoption rate			
Vendor support			√
Security			√
Cost			√
Other industry characteristics			
Legal systems			
Independent influential industry bodies			
ASP capability in retail mgt.			

CHAPTER 6 CROSS-CASE ANALYSIS

6.1 Introduction

The cross-case analysis is divided into three parts. The first part is a cross-case analysis of CR implementation status, approach and quality. A table that contains general information of case companies, CR implementation status and approach for improving CR implementation quality within the companies is used in this part. The second part is analysis of CR-BIS configuration within case companies along with important contingency factors within case companies. Detailed information about CR-BIS configuration and contingency factors within each aspect of CR-BIS will be presented in a table. The third part is analysis of culture influences within case companies. A table presenting the investigation outcomes of antecedent and moderation effects of culture within case companies will be presented in this part.

6.2 Analysis of CR implementation status, approach and quality

General information of the case companies, CR practice and CR implementation approaches within the case companies are presented in Table 6.1 for cross-case analysis of CR implementation status, approach and quality.

Table 6.1 General information of and CR practice within the companies

Dimensions	Company A	Company B	Company C	Company D	Company E
General information					
Year of establishment	1995	1988	1990	1887	1888
Retail type	Supermarket chain	Mini market chain	Supermarket chain	Supermarket chain	Supermarket chain
Number of outlets	54	800	35	700	500
Number of SKUs	Around 11000	Around 3300	Around 10000	Around 18000	Around 12000
Scope of operation	National	National	National	Multinational	National

Table 6.1 General information of and CR practice within the companies (*Cont.*)

Dimensions	Company A	Company B	Company C	Company D	Company E
CR practice					
Year of ECR membership	2000	2001	2001	1995	1995
First time CR application	1998 on store level, stopped in the end of 2003 & restarted in 2004	1990 on DC level	1998	Before 1995	1991
Type of CR practice	RMI	RMI	RMI	RMI and SMI after 1995	RMI (SMI failed in 1995)
Strategy for improving CR quality	Technology initiated, more leap frog strategy	Technology initiated based on store and DC requirements	Balanced focus on data, process and technology. Development is done gradually.	Able to balance internal and external capabilities	Cannot balanced internal and external development

Status of CR implementation

RMI is the dominant status among case companies. Only Company D practiced SMI with suppliers. Since those companies were picked from the top list in their countries, this indicates that advanced CR practice is not yet popular among retail companies in the two countries.

Number of stores explains necessity for SMI

Dutch retailers perceived that SMI on a DC level was important because this would enable them to concentrate on managing store operations. ECR Nederland states that inventory management tasks on the store level are strategic for Dutch retailers because they determine consumer loyalty to the companies. Because of this, and the consideration that managing a large number of stores requires attention and resources, the company decided to delegate inventory management tasks on the DC level to suppliers. This was not a strong motivation for Indonesian companies because the number of outlets is relatively smaller. In the case of Company B, although the number of stores is big the operation is rather simpler because of smaller size of stores and accordingly the number of SKUs to be managed by the company in each store.

Strategic fit of store's inventory management and SMI practice

Excellence in store operations was declared a key determinant in the companies' efforts to improve consumer loyalty. One important aspect in operations is inventory management. Studies show consumers change stores when they cannot find the products that they want. A good inventory management practice is required to avoid out-of-stock problems. Thus, the activity is strategic for the companies. They could not delegate this task to suppliers because they did not have sufficient knowledge to manage inventory on the store level. This was found in Company D and indicated by the three companies in Indonesia; especially Company B.

Conclusion 1:
RMI is the most dominant status among case companies. The need to focus on store operations explains the requirement to adopt and limit SMI practice with suppliers to the DC level.

Technology–driven process innovation vs. mutual adaptation

It was intriguing to find that Company A was able to keep pace with Company C in CR implementation. Company A was established 5 years after Company C, but both implemented CR in 1998. Company A was able to catch Company C because they adopted a powerful data processing application and brought innovation to the replenishment process by implementing this application. Their technology-driven approach has arguably brought them to the same level as Company C. Analysis showed that the technology-driven approach followed by Company A was related with the company's history. The company did not follow any specific strategy before they were acquired by a major IT vendor in Indonesia. This company bought more than 50% of the shares of Company A. After the acquisition, the company aggressively invested in technology to fill the gap between them and the market leader. The POS application, Retek application, and the Oracle database were adopted by the company after the acquisition. The objective was to take the market leadership through technology excellence. This approach was necessary because the market leader had practised automatic replenishment and Electronic Data Interchange (EDI) with their suppliers. They expected that their technology approach would bring them to the same position as the market leader, reduce operation costs, and make the company more competitive.

Meanwhile, Company C achieved the same position step-by-step. They improved the capability of their application but did not depend on technology to bring them to that position. They also made adjustments in other aspects, especially data accuracy. The technology role is an enabler in Company C, and a driver in Company A. As an enabler, technology only provides the capability that will be used when the entire system is ready, but as a driver technology pulls the entire system to a certain position with the

expectation that the system will adapt later. Their technology-driven process innovation has quickly brought Company A to the same level as Company C in CR implementation.

Effectiveness of mutual adaptation vs. technology-driven approach

It is interesting to compare the effectiveness of mutual adaptation vs. technology-driven approach in implementation of CR practice. Effectiveness was measured by the stability of the CR principle in the company. An indication of stability is the absence of significant problems in implementation. The fact shows that the technology-driven approach was not effective because it was proven that the company was not able to maintain stability in implementation. The systems had to be reviewed after data inaccuracy was found.

The mutual-adaptation approach of Company C is more effective if stability is the main concern. A mutual-adaptation approach maintains a balance between data accuracy maintenance and technical capability improvement efforts. Company C managed to achieve this; the process toward automation was done gradually to ensure that the company had sufficient infrastructure to support the process execution. The study did not find any problem that could stop the systems from working. The systems performed as expected because the company was able to maintain balance.

Bottom-up vs. top-down technology-driven approach

The data in Table 6.1 shows Company B also applied a technology-driven approach. Changes in the BIS configuration of the company were initiated by technical changes. CR application in the company was more stable than in Company A however, who applied a similar approach.

The explanation is obtained from analysis of actual system development flows in the two organisations. Systems development in Company A followed a top-down approach after acquisition, while the development in Company B was bottom-up. That approach was conducted to bring Company A into a leading position in the industry. It seems like the management team of Company A had the ambition to realise this objective very quickly. They did not realise that this practice created a technology-dependent condition; the company held the opinion that the new technology would work properly and deliver the expected outcomes. They were not aware that there was an important part in the system that needed to be maintained regularly (data accuracy), and that the whole system will not work properly when this is absent.

In Company B, the technology-driven approach was done by accommodating requirements from store and DC in a bottom-up approach. The requirements are fed to a software development function in the IT division. The function studies those requirements and if it is important, they initiate a project to realise the requirements.

Before the project is initiated they determine important changes in other aspects of the systems. It can be concluded that mutual adaptation is also practiced in Company B.

The above comparison between mutual adaptation and technology-driven approaches for CR implementation within the case companies confirms that mutual adaptation is better than the technology-driven approach if the latter creates a technology-dependent situation where the company depends too much on technology to bring improvements. The findings also confirm that data accuracy is very important for systems' effectiveness. Data is the basis and its accuracy is important to minimise improper decisions for inventory replenishment. Those findings lead to two conclusions:

Conclusion 2:
The mutual-adaptation approach minimises technology-dependent situations in companies and eventually lead to a more effective CR practice.

Conclusion 3:
Data accuracy is crucial for CR-BIS effectiveness as inaccurate data prevents companies from practising CR principle.

Trust matters for advanced CR practice

Advanced implementation is marked by suppliers' involvement in the inventory management process. The five cases confirm that trust is very important for advanced implementation of the CR principle. Trust can be defined as the belief that suppliers add significant value from additional data exchange or the belief that suppliers are able to keep the data properly and use it in the right way. This means that suppliers do not share the data with retailers' competitors or enter the retailers' market. If these conditions are met, advanced data sharing cooperation can be initiated.

A power approach to improve trust

The comparison between Company D and E shows both companies advanced their CR practise from an RMI to an SMI level at the same time, though the results differed: Company D was successful, but Company E was not. The two companies arguably had comparable internal resources to support advanced CR practise so availability of internal resources was not the problem. What mattered was the company's position in the market. The two companies did not have comparable positions at that time; Company D was more powerful than Company E. When Company D asked for suppliers' cooperation for SMI practice they immediately got a quick response; this was not the case for Company E where the response was slow and results were unsatisfactory.

The reason why suppliers responded to Company D was because they risked consequences from the company regarding opportunities or benefits. It was very important for suppliers to get more benefits from Company D because of their huge market share. Suppliers devoted all their resources to deliver what Company D asked. Due to limited resources, they could not do the same thing for Company E.

From this description, it can be concluded that Company D used a power approach to implement SMI with suppliers, which means that they used their respectful bargaining position to encourage suppliers to support their CR practice and to secure suppliers' trustworthiness in the implementation of CR practice. By doing this the company ensured added-value from their suppliers in the implementation of CR practice.

Consensus approach to improve trust

This is a finding from comparisons between Indonesian cases. The three companies currently perform, or plan on, CM practice with suppliers. Data will be exchanged in this cooperation but according to the literature, this is not as detailed as data requirement for CR practice. CM offers a good opportunity for retailers to evaluate suppliers' performance in handling their proprietary data.

Achievement will be assessed according to agreed measures. Because the assessment is conducted mutually and results are discussed and consulted with each other, this approach is called the consensus approach. Based on the assessment the two parties would determine the extent of their future relationships.

It is concluded there are two approaches in building and improving trust: the power and consensus approaches. From the comparison between the experience of Company D and Indonesian companies it is concluded that the first gives quicker results than the second. No matter the approach, it can be concluded that retailers are trying to improve trust level with their suppliers because this is an important condition for getting more benefits from their relationships. This statement leads to the fourth conclusion as follows:

Conclusion 4:
Trust is very important in CR relationship between retailer and supplier. A higher level of trust can be obtained by two approaches: the power approach and the consensus approach. The applicability of each depends on the position of companies in their market.

Internal & external improvement for advanced CR practice

From the cases it can be concluded that improvement of internal and external conditions are prerequisites for advanced CR application. The most important internal point is improvement in and maintenance of data accuracy. Improved technical capability would not be effective if data is not accurate. It is expected that retailers are able to ensure data accuracy when they develop systems capability. Also, it is required that retailers conduct harmonised development for all sub-systems in order to improve the quality of CR practice in their internal organisations. For Indonesian retailers, the capability of the inventory management application to identify, generate and accommodate exceptions into existing orders needs to be added for advanced CR practice.

For external improvements, retailers need to improve ties with suppliers. The main objective is to evaluate suppliers' trustworthiness in handling proprietary data. Trust is multi-dimensional and retailers would pick the most important dimension to define trust. It might be defined as suppliers' capability to give better outcomes or suppliers' goodwill to keep data safe and confidential.

Conclusion 5:
Moving towards a JMI or SMI level requires both data accuracy and a substantial trust level.

6.3 Analysis of contingency factors

CR-BIS configuration and contingency factors that influence the configuration of different aspects are summarised in Table 6.2. This is used for finding common factors that influence the arrangement of data processing and technical sub-systems.

Table 6.2 CR-BIS configuration and contingency factors within the case companies

Dimensions	Company A	Company B	Company C	Company D	Company E
CR-BIS configuration					
Data processing sub-system	No data sharing for CR practice. RMI type with limited suppliers' assistance for monitoring product availability on shelves	No data sharing with suppliers. RMI type without suppliers' assistance	No data sharing with suppliers. RMI type with limited suppliers' assistance for monitoring product availability on shelves	Data sharing at DC level. Combination of RMI and SMI. SMI at RDC level for fast moving and premium items. RMI for other products	No proprietary data sharing with suppliers. RMI type without suppliers' assistance
Technical sub-system	Web-based EDI for internal and external links (using a value-added network). Outsourced application for inventory management in store (Retek). Retek supports advanced functionalities.	Dial-up comm. using FTP for internal link. E-mail for external data comm. All using a public network. Proprietary applications for inventory management in DC and store. Supports basic functionalities.	LAN for internal data comm. and web-based EDI for external data comm. (using a value-added network) Proprietary applications for inventory management in DC and store. Does not support advanced functionalities	A private network was used for data comm. between shops and DCs. Third party (value-added) EDI network for external data comm. Proprietary business application was used for inventory management. Advanced functionalities are available	A private network was used for data comm. between shops, DCs and Head Office. Third party (value-added) EDI network for external data comm. Outsourced application for inventory management in DC and store with advanced inventory management functions

Note:
Comm.: communication

Table 6.2 CR-BIS configuration and contingency factors within the case companies (*Cont.*)

Dimensions	Company A	Company B	Company C	Company D	Company E
Contingency factors					
Extent of data sharing	Factors that contribute to data sensitivity (type, format & quality of data), and lack of credibility of industry-level institutions	Data sensitivity (does not mention factors that contribute to sensitivity), supplier trustworthiness and output stability	Factors that contribute to data sensitivity (type, format & quality of data) and supplier trustworthiness	Data sensitivity (does not mention factors that contribute to sensitivity) and suppliers trustworthiness	Data sensitivity (does not mention factors that contribute to sensitivity), suppliers trustworthiness and relatively low market power
Tasks assignment	Factors that contribute to data sensitivity (type, format and quality of data), time specificity of monitoring tasks, and existing IT infrastructure in the company and their suppliers, and suppliers' trustworthiness	Existing process config. (the perceived benefits of the config. over advanced CR practice) and output stability	Factors that contribute to data sensitivity (type, format and quality of data) and suppliers performance	Data sensitivity (does not mention factors that contribute to sensitivity), strategic fit of tasks and the company's strong market power	Performance of prior config. of process execution and insufficient market power to encourage suppliers

Note:
Config.: configuration

Table 6.2 CR-BIS configuration and contingency factors within the case companies (*Cont.*)

Dimensions	Company A	Company B	Company C	Company D	Company E
Contingency factors					
Technical solution selection	**Data comm. mechanism:** Flexibility of data comm. media **Business application:** The company's IT capability, suppliers' IT flexibility, and flexibility (compatibility with internal platform and connectivity), functionality, and adoption rate of technical solutions	**Data comm. mechanism:** Functionality (speed requirement) **Business application:** Costs, functionality, technical and process knowledge, and flexibility of existing IT infrastructure in the company	**Data comm. mechanism:** Functionality (speed), reliability and flexibility (openness) **Business application:** Functionality, available technical knowledge, vendor support, and flexibility of existing IT infrastructure in both the company and their suppliers	**Data comm. mechanism:** Cost **Business application:** Functionality	**Data comm. mechanism:** Reliability, technical support, and security **Business application:** Functionality and vendor support

Note: comm.: communication

Data sensitivity influences data sharing with suppliers

Table 6.2 shows data sensitivity was significant in all cases. Data sensitivity is defined in this study as the potential of the data to develop a business strategy in order to survive the competition in the industry. A preliminary conclusion is that data sharing is limited because data is sensitive. It is important to develop business strategy and/or may give information about the companies' strategy. It is argued however, that sensitivity of data is not only determined by the data type, but also by the accuracy, accessibility, relevance, value-adding potential, timeliness, completeness, interpretability, conciseness, and consistency of the data. As found in Company A and C suppliers' sales agents were able to collect sales data. However, since the data is not complete and lacks of detail it is not considered highly sensitive thus reducing the negative effects of the data possession by suppliers.

Suppliers' trustworthiness related to data sensitivity

An important factor regarding the use of highly sensitive data is suppliers' trustworthiness. Suppliers need to prove they have the capability to make the systems more effective with additional data and have a strong goodwill to keep the data safe and confidential.

This is the factor that impedes advanced CR practice in the Indonesian cases, and Company D to extend CR practice to store level. Also, this is the factor that made Company E stop the SMI project with suppliers. The companies did not trust their suppliers' capability to add significant value.

The conclusion is that if the data is highly sensitive and suppliers have a low level of trustworthiness, then retailers will not share data with them. This conclusion may explain why Company A and C did not complain about the activity of suppliers' sales people collecting sales data: the collected data is not valuable enough to be considered sensitive due to the lack of completeness and detail. Although the suppliers' might not be trustworthy, their action to collect the data is not disruptive because the data is not useful for discerning the companies' strategy.

Added-value of suppliers' involvement as factor in process sub-system

Added-value was the common theme across companies when considering suppliers' involvement in their inventory management practice. For Company A, this was defined as suppliers' capability to perform monitoring and decision-making tasks in a timely manner. For Company B, this was suppliers' capability to deliver better outcomes than the existing process configuration. They state that they had enough resources to do monitoring and ordering in DCs and stores. In addition, they thought supplier involvement would not add significant value because they did not have problems with strong demand fluctuation, the situation in which suppliers play a significant role. For Company C, the added-value was defined as suppliers' capability to improve service level once data is shared with them. For Company D, this was realised in faster responses from suppliers to avoid out-of-stock condition in DCs. For Company E, this was defined as better service level and profitability.

The expected added-value could only be realised in the case of Company D. The company is now enjoying better responses from suppliers. For other companies, this is where the suppliers are weak. In their perception, suppliers were not able to deliver the added-value they expected. This is a reason why they did not initiate a higher level of CR practice with suppliers.

Another common factor and determinant for suppliers' added-value is data sensitivity. This factor explains why Company D would not extend their CR relationship with suppliers to store level: the data is sensitive and suppliers were not trustworthy enough. Data sensitivity was also the main concern of other companies.

When data sensitivity is concerned there is the perception that suppliers are not trustworthy. Those two factors are highly related. This is crucial because added-value is a function of benefits that may be gained from a closer relationship with suppliers (by sharing more data and/or assigning more responsibilities) and the risks associated with sharing sensitive data. If the risks are higher, then it is likely that companies will not share their data or assign tasks to suppliers.

The conclusion from this comparison is that added-value is an important factor in delegating inventory management tasks to suppliers. Added-value is a function of benefits that can be derived from assigning tasks to suppliers and risks involved because of sensitive data. If added-value is significant then retailers will be encouraged to assign the tasks to suppliers.

Retailers' IT infrastructure related to technical solution

The existing IT infrastructure in the retail company was the key determinant in selecting a technical solution. The existing infrastructure determines the capabilities that need to be added by a future application and the required flexibility of the technical solutions. For example, Company A stated that all technical solutions adopted by the company should fit the SUN platform. In the case of Company B this was stated as the fit of technical solutions to their proprietary platform.

Retailers that start cooperation with suppliers also consider existing IT infrastructure in the supplier company when selecting technical components for CR application. For example, Companies D and E opted for conventional EDI because this was the common network among Dutch suppliers. Having a similar platform enables seamless data communication between parties.

The basis for selecting a technical solution

Functionality, though defined differently, was the most important factor for all companies in selecting technical solutions in implementing CR[19]. Definitions vary because companies had different requirements. Company A required the communication media to support their goal of web-enabled transactions with suppliers, and required the applications to support processes within the company. For Company B, this was the requirement for fast connection between store and DC to support a daily delivery program (data communication) and to support business processes (business applications). The speed requirement was also the required functionality for Company C.

Functionality is not only a criterion for selecting communication media but also in selecting a business application. The Dutch retailers used this criterion for selecting their business application. In general, functionality was defined in relation to business

[19] Both data communication media and business application

process requirements. The business requirements themselves were different for each company.

Flexibility, vendor support, solution cost and functionality

Flexibility becomes a lower priority. Regarding flexibility, companies can be grouped into one of two types: a company that focuses on internal flexibility or a company that focuses on both internal and external flexibility. Internal flexibility is defined as the ability of the technical solution to adapt to the existing infrastructure. In external flexibility, this is extended to include the ability of a suppliers' infrastructure to adapt to the companies' infrastructure. Company B belongs to the first type. Their main concern in selecting business applications was the ability to fit their internal business requirement and existing IT infrastructure. Companies A and C are from the second type. Besides focusing on internal conditions they also considered the suppliers' condition in selecting business applications. The difference between company B and the other companies is due to a different requirement in communication with suppliers. Companies A and C are planning to extend their cooperation with suppliers in CR and CM and require systems with good flexibility to connect with different supplier systems.

Flexibility was not mentioned by Dutch retailers as a factor in selecting a technical solution. This could not be assessed in Company D because of incomplete data. The absence of this factor in Company E is due to their focus on security and reliability. They argued that although Internet was highly flexible, security and reliability was less than a conventional EDI network. Therefore, they prefer conventional EDI to Internet-based EDI.

Selecting a flexible connection was related to minimising transaction costs and network development because a flexible connection enables the companies to build a large business community much easier than a rigid connection.

Vendor support was mentioned by Company C and E as an important factor. In the case of Company C, this criterion was inspected before adopting the Oracle database application, while in the case of Company E, it was inspected when adopting all applications because those applications were outsourced. Vendor support was not important for Company B because they used their internal capacity to develop internal systems. This is not mentioned by Company A, because they had an IT department capable of giving technical support after the company was acquired by the IT vendor. For Company D, vendor support is realised in the maintenance of the data communication network. This factor could not be assessed in business application selection within the company because of incomplete data.

Cost is the last consideration among the companies. They always try to minimise the costs of adoption, but their main priorities are still functionality, flexibility and

vendor support. The IT manager in Company C, for example, stated that the Oracle application was more expensive than other alternatives, but the support was worth it.

From the above description, it is argued that functionality is the main factor in selecting business application for inventory management, flexibility is second, and vendor support and costs are third and fourth respectively.

6.4 Analysis of cultural influence

Table 6.3 present a summary of antecedent and moderation effects of culture on contingency factors and their influences on CR-BIS configuration.

Table 6.3 Summary of antecedent and moderation effects of culture

Case	Expected antecedent effects on		Expected moderation effects on		
	Data sensitivity	Supplier trustworthiness	Data aspect	Task aspect	Technical aspect
Company A	Supported	Supported	Not supported	Not supported	Supported
Company B	Supported	Supported	Not supported	Not supported	Supported
Company C	Supported	Supported	Supported	Not supported	Supported
Company D	Not supported	Not supported	Not supported	Not supported	Supported
Company E	Supported	Supported	Not supported	Not supported	Not supported

Antecedent effect of culture in Indonesia

The studies in the Indonesian companies provide support for antecedent effect of culture on data sensitivity and supplier trustworthiness, meaning that Indonesian retailers consider data to be highly sensitive and doubt their suppliers' trustworthiness, which can be attributed to the high power distance and collectivist cultures' influences.

Conclusion 6:

The expected antecedent effect of high power distance and collectivist culture can be recognised in the studies of Indonesian retailers. Implementing sudden changes to advance CR practice in Indonesian companies (meaning more extensive data and responsibility sharing between retailers and suppliers applied in a relatively short time) will not be an effective approach for improving CR practice in Indonesian cases.

Antecedent effect of culture in the Netherlands

Evidence from the Dutch case studies show contradicting results about antecedent effect of culture. Although the effect is supported by the results in Company E no evidence was obtained for low data sensitivity and high supplier trustworthiness in Company D. Due to this, no conclusion that can be drawn regarding antecedent effect of culture in Dutch cases.

Different outcomes of antecedent effect of culture on data sensitivity and suppliers' trustworthiness in Indonesia and The Netherlands may indicate different things. Those are discussed at the end of this section together with the outcome of moderation effect assessment.

Moderation effect of culture on contingency factors' influence on data aspect of CR-BIS

The expected moderation effect of cultures is not supported because of two reasons. For Indonesian cases it is because there are evidences of other contingency factors beside the expected contingency factors. For example, Company B considered suppliers' data handling knowledge as an important contingency factor in determining the extent of data sharing with suppliers beside data sensitivity and suppliers' trustworthiness. For Dutch cases it is because there is no evidence at all for the expected contingency factors. Instead there are evidences of other contingency factors that are actually expected to appear in different context of culture. For example, Company D considered data sensitivity and suppliers' trustworthiness as important contingency factors in data aspect of CR-BIS although those factors are not expected in low power distance and individualist cultures.

Moderation effect of culture on contingency factors' influence on task aspect of CR-BIS

Similar with data aspect there are two reasons why the expected moderation effect is not supported. For Indonesian cases there is evidence of other contingency factors beside the expected ones. For example, within Company A strategic fit of task, time specificity of task, and IT infrastructure capability were considered as important contingency factors in assigning CR activities with suppliers. For Dutch cases, evidences are found for contingency factors that are proposed to appear in different cultural context. There is no evidence of the expected contingency factors. For example, in Company E prior or existing process configuration and relative market power were found important in

determining the extent of suppliers' involvement in the company's CR practice. These contingency factors are not expected because Company E was assumed to be influenced by low power distance and individualist cultures. Within this context, data sensitivity and suppliers' trustworthiness are not expected to be influential.

Moderation effect of culture on contingency factors' influence on technical aspect of CR-BIS

The technical selection in Indonesian companies is influenced by technical solutions' characteristics and contingency factors from other groups. For example, technical solution selection in Company A is influenced by retailer's IT infrastructure capability and suppliers' IT infrastructure flexibility beside functionality, flexibility and adoption rate of technical solutions. The presence of other contingency factors than technical solutions' characteristics indicates that collectivist culture influence Indonesian retailers in determining technical solution to be used for practising CR principle. The influence of individualist culture in selection of technical solutions within the Dutch companies is not fully supported because Company E considered other factors than technical solution characteristics, i.e. retailer's technical knowledge.

Conclusion 7:
In determining the extent of data sharing with suppliers and the extent of suppliers' involvement in CR practice Indonesian companies considered more factors than expected. This indicates that those companies are not influenced by high power distance and collectivist cultures in configuring data and task aspects of CR-BIS.

Conclusion 8:
In determining the extent of data sharing with suppliers and the extent of suppliers' involvement in CR practice Dutch companies considered contingency factors which are not expected to be influential in low power distance and individualist cultures. This indicates that those companies were not influenced by those cultures in configuring data and task aspects of CR-BIS.

Conclusion 9:
In Indonesian case inherent characteristics of technology are not the only factors that matters for selecting technology for CR practice. The ability of technology to fit existing companies' and their suppliers' IT infrastructure and utilisation of available technical knowledge within the companies would be important in selecting the optimal technical solution. This indicates that Indonesian companies were influenced by collectivist culture in configuring technical aspect of CR-BIS.

Because of inconsistent result there is no single conclusion that can be drawn from Dutch cases regarding the influence of cultures on contingency factors' influences on technical aspect of CR-BIS.

From the above descriptions one may conclude that cultural influence is unpredictable. The research findings cannot be used to confirm the expected cultural influences. There is hardly any explanation for this deviation. A better explanation may be obtained if a dedicated study for cultural analysis of CR-BIS configuration in the companies is executed. At this point the researcher formulates the following conclusion:

Conclusion 10:
There is an inconsistent and unclear pattern of cultural influences within the case studies and no strong foundation could be found to warrant a conclusion that culture plays significant roles in determining CR-BIS configuration.

Unexpected outcomes of antecedent and moderation effects of national culture on contingency factors may be interpreted in different ways:

1. Hofstede theory on national culture is not universally applicable.
   Different outcomes regarding antecedent effect in Indonesia and The Netherlands may indicate that Hofstede theory is not universal; applicable in one country but not in another. There is still an ongoing debate about the applicability of cultural dimensions of Hofstede and further research is required to obtain more insight in this matter.
2. Hofstede theory on national culture is not appropriate for the context of this study,
   Unexpected outcomes of this study may indicate that the Hofstede theory has limited applicability for the issues investigated. This is because the study involves people in managerial and operation levels in data collection activities. Those people have different values. For example, people in operational levels tend to be more open to suppliers about data than people on a managerial level. In addition, there are different values to each level. For example, in Company A there are several expatriates on the management team that influence decision-making. They may have a different national culture. Due to this it is possible that unexpected evidence is found. The assumption of the Hofstede theory (a homogeneous pool of interviewees) may violate the results in the absence of national culture effects on contingency factors.
3. The theory is applicable but limited to CR practice on a warehouse level.
   This argument is based the fact that the two Dutch retailers have implemented SMI at warehouse level, while Indonesian retailers still consider warehouse data sensitive and distrust suppliers to handle it.

4. Another mechanism links national culture and contingency factors.
   Beside the inapplicability of the Hofstede theory, the absence of evidence may be caused by incomplete identification of the mechanism that links national culture and contingency factors. Although it is argued in section 3.5.1 that national culture influences organisational practice there might be a complex mechanism followed by national culture before it can influence the practice of an organisation. Because of this, a more complete theory of the extent of national culture influence on contingency factors cannot be formulated and is not the objective of this study.
5. The theory is applicable when similarities in national culture are considered.
   This study considers only cultural differences between Indonesia and The Netherlands and ignores the influences of cultural similarities. It may be that influences of other national culture dimensions (uncertainty avoidance, masculinity, and time orientation) are more dominant than the influences of power distance and individualism dimensions. It is arguable since the comparison is 3 to 1; there are more similarities than differences between the two countries. This might result in stronger influences of dimensions other than power distance and individualism. Ignoring the similarities may result in absence of evidence as in the case of this study.
6. The case companies are not cultural representatives of each country
   The case companies might not be cultural representatives of each country. This is caused by heterogeneity in the company (the case of Company A), globalisation of business operations that would incorporate different values in the world (the case of Company D), or participation of the company in industry that generates different values (the case of Company E). The main criterion for selecting companies in this study is application of the CR principle and not national culture representation; the cultural aspect of the companies is not considered in data collection. It is suggested to balance these things so that cultural influence in CR practice can be assessed more properly.
7. Culture is not a main determinant in CR-BIS configuration.
   Another possible explanation is that culture is not a main determinant in CR-BIS configuration. Perhaps CR-BIS configuration is independent from cultural influences. The determinants would be the contingency factors identified within this study: data sensitivity and accuracy, suppliers' trustworthiness, economic value of advanced CR practice that depends on suppliers' response and knowledge of retail operations, IT infrastructure (business application and data communication technology) supports, and functionality, flexibility, vendor support, and cost of technical solutions.

Stronger support for points 3 and 6 are available in the research findings. However, there is no clear evidence to support the other possibilities. A further study is needed to obtain more insight. A more comprehensive study on culture is necessary in order to select the most appropriate cultural dimensions to study BIS configuration in a CR context and to build a more complete framework of cultural influence. A more structured research method is necessary to take into account the influence of different cultural groups in a company and measure cultural characteristics of the company to conclude whether the company is representative of its national culture or not.

6.5 Summary

CR implementation progress in five retailers has been analysed. The five companies demonstrate variations in implementation. The findings are:

1. RMI is the general status of CR application in the case companies
2. The requirement to apply SMI practice on a DC level is related to the number of stores. Retailers with a large number of stores are more likely to practice SMI at DC level. By giving the responsibility to manage DC inventory to suppliers, retailers are able to concentrate on managing inventory at stores to improve consumer satisfaction.
3. Internal and external improvements are needed for advanced CR practice. Internal improvements are data accuracy and technical capability. Data accuracy needs to be regularly maintained because it is the fundamental part of the BIS. Technical capabilities that need to be added among Indonesian cases are expandability of the technical infrastructure and the ability to identify exceptions in operations. External action is geared toward improvement of supplier trust levels so that more data and responsibilities can be shared.
4. The companies are following either technology-driven or mutual-adaptation approaches for internal improvement. The most important thing when following these approaches is a balance among sub-systems in the BIS structure. For external improvement there are two approaches: power and consensus. The power approach gives fast results in trust building, but requires a significant level of market power. The consensus approach is slower, but bears fewer risks because companies are well prepared for the consequences of an extended data sharing relationship with suppliers.
5. There is no strong foundation to support national culture influences on CR-BIS configuration. Seven possibilities are proposed to explain this situation. Two are supported by the research findings. The first says that national culture influence is limited to the warehouse level and that a negative attitude toward advanced cooperation on store level is not specific to one national culture. The second says that the absence of evidence to national culture influence is because of inappropriateness of the companies within this study with their national culture.

They may represent the national culture completely because sub-groups within the companies tend to embrace different cultures. A further study is needed in order to evaluate the other possibilities. This is described in section 7.7.

6. Practical implications regarding the findings of cultural influence in the case studies are as follows:
    a. Assuming that companies are influenced by national culture is not fully relevant in the configuration of CR-BIS and may lead one to create ineffective CR-BIS configuration because it is designed for something barely present in practice.
    b. The fact that data sharing and task assignment in four cases (A, B, C and D) are influenced by data sharing and suppliers' trustworthiness indicates that the two contingency factors are becoming global (not exclusive for a particular culture). Because of that, retail companies in many countries need to consider those contingency factors carefully before advancing their collaboration with suppliers.
    c. Technical selection for CR practice in retail companies is still influenced by culture to a certain extent. Technology providers in collectivist cultures need to consider the ability of their technical solutions to connect with external IT platforms. However, there were no indications that it is necessary for technology providers in an individualist culture to consider factors other than the inherent characteristics of technology. Focus on the ability of their solutions can deliver the expected functionalities.

CHAPTER 7 CONCLUSIONS

7.1 Introduction

With respect to CR implementation the issue concerned the slow adoption and advancement of CR concepts among retail companies despite the benefits mentioned by CR proponents.

The literature study revealed that studies have been conducted to analyse this problem, but information about configuration of Business Information Systems (BIS) within the practising companies is missing. This is considered important because the quality of CR practice is represented and determined by BIS configuration.

It is argued that a relevant BIS model for examining CR practice is needed. The model consists of two sub-systems: data processing and technical sub-systems. Aspects and important characteristics of those aspects within the sub-systems are elaborated. In order to explain changes and development in the configuration of this model within retail companies, knowledge of contingency factors is needed. A literature study was conducted and a research model formulated. The research model was tested in five cases. The findings are presented and analysed in Chapters 5 and 6. The findings from cross-case analysis in Chapter 6 are used to address the following research questions:

- How do select Indonesian and Dutch retailers configure their BIS for implementing CR?
- What are important contingency factors as perceived by those companies in selection of the configuration?
- What similarities or differences can be found?
- To what extent can cultural influence be identified in the CR implementation in the cases?

7.2 CR-BIS configuration in the case companies

At the time of the study, all Indonesian cases implemented a Retailer-Managed Inventory (RMI) type of CR practice; this means they carried out inventory management activities (data updating, inventory monitoring, and ordering) without suppliers' formal assistance. This practice also assumes that no proprietary data is shared with suppliers. Data sharing was limited to Purchase Orders (POs) only.

This practice was also done by the Dutch supermarket operator, Company E. In Company D one finds a combination of RMI and SMI (Supplier-Managed Inventory) practices. Company D applied SMI for high-volume, fast-moving and premium products. The rest of the products are managed by RMI. The SMI practice in the company is limited to the RDC level. Suppliers were responsible for inventory management in RDC and the company provided them with information on inventory

levels within the DC and orders from stores. Another Dutch retailer, Company E, failed to apply the same practice and returned to RMI practice.

RMI in the Dutch companies was different from their Indonesian counterparts; there was no suppliers' informal assistance found in Dutch supermarkets. This informal assistance was found in two Indonesian supermarkets. The assistance was needed to monitor product availability. Although suppliers were involved in this task, it could not be concluded that they practiced JMI or SMI because the suppliers were not involved in making decision for inventory replenishment. Their involvement was done on a voluntary basis. In JMI and SMI this needs to be formalised and suppliers' involvement in decision-making needs to be present.

Technical solutions used to support the practice varied between companies. The findings show that the case companies used both proprietary and outsourced technical solutions. Companies A and E adopted packaged solutions from IT vendors. Companies B and C used proprietary applications. It was not known what kind of business application was used by Company D. However, it was predicted that the company also bought a packaged solution from IT vendors. The study found a trend towards technical outsourcing. Proof is adoption of an outsourced package by one of two companies that developed the systems in-house. This is seen in Company C when they decided to adopt Oracle to replace their legacy database application. Company B was still loyal to their legacy application. However, they would think of buying a packaged solution if the legacy systems could not support their requirements.

Data communication channels used by the companies are different. The dominant channels are satellite. In Companies A and C this channel was used for establishing web-based data communication while in Companies D and E this was used for establishing traditional EDI with their business partners. Company B was the most conservative in using data communication technology. They are still using telephone line for communicating orders internally and externally. This will be a barrier for the company in since telephone line has limited capability for transmitting data.

7.3 Contingency factors

Data sensitivity is the main factor that influences data sharing and task assignment between retailers and suppliers in this study. The companies were afraid that suppliers would use the data for other purposes that might disadvantage them. This includes the using the data to negotiate with their competitors and the possibility that suppliers would enter their market. The companies agreed that the degree of data sensitivity is not only determined by type but also format and quality. Data can be in formal or informal form. A computer file is considered formal data because it has a specific format as described by the companies, while information collected by suppliers' sales agents is considered informal because it does not have a specific format as recognised by the retailers. The quality of data is determined by its completeness, detail, and timeliness.

Data sensitivity is always accompanied by suppliers' trustworthiness. Trustworthiness has two dimensions: capability and goodwill. In the first dimension, trustworthiness is determined by the suppliers' capability to handle data and deliver expected outcomes from data or a responsibility sharing relationship. In the second dimension, trustworthiness is determined by the suppliers' goodwill to keep data as expected by retailers. Suppliers should be able to keep it safe and confidential and not share this information with competitors for their own goals.

Because sharing data may create both advantages and risks, the decision to involve suppliers in inventory management depends on the relative amount of each. This is considered as the added-value of suppliers' involvement and was mentioned as a contingency factor by the case companies. For Company A, this was defined as suppliers' capability to perform monitoring and decision-making tasks in a timely manner. For Company B, this was suppliers' capability to deliver better outcomes than the existing process configuration. The company stated that they had sufficient resources to do monitoring and ordering in DC and store. In addition, they thought that suppliers' involvement would not add significant value because they did not have problems with strong demand fluctuation, where suppliers played a significant role. For Company C, added-value was defined as suppliers' capability to improve service levels. For Company D, this was realised as faster response from suppliers to avoid out-of-stock conditions in the DC. For Company E, this was a requirement for a better service level and profitability.

Functionality, flexibility, vendor support, and adoption costs are important aspects of technical solutions considered by the case companies when adopting a specific solution from the market. Those factors are listed in order of importance from the highest to the lowest. Functionality and flexibility were defined differently by the case companies because they had different requirements at that time. For example, functionality of business application is defined by Company A as the capability of the application to support their policy to perform automatic replenishment and build web-based IT architecture, while in Company B it was defined as the ability of the application to fit their business process requirements. The companies also had a different definition of functionality for the business application and data communication technology selection. In Companies B and C, the functionality of data communication technology that they used is the ability of the technology to perform swift data transfer, while functionality for business application is the ability of the application to support the inventory management process within those companies. A summary of contingency factors that influenced CR-BIS configuration within the case companies is presented in Table 7.1.

Table 7.1 Common factors in BIS configuration

Sub-system	Contingency factors	Remarks
Data extent	Data sensitivity and suppliers' trustworthiness	Those factors are closely related. Data sensitivity is determined by the type, format, and quality of the data.
Tasks assignment	Suppliers' added-value	Added-value is the function of benefits of suppliers' involvement vs. the risks that were associated with their involvement
Technical solution selection	Existing IT infrastructure capability within retailers and suppliers, and functionality, flexibility, vendor support and adoption costs of the technical solution	Existing IT infrastructure in the retail side is always the main focus because retailers try to maximise the utilisation of their infrastructure

7.4 Similarities and differences between Indonesian and Dutch cases

The study is not only intended to study CR implementation in individual companies but to find similarities and differences between companies in terms of CR practice, contingency factors and cultural influence. Similarities and differences are stated for Indonesian and Dutch cases separately and then together.

7.4.1 Indonesian cases

Indonesian retailers covered in this study were practising RMI when the study was conducted. This means that the companies performed all inventory management tasks and did not share any data with suppliers. The factors that were considered significant in causing this situation were data sensitivity, suppliers' trustworthiness and suppliers' added-value for inventory management in those companies.

Although the three companies implemented an RMI type of CR practice, the daily practice of RMI is different between them. In Companies A and C one may witness suppliers' assistance in monitoring product availability whereas in Company B this was not present. Company B did not require suppliers' assistance at all for inventory management. It is concluded that Company B did not think suppliers' involvement would add any value. For the other companies, suppliers may add a little value, i.e., in monitoring product availability on shelves. An explanation of this situation is obtained from the number of product categories to be managed by the companies' outlets. Since Companies A and C are supermarket operators, they have broader product categories to be managed than Company B. Suppliers' assistance is valuable for them although it cannot be done continuously due to the agents' responsibility to promote their own products in store.

The companies are developing the capability for CR practice, but are using different approaches. Companies A and B were characterised by technology-driven approach. However, the practice is different. The technology-driven approach in Company A is top-down, while in Company B it is bottom-up. This gives different effects for CR implementation. The top-down approach created a technology-dependent situation in Company A. This condition contributed to failure in CR implementation in the company. In Company B the approach did not create that situation because the technology is rooted in their legacy system and people in the company are able to follow the technical development. In addition, the technology is developed according to user requirements. In this situation new technology does not create a technology-dependent situation as it grows with other aspects in the systems. The approach in Company C is more balanced. The company gives mutual attention to data, process, and technical development so that the whole system develops in harmony.

Functionality and flexibility are common factors in selecting a technical solution for CR practice. Vendor support and adoption costs were ranked lower by the companies. Cost is more important for Company B in determining technical solutions that will be used for supporting CR practice because the company had lower financial capability than the other two companies. This information was confirmed by an industry expert in Indonesia. There is a tendency toward software outsourcing in the Indonesian cases because of business development. Company C decided to replace their legacy database system with Oracle to support a larger data volume. Although the companies have capable IT for supporting CR practice, they lack expandability and functionality for advance CR practice. The missing functionality is the ability to identify exceptions. This ability would improve the companies' response to changing situations in operations if available. This is also a requirement for collaborative replenishment with suppliers.

Regarding cultural influences there is evidence of antecedent effects of culture (i.e. high power distance and collectivist cultures) on data sensitivity and suppliers trustworthiness. Because of the influence of high power distance and collectivist cultures data is considered highly sensitive and suppliers are not considered trustworthy by Indonesian companies. Despite the support to antecedent effect of culture no strong foundation could be found to support the expected moderation effects of cultures on contingency factors' influences on data and tasks aspects of CR-BIS although there are supports for contingency factors' influences on technical aspect of CR-BIS. Explanation for this deviation is provided in Chapter 5. Because of this inconsistency it cannot be concluded that culture influence was revealed in this research.

From the Indonesian cases four conclusions are drawn:

1. Suppliers need to demonstrate an ability to create added-value if they want to be involved in an intensive data sharing relationship with retailers. Their ability to generate added-value is determined by their knowledge of retailers' operations and logistics network in dealing with possible consequences of intensive data sharing relationship. The main concern of the case companies is suppliers' response. They are not satisfied with delivery performance of the suppliers. The reason of the slow response was not identified because there is no investigation on suppliers' side.
2. Suppliers need to prove trustworthiness in keeping data. Indonesian companies are on a lower bargaining position compared to suppliers. Without trustworthiness suppliers might use their power in an unexpected way. Actually, this can be overcome through a creative contracting as explained in Seidmann and Sundararajan (1997). Readers are advised to read their work to know possible contracting options between retailers and suppliers.
3. Both parties need to develop a capable and flexible IT infrastructure in order to support the cooperation. The retail companies need to enhance their IT infrastructure so it enables a larger implementation scale and identification of exceptions in operations for suppliers to make quick reactions. This improvement needs to be done in a balanced way, which means that companies need to be aware of data accuracy maintenance when improving technical capabilities. If data is not accurate, it is difficult to expect the systems to be effective. Suppliers to improve their inventory management application so that they can manage different data formats of retailers and perform real-time load building and capacity planning to accommodate exceptions from retail operations. Because there is a move to web-based transaction there might be a little problem with compatibility since this transaction uses a more open network. However, both companies need to increase data communication bandwidth and add EDI capability in their inventory management application for fast, accurate, and reliable data communication.
4. Culture has a role in determining the condition of data sensitivity and suppliers trustworthiness. However, its impact on the influences of contingency factors on CR-BIS configuration is less obvious. The reasons to this condition are mentioned in section 6.4. A reflection on this aspect can be read in section 7.5.4.

7.4.2 Dutch cases

The two Dutch companies in this study experienced advanced CR practice (SMI), with their suppliers. Company D, however, is in a better position in the market than Company E and are able to encourage suppliers to join the SMI program. Company E did not hold a comparable position and was unable to motivate suppliers to commit with

expected performance. Company E eventually had to stop the program. Although Company D is more advanced in CR practice than Company E, the two companies held similar opinion about sharing store data. They do not share this data with suppliers because of sensitivity reasons and do not trust their suppliers' goodwill in handling the data. Both of them relied on outsourced applications for supporting CR practice, but used different applications for reasons of functionality. Another important factor according to Company E was vendor support. They replaced an application because they received better support. The two companies used a third party network for data communication. It was not known whether they use the same provider for the network. The companies mentioned that by using a third party's network, they are able to focus their resources on developing consumer service quality. The development of the network services becomes the responsibility of the network provider.

The findings regarding the antecedent effect of low power distance and individualist cultures within Dutch cases were inconsistent. Opposite evidence was found within the two companies. Findings in Company E fit the expected antecedent effect whereas those in Company D deviate from the expected antecedent effect. Company E thought that data is not sensitive and that they trust their suppliers. It was because suppliers incapable to deliver the expected performance that the company terminated advanced CR practice with them. On contrary, data is considered highly sensitive by Company D and they do not trust their suppliers to handle store data. Contradicting evidence was also found regarding the moderation effect. The expected moderation effects do not match the case study findings. Contingency factors that were expected to be found in low power distance and individualist cultures were not present. Because of this conflicting result it cannot be concluded, based on the collected data, whether culture has influence in determining the configuration of CR-BIS.

The conclusions from Dutch cases regarding advancement of CR practice are:

1. It is important to evaluate the added-value of suppliers' involvement in inventory management activities before making such decision. The main concern as reported in the case of Company E is that improvement in inventory costs reduction, delivery lead times and product availability are not as they expected. As described in Chapter 2 this is might be caused by lack of knowledge of retailer's operation. Suppliers need to handle inventory management of Company D and E at the same time. Both have different operational characteristics. The method developed by suppliers to serve Company D is not appropriate for Company E. As a result, they could not perform optimally for Company E.
2. A combination of internal and external strength is needed in order to be able to develop CR practice. The internal strength is obtained from BIS capabilities to provide supports for advanced CR, while external strength is obtained from a strong position in the market that can be used to motivate suppliers to take part.

3. The cultural assessment in Dutch cases shows that culture has less obvious impact on contingency factors' condition and their influences on CR-BIS configuration. Reasons to this are described in section 6.4. A reflection about cultural influence can be found in section 7.5.4.

7.4.3 Comparison between Indonesian and Dutch cases

Despite the fact that in the study there is only one Dutch retailer that implements SMI, there is an indication that Dutch retailers are able to initiate advanced CR practice with suppliers. ECR Nederland reported that SMI is being adopted by other retailers in The Netherlands. The ECR Nederland manager explained that this situation is enabled by an advanced IT and logistics infrastructure in The Netherlands. An advanced IT infrastructure enables retail companies to communicate data with suppliers in timely manner. In addition, short distances, an advanced logistics infrastructure, and a good traffic regulation in The Netherlands make it possible to implement SMI. Indonesian retailers encounter a different situation. IT infrastructure in Indonesia is not as advanced. According to data from ECR Indonesia and ECR Nederland, Indonesian retailers started using POS terminals in the mid 90-s while Dutch retailers implemented POS data terminals in the late 80-s. This explains why Indonesian retailers are late in adopting CR practice. In addition, long distances between suppliers' warehouses and retailers' DCs and deficient traffic regulation and road infrastructure in Indonesia makes it difficult for suppliers to respond quickly to retailers' demands. This situation keeps Indonesian retailers from implementing advanced CR practice with suppliers. They are more conservative in advancing CR practice and decided to build trust with suppliers through CM practice and then extend involvement based on the results. Dutch retailers are more innovative. They decided to pass the JMI stage and directly jump to SMI. Based on the outcomes of the cooperation, they would decide if they will continue. Although Indonesian retailers are slower in adopting CR practice, they show a stronger willingness to build trust with suppliers. An Indonesian retailer in Bandung is reported by ECR Indonesia to practice SMI on the store level with P&G. There is no report of SMI cooperation between Dutch retailers and suppliers on the store level.

Despite these differences, retailers in this study share similar attitudes toward sharing store data. The companies are aware that this data is sensitive and restrict suppliers' access. Store data is considered more sensitive for Dutch retailers than Indonesian retailers because the Dutch market is smaller. Suppliers learn retailers' operations from data that is open to them. The possibility for learning is bigger for Dutch suppliers than their Indonesian counterparts because of the availability of advanced infrastructure in their country and information in the industry. The resulting knowledge can be used to help retailers managing their inventory or to enter the retailers' market to increase their profits. The latter situation is not expected by retailers, especially Dutch retailers because of smaller market size. Any reduction in market share

impacts Dutch retailers more than Indonesian retailers. Indonesian retailers may create another market in other areas of the country. Because of this, Dutch retailers are stricter than Indonesian retailers in sharing store data. Cooperation between the Indonesian retailer in Bandung (the capital city of West Java) and P&G for SMI on store level supports this. The retailer shares data about the manufacturer's products and lets P&G manage the availability of those products in stores. It was reported by ECR Indonesia that this cooperation has generated significant profits for both parties.

The case companies agree that suppliers need to be able to convince them that sharing data will add value to inventory management in their companies. Regarding the selection of technical solutions, retailers agree that functionality is the main factor in selecting business applications for inventory management. Flexibility is second, and vendor support and costs are third and fourth respectively. The current IT infrastructure of the company was significant in determining future technical solutions for inventory management in those companies. Because the companies want to increase the utilisation of the existing infrastructure, the new solution needs to be compatible with the existing infrastructure.

In the cross-case analysis the determination of cultural impact showed an unclear and the results show inconsistent influence on contingency factors condition and their effect on CR-BIS configuration. Although the antecedent effect of culture is (partially) supported in Indonesian cases the overall findings show that the expected moderation effects could not be determined. Explanation to this condition is found in section 6.4

Based on the above description it can be concluded that:

1. Evaluation of suppliers' added-value is important in the development of CR practice toward an advanced stage. Added-value is the function of risks of involving suppliers and benefits gained from that cooperation. However, added-value is defined differently among companies.
2. The added-value in Indonesia will be higher if suppliers have capable IT and logistics infrastructure, whereas in The Netherlands it will be higher if suppliers comprehend different characteristics of retail operations.
3. Trust is important for developing CR practice onto a higher level. Companies need to believe that their suppliers are able to deliver the expected value and that they will not use data in an improper way.
4. Effect of culture is unclear with respect to the contingency factors' condition and their influences on aspects of CR-BIS configuration. More explanation about this is provided in section 7.5.4.

7.5 Reflection

7.5.1 Reflection on CR-BIS model

The model is developed from a combination of Information Systems (IS) literature and CR-specific literature. The result is a CR-BIS model including all aspects and their important characteristics for the CR context. The model is comparable with the technology model from JIPECR (1998), in the sense that the two models recognise data and Information Technology (IT) as important aspects. The difference is JIPECR's technology model put those aspects in a more technical level similar to the technology model in Zachman's framework. Thus, the two models differ in their level of application. The technology model of JIPECR is focused on a micro level whereas the CR-BIS model in this research is used for a macro level study.

The CR-BIS model is relatively easy to explain in scientifically, but not in practice. The reason is that the two sub-systems of CR-BIS are common for any BIS, as a result of taking a generic BIS model from IS literature. Interviewees are confused with this model because, according to their knowledge, any BIS consists of these two sub-systems. Only after knowing the characteristics studied within the sub-systems, could they see the difference. Even so, it was still difficult for them to recognise the special characteristics of CR-BIS model because there are similarities that can be found with other BIS. For example, data communication technology and its characteristic (medium type) can also be studied in different BIS applications as the technology is used by different applications. Another example is data and its characteristics. Sales and inventory data is not limited to the CR context, but also for other logistical programs. This is logical since this data is used for executing different logistical programs. The question is what really makes the CR-BIS model special?

The answer can be found by looking at the situation comprehensively. It is true that sales data can be used for other applications, but the use of this data for continuous updating and monitoring of stock level is only found in CR activity. Furthermore, the focus on the actor responsible for executing the monitoring and decision-making activities can only be found in CR field. In relation to technology, the use of automatic store ordering and exception handling applications in managing stock data are specific to CR programs. It is true that data communication technology medium is a common characteristic of the technology for different study of BIS applications. However, it is only CR that emphasises the medium since communication with business partners is more intensive in CR practice than other practices.

The peculiarity of the model can be understood if it is described comprehensively. It is important in practice to make sure that interviewees understand the model before asking them the questions. The interviews could not be properly conducted until the interviewees had an understanding of the model.

7.5.2 Reflections on research model and implications for practice

The model was developed from general management theories that frame how to find relevant contingency factors that influence CR-BIS configuration. Although the framework is quite complete another source of contingency factors needs to be added in the framework. This group is IT solutions and IT vendor characteristics. The group was initially considered to be part of industry characteristics. However, due to their closer relationship with software industry they cannot be considered as part of food industry. This group is relevant in CR context because they influence how technical solutions are adopted by retail companies.

The contingency factors in this study are identified from various sources. Initially, their influences are assumed to take place in a one-way relationship from the factor to CR-BIS configuration. Inter-relationships between factors are not described in this research model in order to make the research feasible and manageable.

The empirical findings show that the relationship is more complex. Existing IT infrastructure may have a strong relationship with technical solution functionality and flexibility. In addition, suppliers' trustworthiness is always mentioned when the interviewees talk about data sensitivity. Also, the term sensitivity in data sharing is not only determined by the type of data but the quality of data presentation. The same type of data would give different impacts when presented in different details.

The intention here is not to re-establish relationships between all factors. Rather it is intended to identify dominant factors that influence CR-BIS configuration in practice and to explain relationships between those factors. The findings show there are four factors that dominate the advancement of CR practice: data quality, suppliers' goodwill, IT & logistics capability of both parties, and knowledge for executing the CR principle. Relationships between these factors are illustrated in Figure 7.1. A good combination of those factors will create added value to practice advanced CR with business partners. When both companies realise the added value they would extend CR practice to a higher level.

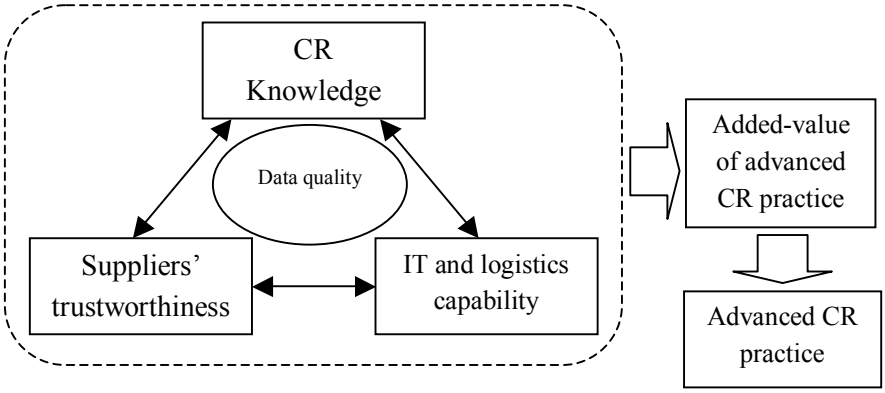


Figure 7.1 Important factors for advanced CR practice

The model in Figure 7.1 indicates that data is the basic need for CR practice. Detailed data gives more insight to suppliers to make better responses to retailers' situations. However, the data must be good quality. The quality is determined by its accuracy, completeness and detail. Those are necessary for advanced data analysis. Due to its importance, data quality is placed in the middle of the model.

More data will be shared if suppliers have proven trustworthiness to keep the data safe and confidential and not use the data to take the retailers' market share. IT and logistics infrastructure are important for this relationship. Technical capabilities are needed to capture, process and communicate data with business partners. IT makes these activities efficient and reliable. From the study it was found that retailers need to add functionalities to identify exceptions in operations and to use this information to adjust their inventory plan and their suppliers' production plan. They also need to improve expandability and openness of data communication systems to enable reliable communication with various suppliers. Advanced IT functionalities need to be present in suppliers' infrastructure as well. Among others are functionalities to revise delivery schedules when there is an exception, and functionality to adapt production schedule due to variations in retail companies. Beside this capability, the partnering companies need to improve the logistics structure as demonstrated by Company D. The company was able to improve technical capability to inform the latest developments in their operation and also improve the distribution structure so the fulfilment process could be done efficiently. If they had kept the old distribution structure they would not be able to get quick responses from suppliers because it would be too costly for those suppliers.

An important aspect to combine these capabilities is knowledge. Knowledge of market, products, consumer behaviour, production, and logistics systems are vital for CR practice. Company B, for example, refused to involve suppliers in inventory management because suppliers did not have the market knowledge to help them make significant progress in the activity. Company D, as the most advanced company in this study, also stated the importance of managing inventory in-store. Beside data sensitivity, the reason for not involving suppliers in store operations was because they did not have significant knowledge of consumer behaviour. It was explained that store operation is strategic to maintain consumer loyalty. To improve the operation they need to study consumer behaviour. This knowledge was not available in suppliers. Logistics knowledge was considered important by Company C because when CR practice is advanced, there are logistical consequences that will happen such as more frequent delivery and change in supply requirement due to changes in consumer behaviour. If suppliers do not have good logistical knowledge then it would be difficult for them to respond properly.

All of these factors contribute to the added-value of data sharing with suppliers and their involvement in inventory management activity of the retailers. The added-value is used as the basis to determine those aspects in their relationship.

Other important findings from the application of the research model in this study are:

1. Technical capabilities cannot be used as a single source to explain the extent of CR practice in the retail companies; there are also non-technical factors that influence this situation.
2. Technology needs to be treated as enabler, not as driver, because otherwise it will create a technology-dependent situation that reduces the awareness of companies to maintain data accuracy and performance of other sub-systems. This concern is also indicated by ECR Europe in their ECR model where IT is considered an enabler for advanced cooperation between retailers and suppliers. According to ECR Europe, the most important thing is application of the main principle of the concept in the model. Technology would make the application more efficient and effective. Hence, it is important for companies to check their IT capabilities whenever they want to improve collaboration with suppliers.
3. A mutual adaptation approach is recommended for improving CR collaboration with suppliers. Mutual adaptation is intended to balance development of internal and external capabilities. However, it is important to focus on internal capability first before external capabilities, because the extent of advanced collaboration with suppliers is determined by the readiness of the internal systems.
4. The consensus approach to improve trust is recommended over the power approach, because not all companies have strong positions in the market and this would enable a win-win situation for both parties.

7.5.3 Reflections on research method

The researcher has been able to capture details of CR-BIS configurations by using the case study method. Interaction between retail staffs and suppliers' agents in store can be comprehended by taking a closer examination of the interactions. This would be difficult if the research was carried out by other methods. The examination of the interaction has extended the researcher's understanding of data sensitivity. Data is sensitive not only because of its type, but also because of its quality. Based on this understanding, the researcher has been able to explain why retailers allow suppliers' agents to collect sales data. In addition, the semi-structured interview as a data collection technique in the case study method, has extended the researcher's ability to identify factors not described in the research model. One of the factors is output stability mentioned by Company B as their reason for not sharing data with their suppliers.

The Critical Incidents Technique (CIT) used to describe changes in CR-BIS configurations has enabled the researcher to balance describing changes that applied to

data, data processing tasks, and data processing technologies as main aspects of the systems. Using this technique, the researcher is able to judge whether the retailers' approaches are balanced.

The aggregation approach used to solve different opinions of interviewees is effective. This is supported by the situation where knowledgeable persons were still in their positions when the interviews were conducted so that they could explain past circumstances.

The historical data collection method allowed the researcher to describe the transition between pre- and post-CR implementation. However, it lacks the ability to portray changes from one CR type to another one because it takes a long time to move from one level to another level. The time is needed to build trust, enhance BIS capabilities and improve other factors as described in Figure 7.1.

The research has been able to achieve construct validity by testing the model in pilot case study and finding expert opinions regarding the constructs in the research model. Internal validity is maintained by empirical findings that support statements in this thesis. The model in Figure 7.1 is also based on empirical findings from the five cases. The external validity is the most difficult to achieve because there are factors that were not considered significant in the case companies. Also, the findings are based on five cases, which are small parts of retail companies implementing the CR principle in the world. This limits the applicability of the research findings to a broader domain. Reliability is achieved in this study by presenting a clear definition of concepts, the research process, case study protocol, and interview questions as seen in Appendix 1. Also, by taking time to explain the concepts and models to the interviewees the researcher believes that they have a common understanding of the research problem and objectives. This is arguably a basis for obtaining reliable answers from the interviewees.

7.5.4 Reflection on cultural influence

Power distance and the individualism characteristics of a country were expected to influence Information Systems configuration. Power distance is expected to influence the condition of data sensitivity and individualism the condition of suppliers' trustworthiness. Additionally, the two dimensions of national culture are expected to moderate the influences of contingency factors on CR-BIS configuration. This study could not confirm the expected moderation effect though it confirms the antecedent effect of those cultures on data sensitivity and supplier trustworthiness in Indonesian cases. This was the case because there are other factors beside the expected ones or because the findings were different from the expectations.

As mentioned in section 6.4, unexpected outcomes of antecedent and moderation effects of national culture on contingency factors may be interpreted in different ways:

1. Hofstede theory on national culture is not universally applicable,
2. Hofstede theory on national culture is not appropriate for the context of this study,
3. The theory is applicable but limited to CR practice on warehouse level and (based on the fact that the two Dutch retailers have implemented SMI on warehouse level while Indonesian retailers still considered warehouse data sensitive and distrusted suppliers to handle warehouse data),
4. There is another mechanism that links national culture and contingency factor,
5. The theory is applicable when similarities in national culture are considered,
6. The case companies are not cultural representatives of each country, or
7. Culture is not a main determinant in CR-BIS configuration.

In section 6.4 it is argued that possibilities 3 and 6 are more likely in this study because there is evidence that supports their validity. However, the other possibilities are still applicable. In order to check their validity a further study is needed (discussed in section 7.7).

7.6 Research contribution

This study has extended the focus of CR study from data sharing issues between retailers and suppliers to a wider context of Business Information Systems (BIS). Data, process and technology as BIS aspects cannot be separated in CR practice. The study of data sharing configuration needs to be accompanied by study of process and technology configuration involved in data sharing activities. This will provide complete knowledge about how companies configure their systems to adopt the CR principle.

In addition, this study describes the development of BIS capabilities and configuration in retail companies that can be used to show how those companies add their BIS capabilities from time to time. From this description, one may notice that companies use different approaches to be able to adopt the CR principle. This approach was not described in the literature. The study identified two approaches: technology-driven and mutual-adaptation approaches. Comparison between the two is also described by taking examples in this study.

Another contribution of this research is the explanation of contingency factors that influenced not only CR-BIS configuration within the companies, but the approach companies used in improving their internal systems' capabilities for CR adoption. The model in Figure 7.1 is a contribution regarding key factors that influence the added-value of development of the CR practice in retailer-supplier relationships. The model shows that Information Technology (IT) is not the only influential factor.

The research support existing theory that suppliers need to have the capability to perform advanced CR practice, which are capability to handle logistical consequences

of the advanced practice, capabilities to support real time data sharing, and knowledge of retail operations to handle the shared data.

The literature states that internal systems, costs, and trust are the key factors that influence the extent of CR practice between retailers and suppliers. The findings confirm that internal systems and trust are key factors, but not cost in this context. This is because the research takes the retailers' perspective in exploring the factors. Cost will be considered if the research takes the suppliers' perspective. From their perspective, advancing CR practice is expensive because they would need to do more delivery to retail warehouses or stores.

Deviation from the literature was found regarding the influences of culture on contingency factors influences (antecedent role) and on the contingency factors' influences on CR-BIS configuration (moderation role). This study has contributed seven reasons that can be used to explain the deviation. However, it is not clear whether the reasons can be applied generally. Hence, a further study of cultural aspect in CR practice needs to be conducted to check the validity of those reasons.

7.7 Recommendations and further research

Recommendations from the case studies are as follows:

1. Evaluation of suppliers' added-value is important to the development of advanced CR practice. Added-value is the function of the risks and benefits of involving suppliers.
2. The added-value will be higher if both companies have capable and compatible IT and logistics infrastructures.
3. Internally and externally balanced focus is needed in any stage of CR development. Internally balanced focus is needed to develop an accurate and capable data handling system and externally balanced focus to develop the ability to motivate suppliers to create better added-value and accurately gauge timing to advance CR practice to a higher level.
4. Since culture influence was less obvious, it is recommended to use cultural perspective carefully in configuring CR-BIS in order to avoid ineffective configurations.
5. It is necessary to refine the theory of cultural influence by incorporating different set of cultures (global, national, organisational and individual) into the relationship of contingency factors and CR-BIS configuration; by recognising different relationships between contingency factors a more comprehensive understanding of cultural influence on contingency factors and their influence on CR-BIS configuration can be obtained. It is also necessary to consider heterogeneity in data collection that may affect the assumptions of each national culture theory and check the appropriateness of the companies in representing their national culture.

It was found that trust is a basic issue in advancing CR practice. Trust was defined as retailers' belief that suppliers will not use their proprietary data to enter their market or negotiate with their competitors for products and prices that will reduce their profitability. This concern raised two questions:

1. How can suppliers build market knowledge based on retailers' proprietary data?
   Literature on knowledge building is needed in order to answer this question. The literature would give information on how knowledge is built from different kinds of information and how data quality influences the resulting knowledge. This requires a study on impacts of different data sharing scenarios with suppliers on suppliers' knowledge building activities. An answer to this question can be used to measure the extent of suppliers' threats to the retailers' market share.

2. What is the impact if suppliers use the data to negotiate with the retailers' competitors?
   This is still unknown exactly because what was found in literature only concerned retailers. Empirical proof was not available and the impacts varied. In one situation it would benefit suppliers, but in another it would benefit retailers. A comprehensive study needs to be conducted and carried out in a real setting.

3. How can Category Management practice improve the trust level between retailers and suppliers?
   Indonesian retailers stated that CM practice would be used to enhance their knowledge of suppliers' trustworthiness. This may sound applicable, but the practice itself is complex because many aspects of CM practice may contribute towards this goal, or become barriers in realising the goal.

Research into these issues would be useful in advancing CR practice because these are the basic concerns of retailers. If those issues are clear, then retailers will be able to make a better plan to advance their CR relationship with suppliers. For science, the study of these issues is valuable in explaining how retail data can be converted into valuable knowledge by suppliers, how data use by competitors reduces retailers' bargaining position in the market, and how trust can be built by a consensus approach. The first study will contribute toward the knowledge of important data and conditions and steps for converting retail data into retail knowledge. The second study will contribute toward knowledge of conditions or factors in which data use by competitors reduces retailers' bargaining position. The third will contribute toward the knowledge of steps and factors for building trust with a consensus approach. This will enhance the body of knowledge of trust building.

Further study needs to be conducted on cultural influences in CR practice, especially on CR-BIS configuration since the case study findings could not confirm the expected cultural influence. For this it is recommended to refine the theory of culture by studying a different set of cultures within the case studies, investigating influencing mechanisms of national culture on contingency factors, considering heterogeneity in data collection, and enlarging the number of case studies. By doing this more insight about national culture influence on contingency factors and their influences on CR-BIS configuration can be expected. It will help CR-BIS designers to find an optimal design and implementation plan in their own context.

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Appendix 1 – Interviewees and list of questions in the interview

A. List of interviewees

Below are interviewed functions in case companies:

- Logistics manager
- Information Systems (IS) or Information Technology (IT) manager
- Operation manager
- Merchandising manager
- Supermarket manager
- Supervisor in the store

B. Questionnaire

The list below is not exhaustive since the interview is semi-structured and there may be some questions not on the list.

General questions

Questions in this category were addressed to explore the existing conditions in the retail industry especially about retailer-supplier cooperation for inventory replenishment. The questions were:

1. What grocery retailer types that can be found in the industry? (e.g. mini market, supermarket, hypermarket, etc)
2. What is the composition of this number? (number or each category)
3. Who are the leading retailers in the industry?
4. What is the bargaining position of retailers relative to suppliers?
5. How do retailers perform their inventory replenishment function in general?
6. How do retailers utilise Information Technology to perform this function?
7. What kind of data that is shared between retailers and suppliers in general?
8. How do retailers share their data with suppliers?
9. What is the possibility of CR implementation in the industry?
10. What might be the influential factors that create this situation?
11. How was the national ECR body established?
12. What are the missions and programs of the ECR body?
13. What parties are involved in this organisation?
14. How is the awareness of CR among Indonesian retailers?
15. Who is more knowledgeable between retailers and suppliers about CR and inventory replenishment at retailers' side?
16. How is the retailer's IT infrastructure compared to suppliers'?

17. Who is more knowledgeable or advanced between retailers and suppliers about Information Technology (IT) utilisation for inventory replenishment?
18. How is the national logistics infrastructure in general?
19. How is the national IT infrastructure in general?
20. How is the legal framework regarding inter-organisational data exchange or companies' data confidentiality?

Company-specific questions

Those questions were addressed for each company. The questions were grouped into four categories: general condition of the company, data sub-system specific, technical sub-system specific, process sub-system specific, and managerial sub-system specific. The questions were:

A. General condition of the company

1. What is the official name of the company?
2. When did the company start its business?
3. What is the mission of the company?
4. What is the market share of the company?
5. What is the bargaining position of the company in the industry relative to its suppliers?
6. How many Distribution Centres (DCs) does the company have?
7. How many stores does the company own?
8. How many items or Stock Keeping Units (SKUs) are currently managed by the company?
9. How many staffs are employed by the company?
10. When did the company join ECR Indonesia?

B. Question regarding data sub-system

1. What data is exchanged between the company and its suppliers?
2. Is this limited to suppliers with specific characteristics? If yes, please mention those specific characteristics.
3. Were there any changes regarding data exchange with suppliers in the past? If yes please mention.
4. What might be the influential factors that cause changes from past to existing configuration in data sub-system?
5. What is the future plan of the company regarding data sharing with suppliers?
6. Why did the company devise such plan?
7. What is the strategic data for the company?
8. What strategic policy did the company make using this data?
9. What would be the effects if the company shares this data with suppliers?

10. How sensitive is the data to the company?
11. How accurate is the inventory-related data?
12. To what extent data accuracy influence data sharing policy with suppliers?
13. What capabilities are provided by the company's IT infrastructure for data sharing relationship with suppliers?
14. How does the IT infrastructure influence data sharing policy with suppliers?
15. How does the company think of its bargaining position with suppliers?
16. How does the company think about the influence of this position on data sharing agreement between the company and its suppliers?
17. What is the standard that is used by the company for product identification?
18. What kind of technical knowledge is available in the company?
19. To what extent does the company's technical knowledge influence its decision to adopt a specific standard for product data?
20. What is the importance of adoption rate of the standard to the company?
21. What would be the barrier from suppliers' side if the company considers data sharing with them?
22. What does the company think about suppliers' trustworthiness in handling its inventory-related data?
23. What does the company think of suppliers' IT infrastructure capability to support the data handling?
24. What does the company think of suppliers' knowledge in handling its inventory-related data?
25. What knowledge is lacking on suppliers' side?
26. Is there any industry regulation that can give protection for company's data from any misuse?
27. What is the company's opinion about the effectiveness of the regulation to encourage them to share data with suppliers?
28. What is the company's opinion about the existence of ECR Indonesia as a medium to promote and enable more intense data sharing with business partners?

C. Questions regarding technical sub-system

1. What are the IT components used to record sales, stocks and other inventory related data?
2. What are the IT components used to process those data?
3. What are the IT components for communicating or sending business documents with suppliers?
4. What kind of business application is the company using for handling those data?
5. What are the functionalities that can be provided by the IT components above for inventory data handling?
6. Who are authorised to utilise those functionalities in the companies?

7. What are the differences regarding the access to those functionalities?
8. How the IT components and their functionalities are deployed within the company in order to perform CR?
9. How do different functions in the company communicate in performing CR?
10. Are there any changes in the past regarding those IT components?
11. What were the reasons of using those components in the past?
12. Why were they changed into the current ones?
13. What is the significance of the company's existing IT infrastructure in selecting future infrastructure?
14. What is the significance of suppliers' IT infrastructure in selecting the appropriate IT components for CR implementation in the company?
15. What is the influence of supplier companies in determining the future IT components for CR implementation in the retail company?
16. What is the importance of suppliers' IT infrastructure flexibility in the selection of IT solution for CR implementation in the company?
17. How does the company develop its technical knowledge for dealing with future IT needs?
18. How does this knowledge compare to suppliers' knowledge?
19. To what extent does this difference influence technical solution selection in the retail company?
20. How does the company manage to develop their IT infrastructure?
21. Does the company perform systematic analysis on IT solutions in the market?
22. What are the important characteristics of the solution to be considered?
23. How good is the selected solution in terms of functionality, flexibility, security, and vendor support?
24. How high is the adoption rate of the solution in the industry?
25. Who recommended this solution to the company?
26. How did the company know this solution?
27. How much does the solution cost?
28. Is it the cheapest solution in the market? If not, why did the company select the solution?

D. Questions regarding process sub-system

1. Is the company practicing CR principles?
2. How is the principle carried out in the company?
3. What are the organisational functions needed to perform this principle?
4. Are there any changes in past regarding the execution of the principle?
5. Why did the company choose that configuration in the past?
6. What was the reason to change that configuration into the existing one?

7. What are the necessary changes regarding the execution of the same principle in the future?
8. What will be the company's next plan regarding CR implementation?
9. To what extent will the company collaborate with the suppliers?
10. What is the reason to choose that future arrangement?
11. What would be the barriers in introducing new practice in the company?
12. What would be the facilitators in introducing the new practice?
13. What is the importance of inventory management tasks to the company?
14. What is the strategic benefit of doing the tasks alone?
15. To what extent does the strategic importance of the tasks influence tasks assignment between the company and their suppliers for CR implementation?
16. How does the company select personnel for performing necessary functions for implementing CR?
17. Is there any requirement for work experience prior to entering this function?
18. What kinds of CR-related trainings or tutorials that were given to those personnel?
19. Are there any specific knowledge needed for making decision over inventory replenishment?
20. Does the company think that its suppliers posses this knowledge?
21. Would the company delegate the execution of CR to suppliers if they have the necessary knowledge? If not, why?
22. Are there any time-critical tasks in the company regarding implementation of CR principle?
23. Why do those tasks become time-critical?
24. What would be the impacts if those tasks are delegated to suppliers?
25. What would be the benefits of extending data sharing relationship with suppliers over the existing configuration?
26. Have the company introduced this idea in the company? What was the reaction of employees?
27. How does IT infrastructure influence the assignment of responsibilities in performing CR in the company?
28. Does the company think that its suppliers have capable IT infrastructure to help them performing CR?
29. Would the company delegate the execution of CR to suppliers if they have this capability? If not, why?
30. What about the trustworthiness of suppliers in handling the data?
31. What does the company perceive about this issue?
32. To what extent this issue influence data sharing relationship between the company and its suppliers?
33. Is there any influence of the company's market power on the tasks assignment?
34. What are the influences?

35. What would be changed if the relative market power is changed?
36. What knowledge is available in the suppliers' side for the execution of the tasks?
37. What knowledge needs to be improved for the execution of the tasks?
38. To what extent does this knowledge influence tasks assignment between the company and their suppliers?
39. How fast do suppliers react to company's orders or requests for inventory replenishment?
40. Does the company think that this reaction time can be improved in the future? If yes, would the company delegate the execution of CR principle to suppliers after they make this improvement?
41. What is the service level of the company's suppliers?
42. What is the influence of the service level on configuration of process sub-system for CR implementation in the company?
43. What will be the influence of service level improvement on configuration of process sub-system for CR implementation in the company?

E. Questions regarding managerial sub-system

1. How is data control function performed in the company?
2. How does the company perform internal data control?
3. How does the company perform external data control?
4. Who is responsible for each type of data control?
5. What is the formalisation of this function?
6. What was the reason to apply this kind of formalisation?
7. Is there any formal discussion in the company to talk about the possibility to give more access on internal data to business partners?
8. How does the company conduct the discussion?
9. Does the company prepare any specific measure to assess suppliers' performance in handling the shared data?
10. Does the company have a strong position in the market to enforce the measure?
11. How does the company's market position influence their strategy for controlling data sharing activities with suppliers?
12. To what extent does this position influence the formality of the control?
13. What is the importance of having legal systems to protect companies from any fraud or data misuse by suppliers?
14. Is this kind of legal system available in the country?
15. What is the effectiveness of this legal system to protect company's proprietary data?
16. Does it encourage the company to give more data to the suppliers?
17. What is the importance of ECR body in helping the company to perform data governance?

18. What kind of support that is offered by the ECR body regarding data governance?
19. What is the influence of the body on company's tendency toward data sharing?
20. What is the influence of the body on data control mechanism as applied by the company?

Research-model specific questions

1. What do you think about the CR-BIS model?
2. Is it easy to understand the model?
3. What is your for input for improving the model?
4. What do you think about the contingency factors?
5. Are those relevant factors to be studied in CR context?
6. What do you think about the causal relationship between the contingency factors and the arrangement of CR-BIS aspects?
7. Do you have any suggestion to improve the overall research model?

Research method specific questions

1. How to carry out the data collection techniques properly in the field?
2. What are the important things to be considered when conducting interviews?
3. What are the important things to be considered when conducting observation?
4. What are the important things to be considered when conducting document study?
5. Is the case study protocol executable in the field?
6. What are the things that need to be improved in the protocol?
7. Is different approach of asking questions required for different companies? If yes, how to develop a proper approach?

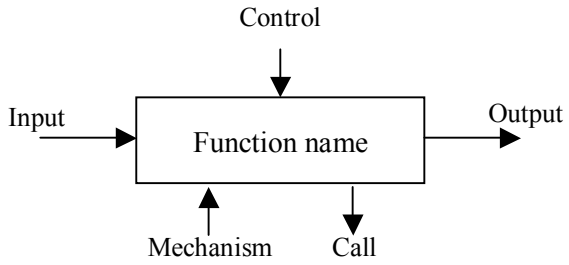
Note: questions for research model and method are mainly addressed in pilot case studies. During in-depth case studies questions are addressed in order to reflect on the research model and method. The feedback is not used to change the research instruments.

Appendix 2 – IDEF0 diagram

This is based on a Federal Information Processing Standards Publications document issued by National Institute of Standards and Technology on 21st December 1993. The document described the rules and technique in IDEF0 to produce a function model. A function model is a structured representation of the functions, activities or processes within the modelled system or subject area.

IDEF0 is based on SADT (Structured Analysis and Design Technique) developed by Douglas T. Ross and SofTech, Inc. The IDEF0 diagram can be used to develop a new system or to analyse an existing system. For the existing system it is used to analyse the functions the system performs and to record the mechanisms (means) by which these are done.

The original publication contains many aspects of IDEF0 diagram. The description in this appendix only covers the box and arrow semantics used to describe activities in process sub-system of CR-BIS. The representation is modelled in a figure below.



The representation consists of one box in the middle and four arrows on the sides. The middle box contains the name of function or tasks. A task requires input(s) that will be converted into output(s). The control item is used to specify the conditions for the function to produce correct output. Mechanisms are means that are involved in the tasks execution. A mechanism may be inherited from the parent box if the function is a sub-diagram of a higher diagram. A call arrow is used when the task requires some resources from other functions. This box is linked with another box on the same level to show a series of process executions.

Appendix 3 – Symbols in computer networking diagram

The symbols are adapted from Microsoft Windows® 2000 Resource Kit Deployment Lab Scenarios network diagram[20]. The following figure shows some symbols in the resource kit that will be used to depict a computer network in this thesis.

Symbols	Meaning	Applications
	Business documents	Used to describe business documents transferred electronically or manually from retailer to suppliers
	Personal Computer	Used to describe any use of personal computer in the process and also represent cash register machine or other machines with similar functions
	Server	Used to describe Point-Of-Sales data server and Application Server
	Data communication	Used to describe basic data communication such as LAN or manual data communication flow
	Dial-up connection	Used to indicate a connection between entities that needs a dial-up to a server or other computing machines
	Internet	Used to indicate a web-based connection between entities

[20] Please refer to http://www.microsoft.com/windows2000/techinfo/reskit/deploymentscenarios/scenarios/scenarioslegend.asp