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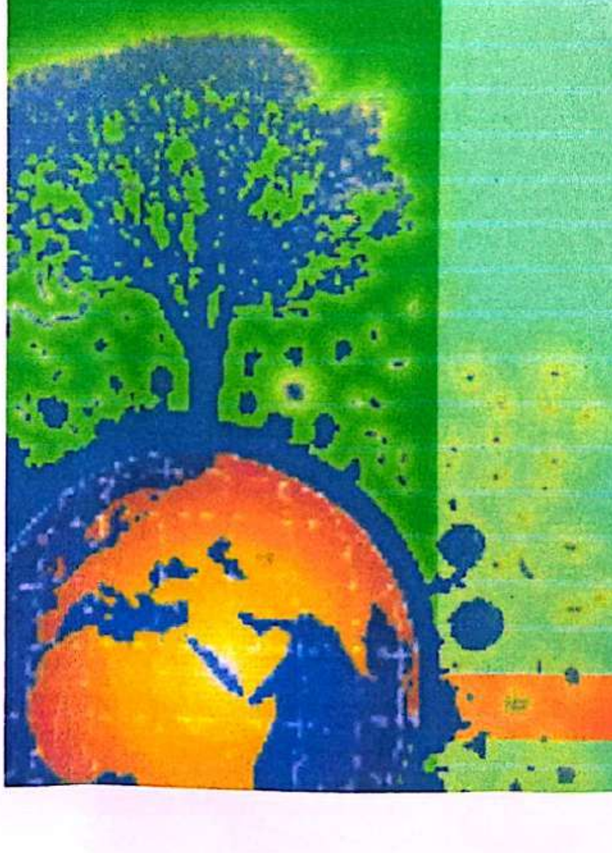
SECOND ANNUAL INTERNATIONAL CONFERENCE 2009

ON GREEN TECHNOLOGY AND ENGINEERING



ENGINEERING FACULTY
MALAHAYATI UNIVERSITY
BANDAR LAMPUNG
INDONESIA

MECHANICAL, INDUSTRIAL AND SCIENCE VOLUME 2

PROCEEDING

SECOND ANNUAL UNIVERSITAS MALAHAYATI INTERNATIONAL CONFERENCE ON GREEN TECHNOLOGY AND ENGINEERING

On April 15-17th, 2009

Editor :

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UNIVERSITAS MALAHAYATI
BANDAR LAMPUNG
2009

FOREWORD

The second (2nd) International Conference on Green Technology and Engineering 2009 (ISGTE2009), Faculty of Engineering Universitas Malahayati, was conducted on 15-17 April 2009. The conference was organized by Faculty of Engineering and collaborated with International Islamic University Malaysia (IIUM) and University Putra Malaysia (UPM).

The participants of the conference are about 300 participants come from 9 countries and more than 60 higher institutions, among others: Unhas, ITS, UI, Tri Sakti, ITB, Unila, Unsri, Unibraw, Unpad, Undip, Unsyah, UPM (University Putra Malaysia), IIUM (International Islamic University Malaysia), UTM (University Technology Malaysia), UTHM, University of Pashawar Pakistan, Univ. Melbourne Australia, Tokyo Institute of Technology Japan, Yangon Technological Univ., and others, which reflect the importance of Green Technology and Engineering. The concept of sustainable development based on the environmental firmament nowadays has become central issues in many developing as well as developed countries. These issues are very important and the topic of this issue can create awareness of the societies to involve in the development of their country toward the sustainable development.

The conference provide platform for researchers, engineers and academician to meet and share ideas, achievement as well as experiences through the presentation of papers and discussion. These events are important to promote and encourage the application of new techniques to practitioners as well as enhancing the knowledge of engineers with the current requirements of analysis, design and construction of any engineering concept. The conference also functions as platform to recommend any appropriate remedial action for the implementation and enforcement of policies related to environmental engineering fields. Furthermore, this seminar provides opportunities to market faculties' expertise in the field environmental engineering, civil engineering, structural engineering, mechanical engineering and so on.

On behalf of Steering Committee, we would like to express our deepest gratitude to the Foundation Alih Teknology, Rector Universitas Malahayati, International Advisory Board members, the Keynote speakers, and to all participants. We are also grateful to all organizing committee and all the reviewers, without whose efforts such a high standard for the conference could not have been attained. We would like to express our deepest gratitude to the Faculty of Engineering Universitas Malahayati for conducting such conference.

Bandar Lampung, 15 April 2009

Agung Efriyo Hadi
The Organizing Chairman

SECOND ANNUAL UNIVERSITAS MALAHAYATI INTERNATIONAL CONFERENCE ON GREEN TECHNOLOGY AND ENGINEERING

On April 15-17th,2009

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CONTENT

SCIENCE ENGINEERING

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The Second International Conference
On Green Technology and Engineering (ICGTE) 2009
Faculty of Engineering Malahayati University

Agile Supply Chain and its Implications on Green Logistics Performance

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ABSTRACT

An agile supply chain is regarded as a dominant competitive advantage in the business of today. While agility is accepted widely as a winning strategy for growth, even a basis for survival in certain business environments, the idea of creating agile supply chains has become a logical step for companies. The main focus is on running businesses in network structures with an adequate level of agility to respond to changes as well as proactively anticipate changes and seek new emerging opportunities. Agility in individual companies can be considerably hindered by the degree of complexity in terms of brands, products, structures and management processes. Therefore, in order to achieve supply chain agility, companies must change dynamically alongside with the market changes, and should reduce as possible the unnecessary complexity of their systems. It is important to determine the impact of complexity and rigidity, under an agile environment, on Green Logistics performance.

Keynotes : Agile Supply Chain, Green Logistics performance, Agile Environment.

1. Introduction

At the beginning of the 21st century, companies have witnessed a period of changes unparalleled in the history of the business world in terms of technological innovations, globalization of markets, and more aggressive customer demand. Based on previous studies, Lin *et al.* (2006) have summarized and categorized the general areas of change in business-to-business2 (B2B) environment as follows : 1) market volatility ; 2) intense competition; 3) changing customer requirements; 4) accelerating technological change ; and 5) change in social factors. Consequently, companies face a situation where they cannot really know what tomorrow will bring – tomorrow's requirements and challenges are unknown and will only become known tomorrow. Companies can no longer reliably predict the future and plan for it (Kidd : 2001). The changes that affect the 21st century manufacturing companies are summarized in Figure 1.

The emerging business paradigm agility addresses new ways of running companies to meet these challenges, and deploys a market driven innovative capability, which will be the main source of competitive advantage in the future (e.g. Goldman *et al.*, 1995; Gunasekaran & Ngai, 2004; Lin *et al.*, 2006) (Fig. 2). According to Goranson (1999), agility is something separate from being better, faster, cheaper, or merely being profitable today; rather, it is the ability to be profitable tomorrow, by being better, faster, and cheaper in different ways. It relates to companies of all sizes and across all industry sectors (Goldman *et al.* 1995).

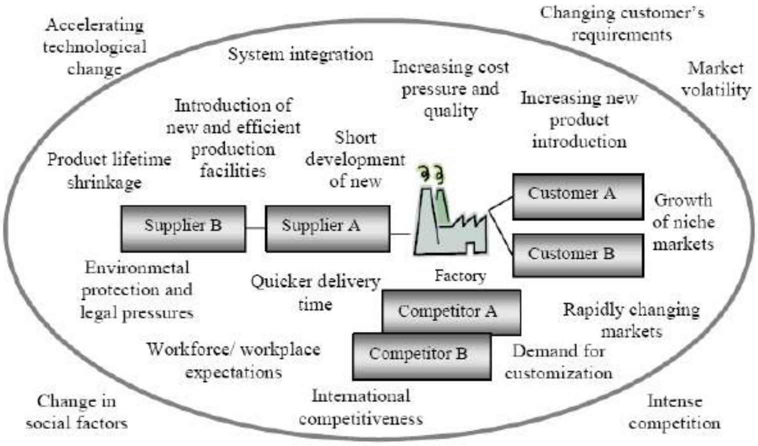

Figure 1. The business environment of the 21st century.

Based on a survey of past decade management literature, van Hoek *et al.* (2001) identify the two most significant lessons for achieving competitive advantage in the modern business environment. One lesson is that companies have to be aligned with suppliers, the suppliers' of the suppliers, customers and the customers' customers, even with the competitors, so as to streamline operations. As a result, individual companies no longer compete solely as autonomous entities; rather, the competition is between rival supply chains, or more like closely coordinated, cooperative business networks (Christopher 1998, Lambert *et al.* 1998a). Another lesson is that within the supply chain, companies should work together to achieve a level of agility beyond the reach of individual companies (van Hoek *et al.* 2001). All companies; suppliers, manufacturers, distributors, and even customers, may have to be involved in the process of achieving an agile supply chain (Christopher 2000, Christopher & Towill 2001).

The logistics industry has responded to the environmental imperatives is not unexpected, given its commercial and economic imperatives, but by virtually overlooking significant issues, such as pollution, congestion, resource depletion, means that the logistics industry is still not very 'green'. This conclusion is borne out by published surveys. Murphy et al (1994) asked members of the Council for Logistics Management what were the most important environmental issues relating to logistics operations. The two leading issues selected were hazardous waste disposal and solid waste disposal. Two thirds of respondents identified these as being of 'great' or 'maximum' importance. The least important issues identified were congestion and land use, two elements usually considered of central importance by environmentalists. When asked to identify the future impact of environmental issues on logistical functions, again waste disposal and packaging were chosen as leading factors. Customer service, inventory control, production scheduling – logistical elements –were seen to have negligible environmental implications.

2. Conceptual framework of an agile supply chain

The supply chain concept deals with the management of material, information and financial flows. Information on customer demand flows upstream from the market place, and ultimately, to the raw material supplier, and material flows downstream, ending up as physical products satisfying end-customer demand (Towill & McCullen, 1999).

According to Christopher (1998), instead of the term "supply chain", it would be more accurate to use the terms "supply network" or "supply web" to describe the net-structure of most supply chains. He emphasizes the network-nature of his supply chain definition: *"Supply chain is a network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer".*

According to Bovet & Martha (2000), a supply chain includes activities such as material sourcing, production scheduling, and the physical distribution system, backed up by the necessary information flows. Procurement, manufacturing, inventory management, warehousing, and transportation are typically considered part of the supply chain organization. Marketing, sales, finance, and strategic planning are not. Product development, demand forecasting, order entry, channel management, customer service, and accounts payable and receivable lie in a grey area; in theory, they are part of the supply chain process, but they are seldom included within the supply chain organization. Importantly, it also embodies the information systems so necessary to monitor all of those activities. (Bovet & Martha 2000.).

Agility was first introduced as a management paradigm in 1991, when the Iacocca Institute of Lehigh University, USA, released its report "21st Century Manufacturing Enterprise Strategy: An Industry-Led View" (Kidd 1994). Agility has been expressed in different ways. First, agility has its roots in time-based competition (Stalk & Hout 1990), and fast-cycle innovation (Tidd *et al.* 1997), and it is built on a foundation of some, but not all, of the practices common to lean thinking (Womack *et al.* 1990). Second, agility has been introduced as a total integration of business components (people, technology, and other organization and business elements) (Kidd 1994, Montgomery & Levine 1996). Third, agility has been represented as the flexibility of the above-mentioned business components working towards a common goal (Christopher & Towill 2001, Montgomery & Levine 1996, Goranson 1999). The European Agile Forum (2000) defined agility as follows : *"Agility is the ability of an enterprise to change and reconfigure the internal and external parts of the enterprise - strategies, organization, technologies, people, partners, suppliers, distributors, and even customers in response to change unpredictable events and uncertainty in the business environment".*

Agility in a supply chain, according to Ismail & Sharifi (2005), is the ability of the supply chain as a whole and its members to rapidly align the network and its operations to dynamic and turbulent requirements of the customers. The main focus is on running businesses in network structures with an adequate level of agility to respond to changes as well as proactively anticipate changes and seek new emerging opportunities. Compared with the general definitions of agility, agility in a supply chain context might be defined simply as (Sharp *et al.* 1999):

"Agility is the ability of a supply chain to rapidly respond to changes in market and customer demands".

In the 1990s, the research interest was focused on finding systematic ways for manufacturers to approach agility in their supply chains. Van Hoek (2005) observes that three characteristics of supply chain operations can be earmarked as directly related to becoming agile: 1) mastering and benefiting from variance, 2) rapid responsiveness, and 3) unique or small volume responsiveness. In addition, many researchers provide conceptual overviews, different reference and mature models of agility (e.g. Kidd 1994, Dove 1994, Preiss *et al.* 1996, Goldman *et al.* 1995, Gunasekaran 1999, Sharp *et al.* 1999, Christopher 2000, Sharifi & Zhang 2001, Yusuf *et al.* 2001, Weber 2002). Based on a review of the normative literature, Lin *et al.* (2006) designed a conceptual framework of agile supply chain, culminating in many research propositions (Figure 2).

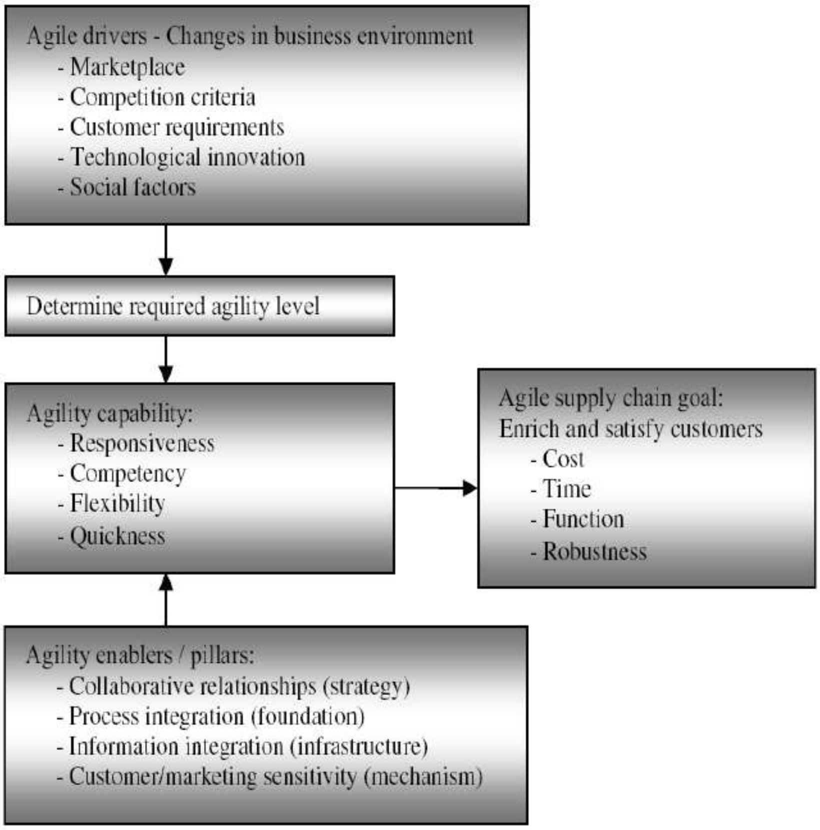

Figure 2. Conceptual framework of agile supply chain (Lin *et al.* 2004).

The ultimate goal for an agile supply chain is to enrich and satisfy customers. In the framework of Lin *et al.* (2006), the customer-satisfied objective is illustrated in four paradigms; cost, time, function and robustness.

3. Green Logistics

Painting logistics "green" is not easy, however. Rodrigue et al. (2001) state that there are basic inconsistencies between "greenness" and "logistics". The cost-saving strategies followed by logistic operators are often at variance with the environment, since they usually externalize the environmental costs. Furthermore, logistical activities do not usually pay the full costs of using the infrastructures. As a result, logistical operators use the most polluting, least energy efficient and most infrastructure-intensive transportation modes to increase the speed of distribution. As the authors describe, globalization and global logistics are harming the environment unevenly because firms are required to maintain high environmental standards in developed countries but can lower these in less developed. Table 1 summarizes the major characteristics of these conflicts. The "Outcomes" column lists the positive effects on the logistics companies and the "Paradox" column the negative effects on society.

Table 1. The paradoxes of Green Logistics (Rodrigue et al., 2001)

Dimension	Outcomes	Paradox
Costs	Reduction of costs through improvement in packaging and reduction of wastes. Benefits are derived by the distributors	Environmental costs are often externalized
Time/ Flexibility	Integrated supply chain. Provide flexible and efficient physical distribution systems	Extended production, distribution and retailing structures consuming more space, more energy and producing more emissions
Network	Increasing system-wide efficiency of the distribution system through network changes (Hub and Spoke Structure)	Concentration of environmental impacts next of major hubs and along corridors. Pressure on local communities
Reliability	Reliable and on-time distribution of freight and passengers	Modes used, trucking and air transportation are the least environmentally efficient
Warehousing	Reducing the needs for private warehousing facilities	Inventory shifted in part to public roads, contributing to congestion and space consumption
E-commerce	Increased business opportunities and diversification of the supply chains	Changes in physical distribution systems towards higher levels of energy consumption

Environmental impacts of logistical activities are most severe where population densities are highest; i.e. in cities. Therefore, city logistics deserve special attention. Taniguchi et al (2003) set three basic pillars as the guiding principles for green city logistics: mobility, sustainability and livability. These pillars should support and enhance the goals and objectives of logistics, such as efficiency, congestion alleviation, energy conservation etc. The harmonization of efficiency, environmental friendliness and energy conservation is vital for ensuring sustainable development of freight transport in urban areas. Consequently, the goal of city logistics should be to deliver and collect the goods for activities produced in a city in an efficient way, without disrupting the sustainable, mobile, livable and environmental friendly character of the city.

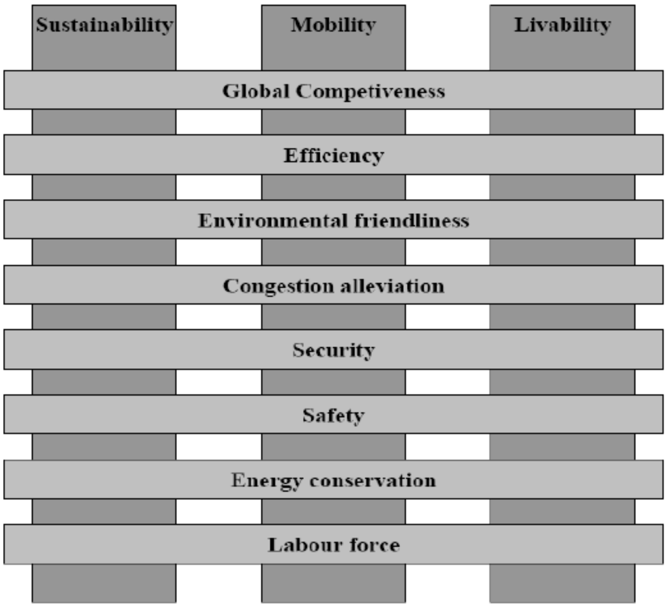

Figure 3. Structure of visions for green city logistics (Taniguchi et al, 2003)

4. Potential Implications of Supply Chain Agility on Green Logistics Performance

Naylor et al (1999) define the Agility characteristics as the use of market knowledge, integrated supply chain value stream/virtual corporation, lead-time compression, rapid configuration and robustness. It is important to discuss these characteristics, in order to integrate contribution of other authors.

- **Use of Market Knowledge**: 'the nature of the end-user or market sector as a whole will have a direct impact upon which paradigm will be the most apt for any supply chain or part of a supply chain' (Naylor et al 1999). Stalk and Hout (1990) stated that if market knowledge if not exploited, 'the supply chain run the risk of producing a wide variety of products at short notice when there is not demand for them'. 'The Agile supply chain is market sensitive, so it is capable of reading and responding to real demand' (Christopher and Towill 2000). Other authors have stated that information transparency (Narasimham and Das 1999, Christopher and Towill 2000) and market as a coordinated mechanism (White et al., 2005) are important characteristics of supply chain Agility, and they are directly related to use of market knowledge. For Green Logistics purpose, it is important to determine the impact of effective use of market knowledge on transport performance, linking use of market knowledge to obsolesce levels within the supply chain. Obsolesces can potentially increase the requirements for reverse logistics, but this need to be verify with a robust methodology.

- **Integrated supply chain/virtual corporation**: Naylor et al (1999) said that 'the goal of an integrated supply chain is to remove all boundaries to ease the flow of materials, cash, resources and information'. Stream lined material flow and virtual integration are strategic aspects of an Agile supply chain (Mason-Jones et al 2000, Christopher and Towill 2000, White et al 2005, Van Hoek 2001), since all the supply chain members need to be electronically linked to be prepared to respond to sudden changes in the market place. However, the level of complexity that supply chain integration caused should be taken into account, and the impact that integration has on Green Logistics performance needs to be determined.

- **Lead-time compression**: according to Naylor et al (1999), lead-time compression is one of the three foundation characteristics of Lean-thinking and Agility. Lead-time compression can be achieved by applying 'inventory and transport consolidation' (Childerhouse et al 2002, Naim and Barlow 2003). In this sense, one example of best practice is 'Honda improves its transportation efficiency by promoting a modal shift to transportation by ship and rail as well as joint transportation with other companies' (Honda Annual Report 2005). However, the effects of inventory and transport consolidation on Green Logistics performance should be tested more, so it could be determined what means inventory and transport consolidation in terms of CO_2 emissions.

- **Rapid reconfiguration**: in an agile supply chain, 'the ability of "rapidly reconfigure" the production process is essential' (Naylor et al 1999). Postponement and Modularity are basic aspects of effective supply chain reconfiguration. Manufacturing and Logistics Postponement are the result of increase in product variation, and the supply chain needs to absorb their potential increase in costs (Childerhouse et al 2002). Other authors have emphasised that Product Modularisation is key to achieve Agility in the supply chain (Narasimham and Das 1999, Barlow et al 2003). However, in order to determine its impact on Green Logistics performance, it is important to investigate this characteristic in a more in-depth way.

- **Robustness**: 'An agile manufacturer must be able to withstand variations and disturbances and indeed must be in a position to take advantage of these fluctuations to maximise their profits' (Naylor et al 1999). According to Christopher and Towill (2002), 'agile supply means reserving capacity to cope with volatile demand. Whereas information transparency is desirable in a lean regime, it is obligatory for agility'. This means that the Agile supply chain needs spare capacity to respond to rapid changes in the market demand, where this changes are usually unpredictable. Therefore, in order to have a robust agile supply chain, there should be spare capacity in key processes within the supply chain; this is more evident in supply chain members that are closer to the end customer. However, from a transport perspective, spare capacity can potentially mean poor delivery performance in terms of in-full loads. This can also have some negative impact on the environment. However, there are alternative ways to mitigate this negative effect of having spare capacity, 'freight consolidation improves vehicle efficiency and allow logistics providers to achieve robustness without having a negative impact on transport costs and the environment' (Wu & Dunn 1995). Therefore, the impact of Robustness on Green Logistics performance under Agility should holistically be assessed.

- **Customer focus**: according to Childerhouse et al (2002), 'focus is required to ensure demand chains are engineered to match customer requirements. Such focus is enabled via segmentation on the basis of each product's characteristics'. According to Christopher and Towill (2000), 'a customer can order from Dell on-line 24 hours a day or by phone from early morning until late in the evening. A Dell representative is available to make suggestions and help customers determine what systems will best meet their needs. Through the Web site, customers can access product information and receive price estimates instantaneously. Dell then confirms the order and verifies the financial credit charge'. The UK house building industry is becoming more agile, 'to capture customer requirements and more responsive production systems to provide a more customized product' (Naim and Barlow 2003). From a Green Logistics perspective, it is necessary to undertake a holistic analysis of the effects of such a system. One of the potential effects of this strategy is that the manufacturer needs to postpone activities and have excess capacity to respond to change in demand, so that can potentially increase the total transport costs. However, if the supply network is re-engineered, inventory and transport consolidation can mitigate this effect. 'Environmentally responsible practices tend to favour fewer shipments, less handling, shorter movements, more direct routes, and better space utilization' (Wu & Dunn 1995). While, other effect of this strategy can be a potential reduction of obsolesce levels, so this can represent reductions in reverse logistics costs.

Christopher (2000) emphasised that agility in individual companies can be considerably hindered by the degree of complexity in terms of brands, products, structures and management processes. Therefore, in order to achieve supply chain agility, companies must change dynamically alongside with the market changes, and should reduce as possible the unnecessary complexity of their systems. It is important to determine the impact of complexity and rigidity, under an agile environment, on Green Logistics performance.

After discussing the potential implications of an agile supply chain strategy, it is important to conclude that supply chain Agility could have positive and negative implications on Green Logistics performance. However, the negative impact of supply chain Agility could possibly be mitigated by implementing alternative transport strategies, such as modal-shift, 3PL horizontal integration, and inventory and transport consolidation (See Figure 4). Postponement constitutes a corner stone of any supply chain Agility strategy. Therefore, it is important to look more in detail the potential effects that Postponement can have on Green Logistics performance.

Figure 4. Agile supply chain characteristics, its potential implication to Green Logistics and its possible alternative means of mitigation

Postponement as a principle has been discussed in the academic spheres since 1950; it has its origins from Marketing. ‘The most general method which can be applied in promoting the efficiency of a marketing system is the postponement of differentiation, postpone changes in form and identify to the latest possible point in the marketing flow; postpone changes in inventory location to the latest possible point in time’ (Alderson 1950). From the point of view of the distribution channel as a whole, Postponement might be considered a method for individual companies to transfer the risk of owning goods to another (Bucklin 1965). The principle of Postponement represents the interaction between the risk of product ownership and the physical activities executed to deliver the product through time (Bucklin 1965). Postponement may relocate final configuration from manufacturer plants closer to the end customer, allowing for rapid delivery of customised products and quick responsiveness to changes in display mixes’ (Yang et al., 2003). Therefore, from a Green Logistics perspective, Postponement as a supply chain strategy can potentially have pitfalls and advantages. That depends on the main external factors that encourage supply chain companies to implement postponement. The total product cost is the most relevant variable that justified postponement in product customisation (Zinn and Bowersox, 1988).

There are three major determinants that impact on the supply chain strategy, product (life cycle, feature and value), market demand (frequency and time of delivery, and demand uncertainty) and manufacturing and logistics (economies of scales and special capabilities) (Pagh and Cooper, 1998). Uncertainty of demand is the most significant factor of time postponement (Zinn and Bowersox 1988).

5. Conclusions

Postponement is a strategy that develops Agility throughout the supply chain, but can have implications to Green Logistics and transport performance. These potential effects of Postponement and other supply chain strategies can possibly be mitigated by horizontal and vertical coordination of materials and information flows between transport providers, supply chain companies and suppliers.

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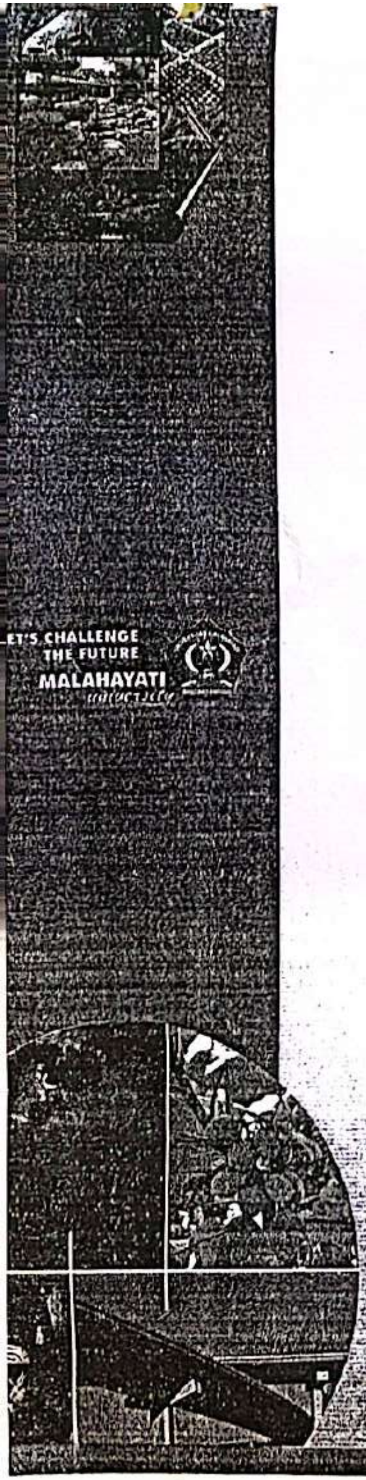

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ON GREEN TECHNOLOGY AND ENGINEERING (ICGTE) 2009

CERTIFICATE OF PARTICIPATION

This is to certify that

Agus Purnomo

PRESENTER in the 2nd ICGTE 2009 International Conference
on Green Technology and Engineering (ICGTE) Universitas Malahayati
held from April 15 – 17, 2009 in Bandar Lampung, Indonesia

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