The Effect of Reverse Logistics on Sustainable Manufacturing

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Abstract

The aim of this paper is to study the effect of reverse logistics on sustainable manufacturing (Environmental Performance, Environmental Performance, Social Performance). Questionnaire was designed and distributed among employees in one multinational oil company operating in southern Iraq (LUKOIL) in Basra. The sample of the study consists 208 employees and they were selected randomly. AMOS 22 was used to analysis the data. The findings indicted that there is a direct positive effect of the reverse logistics on sustainable manufacturing. Several conclusions have been reached, along with implications and suggested future directions for research. Having a sustainable strategy gives the company flexibility in meeting the needs of future generations through innovation and relocation. Cooperation in the implementation of reverse logistics to maintain a good image and reputation in the minds of customers about the company and is a key part of the corporate social responsibility.

Keywords

Reverse Logistics, Sustainable Manufacturing, Environmental Performance, Environmental Performance, Social Performance

1. Introduction

After the signing the Iraqi government at running the 2nd, 3rd and 4th licensing rounds for oil and gas exploration and production with a number of oil industry companies in mid-2009, Shift focus of the concerned and interested in the oil industry in general and society in particular from the focus on the organizational performance only, to focus on what the organizations offer to the community and the environment in which it operates, Under the contracts concluded "sustainable performance"(Al-Abrow et al., 2018b). Therefore Sustainability received much more attention throughout the past two decades since it has a big role in the elimination of pollution and tackling the lack of resources. It contributed to the environmental, social and economic amendment, (Turrisi et al., 2012; Eneizan et al., 2018; Eneizan et al., 2016ab).

This issue was also emphasized by many researchers because sustainability is considered one of the growing significant issues that tackle environment (Eneizan and Obaid, 2016). Companies are struggling to own sustainable- products and service, which means they meet human demands without harm to the future generations (Krajewski et al., 2013; Schenker et al., 2017). Waste processing management caused some companies to raise interest in the reverse logistics through recalling materials or products from the end user in order to retrieve a value or get rid of some materials. They do so to preserve the environment
through collecting testing, sorting, redistributing and recycling of lasted then disposing of it (Wondimu, 2016). By taking such measures, a company may become more reputable and thus more jobs can be created, reverse logistics activities can also be experienced, which aims to eliminate waste and retrieve product value or get rid of it. These activities help preserve sustainability (Gobbi, 2011). Although reverse logistics play a great part in reducing waste and saving process costs, their one a few studies regarding this issue (Hosseini et al., 2014). On the other hand, the change in customer awareness, emphasizing product technology development could create a need for the supply chain of reverse logistics services. These can be done by facilitating customers, and clients, requirements through constraining of defects and establishment of sustainable friendly organization (Vijayan et al., 2014). Therefore; reverse logistics operations are very important for environment preservation, which considered as an advantage for organizations. As a result, this research aims at answering the question as to, "To what extent does reverse logistics affect sustainable manufacturing". To achieve this aim, the basic hypothesis is tested. It implies positive effect of reverse logistics on sustainable manufacturing the theoretical as pact hypothesis.

2. Theory and Hypotheses

2.1. Reverse Logistics

To tackle environmental concerns and manage product around it life cycle, companies turn to reverse logistics- a process of planning, application and control of effective flow of products, materials and information from consumption point to origin point of incomes and recycling. Supply chain, is called closed loop import supply chain since it focuses on operation supply chain from material production until material expiry, (Krajewski et al., 2013). Thus reverse logistics service includes product delivery and retrieval so that it can be sold, repaired, reindustrialized, recycled or disposed of. So operations managers’ objective should not only restricted to burning and burning retrieved products. Instead, products must be reused (Heizer et al., 2017; Govindan et al., 2015). So because of regulations imposed on environment, in response to resources consumption and waste absorption, organizations made effects to support ecological efficiency of import supply chain system (Hosseini et al., 2014).

One of those attempts is (the reuse) relying on reverse logistics philosophy. Apparently, researchers consider reverse logistics process as a conception that help reduce manufacturing costs and constrain environmental pressures which aims at remanufacturing, manufacturing reverse logistics. It plays important role in reduction of waste and establishment of eco–friendly manufacturing environment, (Kumar and Kumar, 2013). In order to achieve reverse logistics objective, it necessary for a company to build pickup sites receive reused goods from and user to the retrieved material processing site, which is an establishment owned by the factory or client. There are other ways to deal with materials and waste. Reverse logistics operations are very important because they can stop pollution and conserve energy. Consequently, they may lead to sustainability and green manufacturing, nowadays, companies tend to shift concentration from product income to logistics and reverse supply chain of import supply chain (Krajewski et al., 2013).

This lead to widespread maintains and repair centers. Companies are likely to use technology that controls materials movement in addition to the use of technology that determine reverse logistics supporting servile management (Vijayan et al., 2014).This process helps companies to revive environmental systems and products through materials recycle porous supply chain (Bansia et al., 2014). Thus, reverse logistics must be part of organizations work strategy, thought the active programs of imports supply chain where big changes made management think of interest in competitive matters as reaction porous with environment and thus it helps increase in weapons sustainable manufacturing (Klapalová, 2013). Reverse logistics process could provide company with appropriate competitive feature through obtaining market share in addition to the ability to meet customer demands and value. It also reduces costs when creating eco-friendly manufacturing environment (Huscroft, 2010). This has been emphasized by many studies, which indicate that reverse logistics help organization improve operations by identifying and reducing disadvantages in import supply chain (Kumar et al., 2009).

2.2. Sustainable Manufacturing

Sustainable manufacturing concept comes to an existence as result of sustainable development concept which was introduced in 1980 to tackle environment effect issue, economic development,
globalization other factors (Rosen and Kishawy, 2012; Eneizan et al., 2015; Akomeah et al., 2018). So it is a process of change that utilizes resources and investment for the sake of technological development and institutional change which ultimately meet human demands. Trans for motional industries sector has become a significant part to deal with this issue (Ocampo and Clark, 2015; Eneizan and Wahab, 2016; Matar and Eneizan, 2018). USA ministry of trade defines sustainable manufacturing as the establishment of product making with less negative effects by using fair operations. This process must be energy and natural resources conserving and not harmful to staff, society, and consumers (Rosen and Kishawy, 2012). Recently, sustainable manufacturing has received particular attention- it is an inclusive strategy to minimize environment in the pact and improve performance (Yuan et al., 2012). In transformational industries manufacturing function should consider some competing priorities which comply with the competitive feature identified by work function (Ocampo and Clark, 2015). In the last delude, pressures have been put on companies to consider environmental and soul effects of their products in addition to the economic advantages (Joung et al., 2013; Amoako et al., 2017). Therefore, manufacturers have come up with on objective that is to reduce the environmental effect and conserve social and economic interests. Transformational industries have trained to achieve farther goals including economic, environmental and social perspectives sustainability. Since there are other concerns regarding resources exhaustion, damage to natural resources and increasing temperature – global warming resulted from excessive emissions of carbon and the increased waste, transformational industries made transformational industries put sustainability into consideration (Ocampo and Clark, 2015; Dincer, 2016; Al-Hawary and Banat, 2017).

Because of the increased numbers of companies, which require sustainability measures in their products and operations, sustainability measuring can be shown as follows (Feng et al., 2010).

1. Sustainability accountability. It is important to assess and document the way resources are used, waste generation and waste emissions from all industrial activities.
2. Effect analysis. Effect that censed by manufacturing activities which may be harmful to people, economy and society, must be evaluated and analyzed by the use of premeditated performance measurements to control sustainability trend.

Thus several studies, such as (Zubir, 2012; Rosen and Kishawy, 2012; Vinodh and Joy, 2012; Joung et al., 2013) reached an agreement on an identification of sustainable manufacturing dimensions, they are environmental performance, economic performance, and social performance.

1. Environmental performance: It deals with emissions effects, resource consumption, pollutants and nature conservation (Joung et al., 2013). One of the companies, most important procedures regarding environmental performance is antipollution in sustainable manufacturing. It is described as an attempt to improve the environmental performance of accompanying (Karlsson, 2011).
2. Economic performance: It refers to the use of profitability and cost indicators and organizations investments (Joung et al., 2013). Supporting economic performance through sustainable building and creating sustainable jobs in addition to the establishment of profitable social activities (Akotia, 2014).
3. Social performance: Employees, laborers and public people are directly or indirectly influenced by organizations performance. It refers to fast development effect, which in society, which is made by businesses (Joung et al., 2013). Social performance implies the dynamic values of invidious and social concepts and how individual objectives are integrated in a way that social objectives are served (Akotia, 2014).

2.3. Reverse Logistics and Sustainable Manufacturing

The barriers hindering the reverse logistics programs pose considerable challenges both for managers and policymakers in industries Because of their impact on sustainable manufacturing (Ravi and Shankar, 2004). Thus, attention to reverse logistics contributes to the welfare of society through the role played by the reverse logistics in the reuse of resources, which reflects positively on the sustainability of the environment (Bing et al., 2012). Therefore, reverse logistics helps create value through its large role in the dynamic recovery of value from different types and volumes of returns over time (Govindan et al., 2015). Because environment issues have become important in import supply chain, managers prioritize improvements in green environment performance. Minimizing costs fast delivery and high quality is also considered significant and caused by reverse logistics. Reverse logistics play the big part in minimizing
waste, which achieves environmental, social and economic sustainability. It is thus a sign of sustainable manufacturing which effects company's sustainable manufacturing (Figure 1) (Wondimu, 2016). Pressure has been placed on manufacturers to adopt sustainability (Corrêa and Xavier, 2013) through a market and regulatory demands that are consistent with environmental regulations and standards, Sustainable industrialization and the conservation and responsible use of natural resources (Kumar and Putnam, 2008). This is required for the introduction of reverse logistics services (Presley et al., 2007) Therefore, this study hypothesizes that:

H1: there is positive effect relationship with statistical and meaning significance between reverse logistics of sustainable manufacturing.

H2: there is positive effect relationship with statistical and meaning significance between reverse logistics of environmental performance.

H3: there is positive effect relationship with statistical and meaning significance between reverse logistics of economic performance.

H4: there is positive effect relationship with statistical and meaning significance between reverse logistics of social performance.

Source: Adapted from Krajewski et al., 2013

Figure 1. The Proposed Conceptual Model

3. Methodology of research

3.1. The Sample and Data Collection

The study was applied in oil company works in the south of Iraq are LUKOIL. Where Russian oil company Lukoil entered Iraq in 2010, which is a region that today represents the cornerstone of its Middle Eastern operations, its main project now in West Qurna-2 project. The sample of the study was randomly chosen from Sample employees. The sample included 208 people out of a total number of 600. The study used a questionnaire to collect the data. Multi-Option questions were used to get answers final questionnaire included (29) items, based on two basic variables. All components were measured according to (five) levels ranging from "1- I disagree" to"5- I strongly agree".

3.2. Measures

Reverse Logistics: Reverse logistics measurement, which is used by (Kapalova, 2013; Wondimu, 2016) was used. It is composed of (14) items (e.g., “lack of needed equipment/machines for reverse logistics operations.”). Sustainable Manufacturing: We used scale which was developed by (Ballantyne et al., 2011; Akotia, 2014) which consists of three dimensions and 13 items, divided into: Environmental performance: 5 items (e.g., “The company has contributions to environmental sustainability and the preservation of non-pollution”), economic performance: 4 items (e.g., “Encouraging investment in business”) and social performance: 4 items (e.g., “The company enhances the health and safety of employees and the community local residents in Basra governorate”).

3.3. Data Analysis

Statistical techniques were used for the description and analysis of the study variables and in order to test the hypotheses, relying on SPSS. V. 22 and AMOS. V.22. AMOS software has been used in management (Al-Abrow et al., 2018a; Al-Abrow and Alnoor, 2017). Cronbach’s Alpha was also used to
ensure measures’ reliability, model fit to ensure the validity of the model, Pearson’s correlation to establish the correlation coefficient among variables, and Path Analysis to test of the one hypothesis of the model. As well the current study’s design will be based on quantitative design, which concentrates on the deriving method, that is the deductive approach. The explanatory method will be adopted here. It will explain the causative relationship between variables, and it builds a pattern explaining the causative relationship between variables than testing hypotheses (Al-Abrrow and Alnoor, 2017; Saunders et al., 2016).

4. Results

4.1. Internal Consistency and Reliability

It refers to the consistent tool used with all data. It explains the extent to which test results in findings that can be similar in similar conditions. It also leads to clear questionnaire items. To detect precision of measurement, the two researchers used (item – to- total) correlation. It measures the effect of each item on the basic variable, where items with correlations less than (0.40) were ignored. Remaining items were maintained those with the correlation greater than (0.40). Table 1 shows coefficients of internal consistency. Many standards, which were used by management literature, have been used in this study. They characterized by consistency and Reliability. They are designed according to (Liker’s) scale. To ensure scales precision and Reliability, Cronbach’s Alpha was used as shown in Table. 1 Alpha confident values ranged between (0.85- 0.89). These values are statistically accepted in management and behavioral studies since values are more than (0.7) (Pallant, 2010).

Table 1. Test Internal Consistency

<table>
<thead>
<tr>
<th>Research Dimensions</th>
<th>Research Variables</th>
<th>Corrected Item-Total Correlation</th>
<th>Alpha-Cronbach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse logistics</td>
<td></td>
<td>.578</td>
<td>0.89</td>
</tr>
<tr>
<td>Environmental</td>
<td>Sustainable</td>
<td>.509</td>
<td></td>
</tr>
<tr>
<td>Economic performance</td>
<td></td>
<td>.721</td>
<td>0.85</td>
</tr>
<tr>
<td>Social performance</td>
<td></td>
<td>.834</td>
<td></td>
</tr>
</tbody>
</table>

4.2. Descriptive Statistics and Correlation

Table 2 also shows the means, standard deviations, and correlations among the variables. Findings indicate that variables mean values are bigger than the assumed mean value (3). This refers to the individuals support for reverse logistics role in sustainable manufacturing. The standard deviation of variables shows superficial variations among the respondents all relationships between basic variable are at level of (p<.05). As table 2 shows, there is linear with meaning correlation between the independent variable (reverse logistics) and the dependent variable (sustainable manufacturing). Its value reached (0.503). This is preliminary support for the hypothesis.

Table 2. Descriptive Statistics and correlation

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>RL</th>
<th>ENP</th>
<th>EP</th>
<th>SP</th>
<th>SM</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL</td>
<td>3.37</td>
<td>.621</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENP</td>
<td>3.40</td>
<td>.836</td>
<td>.379**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP</td>
<td>3.45</td>
<td>.835</td>
<td>.437**</td>
<td>.460**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP</td>
<td>3.36</td>
<td>.910</td>
<td>.409**</td>
<td>.501**</td>
<td>.484**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>3.40</td>
<td>.697</td>
<td>.503**</td>
<td>.802**</td>
<td>.795**</td>
<td>.830**</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: N = 208. RL= Revers Logistic, ENP= Environment performance, EP= Economic performance, SP=Social performance, SM= Sustainable Manufacturing. **. Correlation is significant at the 0.05 level (2-tailed).

4.3. Hypotheses tests

Using the path analysis available in AMOS, because this research carries a correlation hypothesis (measurement of direct effect of variable). Path analysis relies on the idea of last square, which is used for regression analysis. path analysis includes regression weight whose out parts represent path estimate; they are similar to regression weight . It also deals with Critical Ratio, it is given value (t) in regression analysis.
To be acceptable, the hypothesis values (C.R) must be greater than 1.96 (−) (+) at meaning level of (0.05) (Tabachnik and Fidell, 2001). Table 3 and figure 2 show effect relationships between research variable. The four hypotheses were tested for this study, as shown in Table. 3 and Figure 2:

Table 3. Test hypotheses

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>RL --- ENP</td>
<td>.380</td>
<td>.095</td>
<td>5.931</td>
</tr>
<tr>
<td>H2</td>
<td>RL --- EP</td>
<td>.414</td>
<td>.122</td>
<td>4.172</td>
</tr>
<tr>
<td>H3</td>
<td>RL --- SP</td>
<td>.447</td>
<td>.119</td>
<td>4.949</td>
</tr>
<tr>
<td>H4</td>
<td>RL --- SM</td>
<td>.504</td>
<td>.131</td>
<td>4.528</td>
</tr>
</tbody>
</table>

RL= Revers Logistic, ENP= Environment performance, EP= Economic performance, SP=Social performance, SM= Sustainable Manufacturing.***. Correlation is significant at the 0.05 level.

Based on track estimates shown in table 3 and figure 2, research’s hypotheses appear to be supported. Reverse logistics have positive effect on sustainable manufacturing - effect value reached (.50; p < .05). There is direct effect relationship between reverse logistics on sustainable manufacturing dimension (environmental, social and economic) dimension therefore; hypothesis H1, H2, H3 and H4 is accepted.

**Figure 2. Testing hypotheses of study**

**4.4. Discussions**

Reverse logistics and their role in sustainable manufacturing have been discussed in regard with the effect on environmental, economic and social performance of organization. Thus correlation has in turreted the total import series which aims at integrating the main logistics with the reverse logistics in order to reduce environment deterioration. Thus hypotheses have been tested to ensure effect relationship between reverse logistics and sustainable manufacturing some (Wondimu, 2016; Turrisi et al., 2012; Kumar and Kumar, 2013; Vijayan et al., 2014) of the result research are: First: There is direct effect of reverse logistics on sustainable manufacturing; consequently, receding and reuse help environment sustainability through waste reduction; Second: There is direct positive effect between reverse logistics and environmental performance. As a result this effect reflects can pan role in encouragement of voluntary works through which environment may be conserved when waste is recycled and eco- friendly products are used; Finally: There is direct positive mutual effect between reverse logistics and economic and social performance. This result emphasizes the big role played by reverse logistics of accompany in terms of
recycling, maintenance products parts for developers and sponsors and people in change. This is done by creating jobs which lead to increase incomes and improve staff and society's health and safety.

Through the above, the current study has a number of practical implications and managerial implications are: First, Promotion of awareness, culture of reverse logistics among customers and staff which can be followed as a work style to achieve sustainable manufacturing and conserve environment. It can lead to waste reduction and pollution. Thus, LUKOIL Company will have to establish a department for retrieving products waste in cooperation with retailers’ whole salers customers and Basra municipality.

Second, to achieve sustainability in industry, LUKOIL Company has to make balance between economic development, environment protection and social fairness in addition to creation of coordination between sustainable manufacturing and industrial scenario. This may cease the factory to implement its desired objectives and in come in crease. The Social right of Basra Governorate should not be ignored regarding healthy environment with green areas and creation of jobs. Finally, Adoption sustainable strategy makes it flexible for the company to meet future generations, demands through innovation, strategic planning and making mutual effect to achieve reverses logistics. Thus LUKOIL Company may receive good reputation from customers since it is a basic component of the social responsibility.

5. Conclusions

Results have indicated that the company management views the reverse logistics, which are represented by concepts such as integrate import series and closed import series, as influential part on the manufacturing process, including sustainable manufacturing. As a result this can affect the dynamic operations of environmental sustainability which in return effect the environment, social of economic performance.

6. Limitations

It faced the current study a few limitations, and thus its findings should be interpreted carefully.

First, this study is cross-sectional; the study variables were measured at one time, so there may be a need for attention for other reasons. However, we tried to ask the sample of the study on the evaluation of variables in general and comprehensive of their experiences over a long period. This is why previous studies should focus on this aspect by designing longitudinal studies in order to achieve more accurate and qualitative results. Second, With regard to the society and sample of the study, it was limited to the oil sector (LUKOIL) and therefore the inclusion of other sectors may contribute to reach more clear results. Finally, Because of the R-Square values of the direct impact of reverse logistics in sustainable industrialization, there are other factors that may influence sustainable industrialization, which is one of the determinants of this study. For example, previous studies could address the closed-loop supply chain of the Sustainable design near the current study model.

References


