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## **DETERMINING THE INFLUENCE FACTORS IN DECISION MAKING BETWEEN NPD AND REVERSE LOGISTIC: A STATE OF REVIEWING**

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### **ABSTRACT**

A considerable amount of literature has been published on New Product Development (NPD) or Reversed logistics (RL) separately but this study examines the vital factors on each NPD and RL technology overly. The study also discovered that crucial factors in selection of approach in various industry that could be categorized as speed of technology changes in the market, capability of return used product, examine the reusable and remanufacturing product, concurrent engineering facility, potential; center of reverse logistic, organization reliability and range of product life cycle. Most studies have concentrated either in NPD or RL, therefore these studies considered as new methodology in selection of two approaches. This study seeks to determine the crucial factors that influence the application of these two technology. The result of this study indicated that speed of technology changes in the desired market is an essential factor that should be considered, furthermore the effect of reusable and remanufacturable product can't be neglected in selection of RL approach because these factors have direct impact on it. However, these results were very encouraging in determining the most usable approach in today competitive market. It is recommended that senior managers consider these discovered key success factor in selection of NPD and RL more than other ordinary factors.

**Keywords:** *Factors, Decision Making, Reverse Logistic, NPD, Concurrent Engineering, Supply Chain*

### **INTRODUCTION**

In the last decades, fluctuation of competitive rules in production world has caused increased competition in industry and business. Winter *et al.*, (2014) believe increased competition in industry and business was due to the fluctuation of competitive laws in production world. In the last decades Business environment is constantly changing in different nature, furthermore Customers have gained power and gone global. Technology and globalization are two major items which have impacted on business environment.

The corporate Information Technology (IT) environments has been subjecting to a complexity and its growing steadily and because of ever changing business setting it has become a continues challenge. Nowadays, product cycles are going to be shorter and technological competition is becoming more rigorous. Thus, it will cause greater effects on companies to recognize and promote the best minds (Paul and Laudicina, 2012). For example, Sony now estimates that a new electronic device has a life of around three months before its replacement will be produced.

According to the Moise (2009), it seems that the options and information about what consumers can buy and how they can buy are increasing. Many markets have been dramatically growing based on accomplished survey. For example, car selling in china has increased twofold in last five years and it is ranked as the third highest car sales in the world (BIS Department for Business Innovation & Skills, 2010). In this complex environment, managers must choose the best strategy for achieving companies' goals. While most Firms know these shifts are taking place, few are fully prepared to adapt to them. They are forced to quickly adapt to emerging complexity if they want to survive.

Samsung stated that TVs, monitors, semiconductors and digital devices are the other main product items which by using them samsung kept it's pioneer position in the global market (Samsung, 2013). So, the global market will be conducted by state of the arts and quality products.

### **Current Approaches**

Professional players are making change the basic rules of the game with choosing the correct approach

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until reach to stability. Selection of approach should be based on minimizing costs and maximizing revenue so that have been the least damage to firm and customers over implementing period. Using of new logistic procedures can be offer to companies which selection of these approaches need high expense, time and resources.

There is an industrial process named Remanufacturing or Reman (reconstruction) in which used products as cores are revived in life usefully (Sundin, 2004). Due to increased knowledge, the Reman and reverse logistics related to them have earned a great importance (Paton, 1994). According to the Subramoniam *et al.*, (2009) economic benefits as well as ecological profits are the outcomes of reutilization of used product. Therefore, a growing number of customers through deliver their used products to collection points support environment protection (Lee and Dong, 2008).

In opinion of Šenk *et al.*, (2010) the new product development implication as a proactive process is specified by pioneer industries, whereby these companies steadily produce new products by identifying chances on the market. Increased competition and reduced product life cycles put force upon companies to develop new products faster (Ebrahim *et al.*, 2012).

Quality, advantage and costs reduction are met by rapid advancement of a new basic product development which are particularly principal for companies that produce short life cycle products (Senk *et al.*, 2010). It is clear, successful implementation for a winning scenario could be as a result of identifying the best method. Without doubt this method could be selected from NPD (New Product Development) and RL (Reverse Logistic) approaches, although they have exorbitant difference between requirements capacity, design and implementation stage.

**Reverse Logistic (RL)**

This system manages the backward workflow in supply chain to use and implement resource effectively. This method includes all the activities referred to remanufacturing, products returns, disassembly processes, etc.

**Table 1: Reverse Logistic Definitions**

Authors	Definition	Year
Rogers et al.	“The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in- process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal”.	1999
Chien et al.	“A reverse supply chain network is the best approach to facilitate the reverse flow of used products from consumers to manufacturers more effectively”.	2007
Srivastava. s	“A systematic process of moving a product from end user to any stage of the supply chain for using in recycling, remanufacturing and reuse”.	2012

The success of a company will depend on its ability to achieve effective integration of worldwide organizational relationships within a supply chain (Drucker, 1998). Two major reason for using this strategy are importance of environment and decreasing cost. As regards considerable proceedings are done about environmental operation and policy, strategy, finance, product design, supplier relations and post consumer product management, it is important to consider the systemic subjects related to stability, environmental management and supply chains (Linton *et al.*, 2007).

This approach focuses its attention on the waste, the materials arising from any human activities or natural forces, as they usually unintentionally, though difficult to avoid the effect. Ambroźewicz (1999) stated that waste is a useless substance which cannot be used at all or according to its main goal in certain time and place.

Protecting natural sources and decreasing contamination from wastage are the ecological purposes which effects the relationship between logistics and the environment, and rebating expenses when progressing service levels of reverse logistics and waste management is the economic purpose by the nature of logistics (Starostka-Patyk and Grabara, 2010).

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The most important reasons that companies follow RL approach are:

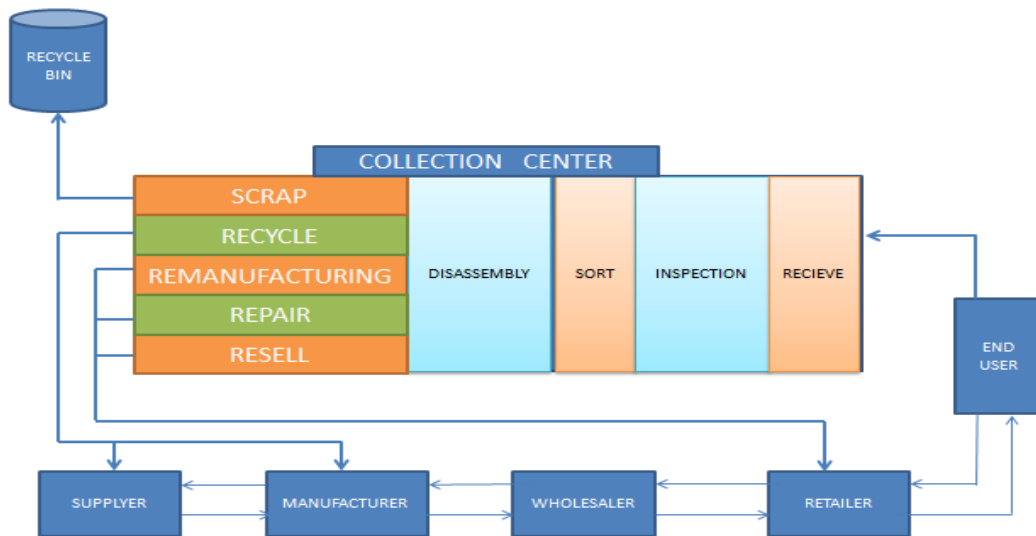
- ✓ Importance of environment to increase customer demand
- ✓ Expect to trade old product
- ✓ Government policies for environmentally friendly companies
- ✓ Achieve to lower costs by using underused resources

Biehl *et al.*, (2007) reported that one of the most controversial subjects in RL is transition of used products, because transportation costs are increased by smaller return quantities and variability in product species. Plewa and Jodejko-Pietruczuk (2012) show that using recycled material instead of costly raw substances by the company and also reuse of products result in many direct profits.

The result of efficient use of reverse logistics is aiding company to challenge its own industry (Hosseinzadeh *et al.*, 2012). IBM’s business activities involve several closed-loop chains, concerning end-of-lease product returns, buy-back offers, environmental take-back, and production scrap. The total annual volume of these flows amounts to several ten thousand metric tons worldwide.

Fleischmann (2001) revealed that a set of reuse choices on a product, part and material level are investigated by IBM to improve a maximum value of different kinds of "reverse" goods courses. Referring to IBM 2000 we can see that a yearly financial benefit of several hundred us dollars is earned by product development, meanwhile it causes the 4% reduction of volume processed in land filling and incineration. RL has important role in productivity and profitability by using low cost, sightless and traditionally resources. As we know productivity is measured by the ratio of output to input.

Therefore, when consume lower inputs, productivity of firms increase. In intense competitive condition and low profit margins, the effective implement of Reverse logistic can maintain customer for organizational competition and create competitive advantage for firm. Figure 1 highlighted the flow of RL activities in supply chain.



**Figure 1 : Total Supply Chain (Vlachos *et al.*, 2007; Sundarakani *et al.*, 2010; Chen IJ and Paulraj, 2004; Prahinski C and Kocabasoglu, 2006; Blackburn *et al.*, 2004)**

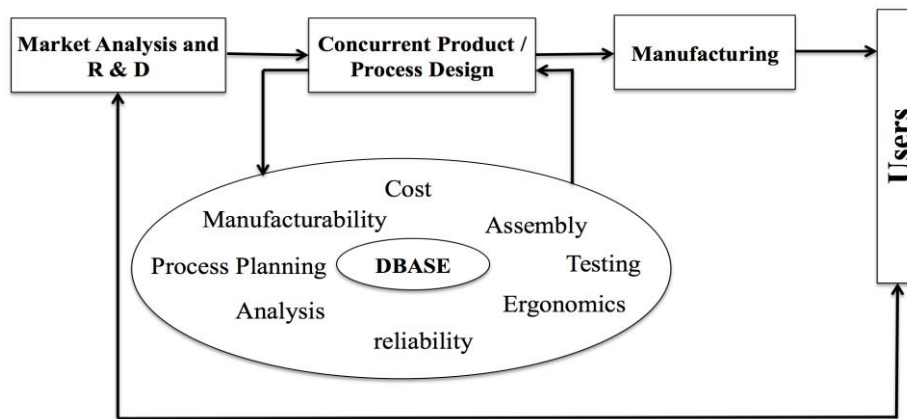
**New Product Development (NPD)**

Product life cycle has become increasingly shorter than before, Customers now demand customization and short order-to-delivery cycle. Accordingly, the main source of competitive advantage is new product development (Li *et al.*, 2010). Ahlstrom (2010) showed that firm's development and conservation of competitive advantage depend on NPD. Gomes *et al.*, (2014) reported that if the goal is to improve product ideas and assess their technical extension, productability and economical possibilities, NPD process should collect, process and construe information about market, technical and financial issues.

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According to Huang (2004) this method is accepted as one of the main step of corporate. The uncertainty of technology and environment, however, makes the development of new products increasingly a difficult task for enterprises. Therefore, many enterprises in different industries are now actively engaged in cross-boundary cooperation, such as establishing vertical cooperation with suppliers or developing new products with assistance from outside.

For instance NPD, short cycle of product development and reduction of recovery and production costs are the new strategies adopted by Chrysler. Lee *et al.*, (2012) believed that outside suppliers must participate in some complex products such as thin film transistor LCDs, digital camera and mobile phones, on the other hand NPD field practitioners and researchers have proved that corporate capability to maintain proper relationship with suppliers is the main factor for NPD success in manufacturers. In this method, performance of a procedure is investigated by companies with the aid of launching a new product onto the market (Šenk *et al.*, 2010).



**Figure 2: Integrated New Product Development Abouel Nasr and Kamrani (2007)**

Nasr & Kamrani (2007) reported that the strategic design, capital investments, determinations and complex operations which are included in NPD create a new product (as seen figure 2). Over the past 25 years, the main factor identified in guaranty the firm's continual existence is NPD (Biemans, 2003). So, NPD is a process which has several dimensions and various tasks (Ozer, 2000).

According to the Van Echtelt *et al.*, (2008) classically, NPD involves an order of separate steps such as modeling, producing and marketing that technology and customers performed these steps. It is important to know that a simultaneous method to NPD has been proposed by some investigators in current mercantile and high-tech professions (Wheelwright, 1992; Repenning, 2000).

Lee *et al.*, (2012) stated that if the classic and ordinal NPD process is replaced, then tasks are accomplished concurrently by component suppliers and in the manufacturing corporate. In the NPD, major technologically revere firms unlike small trades receive special attention, because technologically initiated methodical stages in product development process are better performed by them (Jugend *et al.*, 2012).

### Selection of Approach

According to the above subjects, it can be noted that the selection of an acceptable approach between the two above mentioned approaches has numerous risks. Because each of them requires long term infrastructure and very expensive design and implementation factors.

Suppose that if a pioneer company such as CATERPILLAR find that its approach to making new cars and following the reverse logistics is incorrect and should be changed to the NPD approach, then it has been subjected to high costs and risks, so obviously the possibility of company's bankruptcy and loss is predictable. No doubt there are strategic change risks for a company like SAMSUNG with 427000 employees. According to the mentioned subjects, in order to select a proper approach we should look for

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some important items such as employees, earnings and customers as blessings of our organization. It is necessary to present the proper selection of one approach between the two above mentioned approaches. Markets have considerable variation and among them some instable markets such as mobile phone, tablet and laptop have a changeable situation which use high-tech.

It can be noted that there are huge changes in such markets every day and change rate in them can never be compared with rate of changes in the automobile market. Auto companies typically replace the auto body with the same brand every five years. But as we know, in the last two years SAMSUNG company has produced more than seven different models of high-tech in mobile and tablet which come to the market in every five months.

According to the above explanation, is it possible to use the same approach for dodge company as a leading automotive company in USA and APPLE company as the world's top technology company in the field of electronics?

First of all we should note that there are different items to select a proper approach but due to the short time and high daily costs, corporate managers must know that what decides should be taken by them. Should we wait for expert results for a long time and accept the loss of experimental approach? Can company create change in its strategies? How will employees face with new plan? Here we state, a proper way to adopt a reasonable approach between the expressed methods in this study. Important factors in selecting an approach:

- Speed of technology changes in the market
- Capability to return used products to the collection center
- Examine the Reusable and Remanufacturable products
- Concurrent engineering facilities in corporate
- Potential centers for reverse logistics process
- Reliability of organizational formation (human resources)
- Range of product life cycle

### **Speed of Technology Changes in the Markets**

Technological changes in some markets are too rapid which can give great opportunities in the market. In next 50 years, more new developments will excite, confuse and disturb us. Sheldon (2004) stated that in the early years of 21 century, the general imagination has been captured by computers and internet which found their way into both working settings and internal places. Laforet and Tann (2006) reported that offering new technology, providing world level expertness, training workforce and overcoming new markets are some factors which can be invested by major manufacturing companies. Predicting the position of technology in the next 5 years is very hard and problematic.

Narver *et al.*, (2004) showed that technological breakthroughs make possible numerous new products in this market. A number of complex factors hasten technological change. Limits on performance, breakthrough technology, market competition, manufacturing capability, economics, and changing needs of consumers.

This is the most important factor in choosing the NPD approach. Because it can direct the company to the selection with high weight percentage. Obviously if the speed of technology changes in the market is more, NPD approaches must be used. This kind of market includes mobile phone, tablet and laptop market.

### **Capability to Return Used Products to the Collection Center**

Companies can obtain the advantages of RL approach by creating some centers for retrieval return product, guarantee and inventory returns, main returns, reusable container returns, damaged stuff, seasonal items and dangerous materials (Krumwiede DW and Sheu, 2002). It is obvious that if we are going to consider the reverse logistics approach in our decisions we must have or build the infrastructures of product return (table 2):

- transportation system
- collection center of reverse logistics

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**Table 2: RL Infrastructures**

Required Infrastructure	Service	Extra Definition
Transportation	From Customer to Collection Center From Collection Center to Several Locations Such as Manufacturer, Supplier, Retailer and Recycle Bin	Quite Wider than the Transportation System for after Sale Services
Collection Center	The Main Bottleneck of Logistic System	Have High Cost such as cost of disassembly stages

Although product itself should be able to return. Running a logistics system in forward make difficulty for many corporates and more trouble to running one in reverse in parallel simultaneously. Some companies show that main collection centers for gathering and classifying returns are very helpful and beneficial. For instance in Ford company of US, all returned spare parts are handled by one single carrier, so the dealers can use one single 800 number for all their issues with returned parts at the same time (Schatteman, 2003). The mentioned subject illustrate that main requirement for launching RL approach is the ability to create and manage collection center as central RL centers. If the above conditions don't exist, corporate must be subjected high costs to create necessary infrastructure for RL.

**Examine the Reusable and Remanufacturable Products**

Produced product of the company must have this ability because in the presence of this feature in the product, wider range of reverse logistic can be considered, otherwise we lose an important factor for adoption of RL approach and tend more towards NPD. The innovative manufacturing engineer will identify the five steps of remanufacturing from:

1. disassembly
2. cleaning
3. inspection via parts
4. reconditioning until reassembly
5. final testing

Furthermore, remanufacturing always has been a strong partner throughout the up rise of the automotive sector, which undoubtedly was the main industrial driving force so far. According to Gray *et al.*, (2007) the best place for linking these parts and extending leadership model in sustainable consumption and production (SCP) is South East. Fleischmann (2000) stated that high potential of product recovery is the result of high market volumes, short life cycle of product and technical facility of electronic component reuse versus mechanical components which is due to the lack of "wear and tear". Remanufacturing used product is the main effort of major copy machines manufactures such as Xerox, Canon.

A business specialist finds that in the after sale service market, new business opportunities in manufacturing environments can be obtained by remanufacturing. In this way, their customers have been provided by new solution with lowest whole cost of ownership. Manufacturing "good as new" product from used product have recycled remanufacturing. Returning a used product to like-new situation has been made by remanufacturing. In this process, when a product was first manufactured, the value added to the material is recaptured. Remanufacture results in reduced energy and material use, and production cost reductions (Gray *et al.*, 2007). In opinion of Georgiadis *et al.*, (2004), new material flow from user to producers is yielded by "reuse" chances of used product and materials. Besides, it is found that use of recycled materials both on-site and off-site is too important (recyclable products).

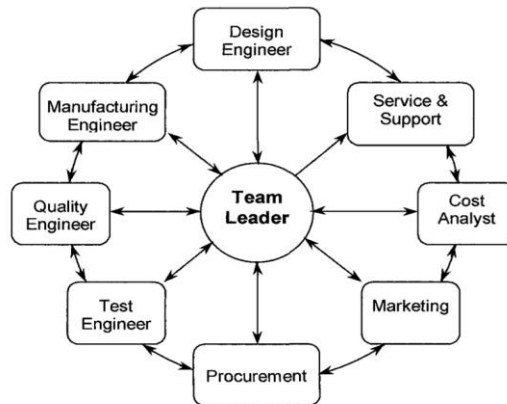
**Concurrent Engineering Facilities in Corporate**

Pennell *et al.*, (1988) believed: "In order to implement the simultaneous and united design of products and their related procedure such as manufacturing and support, there is a systematic method named concurrent engineering. It seems that through this method all items of product life cycle from conception to disposal

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such as expense, scheduling, quality and user demands are investigated from the beginning by the developers". Insurance of effective and profitable product development process and also increasing productivity and thereupon advanced designs depends on the focus of this strategy on the optimization and distribution of a corporate's resources in the process of design and development.

Grum *et al.*, (2004), stated that an inter order cooperation and concurrent work to a general set of stable purposes about development, manufacturing and product sales have been addressed by the term "concurrent engineering saving time and rework is the result of parallel development beside design analysis. Trading off these earnings a like quality detection problem must be done through the time used for verification meetings (Loch and Terwiesch, 2000). The goals including lower cost, higher quality and perfect delivery performance can be achieved with the aid of CE discipline.



**Figure 3: Collaborative Team Composition in CE Abouel Nasr and Kamrani (2007)**

Concurrent engineering is as an integrated and systematic approach to the products design and their related processes, including manufacturing, testing, and services. Through this method quality is improved, costs are reduced, cycle time are compressed, flexibility and productivity are raised as well as efficiency (Nasr EA and Kamrani, 2007). CE require to collaboration between all departments of firm (as seen figure 3).

#### **Potential Centers for Reverse Logistics Process**

Physical structure of the service centers does not respond to the collection center needed for the RL, so in order to adopt the RL approach the collection center should be established for it's identification and infrastructure. If not, the company must spend a lot of money to buy new buildings and disassembly equipment. No doubt these centers are recommended in the areas close to the customer.

#### **Reliability of Organizational Formation (Human Resources)**

A culture high in trust has been found to have the most significant effect on behavior during the NPD process. NPD researchers agree that these outcomes are appropriate measures for collaborative behaviors in cross-functional relationships. This indicates a merging between researchers from the trust area and researchers in the NPD area. Accordingly, in order to success new product outcomes, casual task of trust must be determined by implementing more research (Rowland, 2005).

100 Companies introduce main factors which separate winners from losers by studying success and failure of 200 new business products (Udegbe *et al.*, 2012):

- 1) New products advantage
- 2) Intense market orientation and marketing skill,
- 3) Higher technological and
- 4) production efficiency

This item makes a lot of mental burden in adoption of approach. Coordination of staff and adoption of new approach must be created in the staff thought without abnormalities and lack of dimensional follow

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after adoption of approach. Obviously training and cultural classes to establish the reverse logistics or NPD culture in the organization will be helpful by considering all of the HR tips. This item except for cultural burden is very expensive for the organization.

### **Product Life Cycle**

According to Werker (2003), the product's market potential reduction via technological decrement is called product life cycle (PLC) and the market's variable characteristics during their progress is explained by PLC. The daily shortening of innovative product life cycle (PLC) is happened in period of fast innovations of product and process. Golder and Tellis (2004) stated that PLC as a necessary main event in marketing management must be understood by managers to perceive the sales patterns and hence change their tactics. This is the most important item to select the two mentioned approaches.

### **Conclusion**

Most studies have concentrated either in NPD or RL, Therefore, this study considered as new methodology in selection of two approaches. This study seeks to determine the crucial factors that influence the application of these two technology. According to the above mentioned subjects, it can be noted that various factors exist in selection of an acceptable approach between NPD and RL with different weight percentage. The result of this study indicated that speed of technology changes in the desired market is an essential factors that should be considered, furthermore the effect of reusable and remanufacturable product can't be neglected in selection of RL approach because these factors have direct impact on it. On the other existing the potential centers for collection center and capability to return used product can be faced with different questions in selection of NPD approach. No doubt having the CE facilities will definitely peruse the senior managers to select NPD approach. It is also discovered that the direct role of culture on human resource companies shouldn't be ignored because it has the clear role and direct influence in selection of strategy.

However, these results were very encouraging in determining the most usable approach in today competitive market. It is recommended that senior managers consider these discovered key success factor in selection of NPD and RL more than other ordinary factors.

### **Future Research**

Further research should be done to investigate the Determination each factors effect influence in t strategy selection can be appropriate hatch research in the future. Research questions that could be asked how include the core relationship between Supply chain management factors in providing the guideline in selecting the RL is an important issue for future research.

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