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# The impact of green manufacturing on the transition to the green supply chain in the Iraqi industrial companies

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**ABSTRACT**

In this paper, the six green supply chain (GSC) operations dimensions effect on transition to GSC and performance improvement (Pi) in Iraqi manufacturing were discussed. Samples of 220 in (15) companies were collected from the manufacturing industry. GSC operations and measuring five independent variables were performed including green manufacturing (GM), green purchasing (GP), green information systems (GIS), green logistics (GL), cooperation with customers (CWC), and eco-design (ED). From preliminary factor and regression analysis, an outcome except for GP, the remaining five variables were used for prediction purposes PI. But, ED of green operations Tracked GIS has shown the greatest effect on the PI. As a result, the industry companies managers must not only implement ED in their SC but also should focus on appropriate control and implementation for GIS to raise their companies' performance. The basic contribution of the present paper is the negative GP effect which observed to PI, especially in the case of Iraq manufacturing industry. Another value outcome is that GP is an important former economically in the US manufacturing companies.

**Keywords**: Green manufacturing, Green information systems, Eco-design, Green logistics.

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## 1. Introduction

The expansion and spread of the industry have led to a clear increase in environmental pollution that is inconsistent with the technological development that the United Nations Program seeks to reach [1][2][3]. Experiments have shown that there are many methods of economic feasibility in avoiding health and environmental damage that led to more profit, more efficient use and higher production [4][5]. These methods transform the supply chain into the green supply chain through green manufacturing, environmentally friendly design, green procurement, green information systems, green logistics and customer cooperation [6][7][8]. Thus, preserving raw materials and energy by avoiding toxic raw materials and reducing the number of emitted gases and toxic waste. Achieving all this leads to raising the efficiency of product design and production methods, and recycling of waste [9][10][11]. All these requirements lead to a shift to GSC and improve the performance of industrial companies in the world in general and Iraq in particular.

Subsequently, this paper tries to clarify the relationship between GSCM operations and PI in Iraqi industries and deals with the assumptions and the data collection and analysis process. GM and PI discuss the results of the research, and GP and PI cover conclusions.

Research methodology includes the followings:

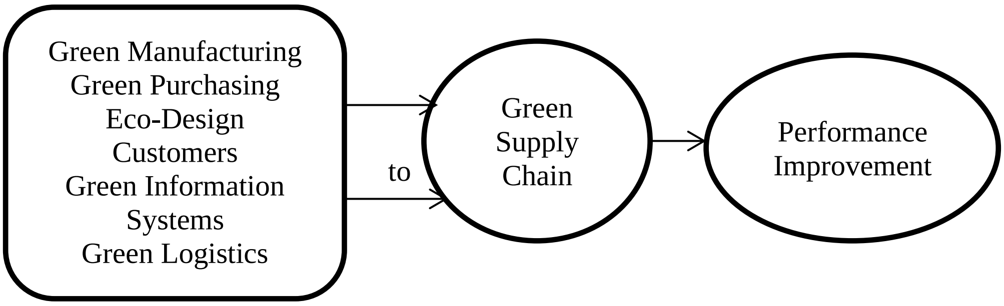
The goal of this research is to make GSCM execution effective, especially in in PI Iraqi companies. The objective is to study the role of various drivers that lead to GSC implementation in a company and its relationship with company performance, and to propose and legitimize a study model showing the relationship between GSCM and company performance. The following research hypotheses were investigated:

H1a: There is a significant and positive effect of the GM variable on the PI.

H1b: There is a significant and positive impact of the GP variable on the PI.

H1c: There is a significant and positive effect of the ED variable on the PI.
H1d: There is a significant impact of the variable of CWC on PI.
H1e: Green information systems effectively and positively impact the PI.
H1f: There is a significant effect of the GL variable on the PI.

## 2. Research model




Figur1. Study model

## 3. Literature review

The Wider opinion of eco-environment to SC has based on triplex concepts including performing economically, socially and environmentally [12][13][14]. A literature related to sustainability is developing in a certain way. Emphasis is placed on environment-friendly operations because of their impact on the economic performance of industrial companies. According to the sustainability law, the transition is made from the organization level to SC [15][16][17]. Preparing BGSCM is integration of administrative information and material flow to meet customer demands for environmentally eco-products and services from eco-environment processes. GSCM is the operation for Environmental integration reforms into corporate operations [18][19][20]. SC can build competitive advantage or prepare the joker to build green operations. Likewise, integrating green operations in supply chain management is not only a company having a competitive advantage but also having new market opportunities [21][22][23]. Also, Environmental laws have been identified as imperative to implement environment-friendly operations [24][25][26]. The implementation of green processes can lead to less waste, which increases water and energy use as well. Also, Much of the research conducted to develop metrics related to green sustainability has found no relations between SC operations and PI .Current research also provides some guidance, but so far it is not conclusive [27][28][29][30].

## 4. Results and discussion

In the current study, Pearson correlation, preliminary factor analysis and multiple regressions were adapted. Preliminary factor to evaluate the implicit body for 32 items of the PI questionnaire was applied. Based on the assumed equation below, (7) were requiring. $F = \alpha 0 + \beta 1\ (GM) + \beta 2\ (CWC) + \beta 3\ (GIS) + \beta 4\ (ECOD) + \beta 5\ (GP) + \beta 6\ (GL) + e$. Also, $\alpha 0$ shows constant and e signalizes error in the study. The elements are designed as indicators for seven constructs: PI dependent variable, however GIS, GP, GM, CWC, ED and GL predictors, a value to measure samples a scale was used as KMO adequacy (.755) prepare that a sample is convenient so to factors analysis. Moreover, a moral outcome to Kaiser Meyer Olkin ($p < .05$) offers this matrix is no specified matrix. In another meaning, these seven elements are related to each other adequately to nominate a significant factor analysis.

Table 1. Study population

| Industry title | Answer .no | Ratio |
|---|---|---|
| SC supervisors | 122 | 55 |
| SC managers | 75 | 34 |
| SC directors | 18 | 8 |
| Industry Type | | |
| Manufactured metals product | 20 | 11 |
| Chemical manufacturing | 35 | 17 |
| Textile factories | 47 | 22 |
| Food Industry | 16 | 7 |
| Plastic industries | 6 | 3 |

| | | |
|---|---|---|
| Electrical industries | 9 | 5 |
| Mechanical industries | 13 | 7 |
| Furniture industry | 9 | 5 |
| Oil and coal product industries | 7 | 4 |
| Paper industry | 25 | 13 |
| Industry soft drinks | 11 | 6 |
| Manufacture of cigarettes | 7 | 4 |
| Wood industries | 10 | 5 |
| Transport equipment | 14 | 7 |
| Manufacturing and sewing clothes | 4 | 2 |

Table 2. illustrates the Kaiser Meyer Olkin and Bartlett test (B.T) results. Also, early factor analysis was a shift by an varimax style with Kaiser Settlement which derivative Required seven no correlated factors. In table 3. They calculated for PI 19.40, GM 17.58, CWC 11.67, GL 8.65**,** GIS 9.07, ED 8.81, and GP 6.29. Nevertheless, these 7 elements elucidate 71.13 accumulation ratio of the total variance. Also calculated Cronbach's alpha of all variants**.**

Table 2. KMO &(B.T) test results

| | | |
|---|---|---|
| Kaiser Meyer Olkin Measurement of sample sufficiency | | .830 |
| B.T | chi-square | 5311.803 |
| | df | 269 |
| | sig. | .000 |

Total credibility of a scale was .919 of 12 elements to promote accuracy; the factor less than .39 was deleted. Table 3 illustrates the elements and factor for a cyclical factors. At the same time, all 12 elements were on both of the elements in the cyclical matrix. Also, there are no such cross-downloads. Guaranteed each of them builds and distinctive validity. At first, satisfied All basic parametric suppositions for simulation multi- regression and then resulted in the test is to find out the volume total relation Between specifies of green operations and PI Dependent variable and the amount of each operations variable (GM, GIS, CWC, GL, ED, and GP) contribute uniquely to prophesy PI.

Table 3. Round elements

| | matrix elements | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Alpha | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| PI 7 | .897 | .849 | | | | | | |
| PI 6 | | .864 | | | | | | |
| PI 1 | | .919 | | | | | | |
| PI 5 | | .962 | | | | | | |
| PI 2 | | .818 | | | | | | |
| PI 4 | | .947 | | | | | | |
| PI 3 | | .817 | | | | | | |
| GM 1 | .918 | | .825 | | | | | |
| GM 5 | | | .824 | | | | | |
| GM 7 | | | .803 | | | | | |
| GM 6 | | | .791 | | | | | |
| GM 4 | | | .775 | | | | | |
| GM 3 | | | .753 | | | | | |
| CWC 2 | .786 | | | .911 | | | | |
| CWC 1 | | | | .921 | | | | |
| CWC 4 | | | | .755 | | | | |
| CWC 3 | | | | .583 | | | | |
| GIS 2 | .720 | | | | .919 | | | |
| GIS 8 | | | | | .765 | | | |
| GIS 3 | | | | | .463 | | | |
| GL 2 | .705 | | | | | .860 | | |

| | matrix elements | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Alpha | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| GL 3 | | | | | | .860 | | |
| GL 1 | | | | | | .855 | | |
| GL 4 | | | | | | .839 | | |
| ED 1 | .714 | | | | | | .960 | |
| ED 2 | | | | | | | .359 | |
| ED 3 | | | | | | | .911 | |
| GP 6 | .917 | | | | | | | .769 |
| GP 3 | | | | | | | | .768 |
| Self-values | | 4.399 | 4.003 | 2.475 | 2.475 | 2.180 | 1.902 | 1.757 |
| % of variance | | 9.40 | 17.58 | 11.67 | 8.65 | 9.07 | 8.81 | 6.29 |
| Cumulative % of variance | | 19.35 | 33.03 | 40.71 | 40.79 | 54.90 | 62.82 | 71.13 |

Table 4. illustrates means (M), standard deviations (S.D), and correlations for the dependent variable (PI) and its operations.

Table 4. Descriptive statistics, and correlations for PI and operators variables (N = 220)

| | M | S.D | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1 PI operation | 1.68 | 0.546 | 1 | | | | | | |
| 2 GM | 2.16 | .718 | .362** | 1 | | | | | |
| 3 GP | 2.90 | 1.043 | .145* | .305** | 1 | | | | |
| 4 ED | 1.79 | .652 | .472** | .434** | .210** | 1 | | | |
| 5 CWC | 1.80 | .891 | .382** | .286** | .211** | .520** | 1 | | |
| 6 GL | 1.78 | .811 | .351** | .273** | .210** | .498** | .147** | 1 | .541** |
| 7 GIS | 2.22 | .910 | .308** | .308** | .216** | .147** | .191** | .171** | 1 |

*p.05 **p < .01

In Table 5. test results from linear regression analysis for portending PI were presented. A mix of variables portended approximation of 31% of the total variance in portend PI F = 30.8, p < .001, together with five variables that significantly forestalled PI except for GP. Moreover, a problem of polylinear not present among the independent variables due to the presence of covariance amplification factor –VIF. The value of each independent variable was less than 10. Estimation factor for the parameters suggests that ED (.245, p < .05), GIS (.130, p < .05), GM (.120, p < .05), CWC (.087, p < .05) and GL (.081, p< .05) reflect the spirits effect on PI. Subsequently, their five respective hypothesis (H1a, H1c, H1d, H1e and Hf1) were useful, and from another direction, GP (−.013, p > .05) It turned out to be immoral effect on PI but, H1-b is not useful.

Table 5. Hypothesis test for PI.

| | Predictors | Se | b | VIF | t | Sig. | Rank |
|---|---|---|---|---|---|---|---|
| | Constant | .110 | .471 | | 5.150 | .000 | |
| H1a | GM | .040 | .120 | 1.339 | 2.738 | ..005* | useful |
| H1b | GP | .025 | −.013 | 1.129 | −.529 | .414 | not useful |
| H1c | ED | .051 | .245 | 1.552 | 5.154 | .000** | useful |
| H1d | CWC | .037 | .087 | 1.412 | 2.566 | .080* | useful |
| H1e | GIS | .029 | .130 | 1.064 | 4.188 | .000** | useful |
| H1f | GL | .034 | .081 | 1.407 | 2.310 | .011** | useful |

F = 30.8, R2 = .300 *p < .05 - **p < .001

## 5. Conclusion

Results of the regression analysis revealed determinants of GSC operations have a significant positive relation to PI. The results show that five out of six determinants of GSC operations (i.e., GM, ED, CWC, GL, and GIS) are important factor in portending PI excepting of GP. A result detects that ED implementation is the key operator of PI. In the same path, [38] found the execution of ED operations were positively effective on PI. Actually, PI can be achieved with successful administration execute green operations in the SC. Relatively [34] manufacturing companies in Iraq are facing impedance from the customer's side, as they have to apply the green environment operations. The following equation illustrates the simulation multi-regression equation to prophesy PI: F = 0.471 + 0.120 (GM) + 0.087 (CWC) +0.081(GL) + 0.130 (GIS) + 0.245 (ED) – 0.013 (GP).This paper checked the effect of GSC operations on PI in the Iraq manufacturing industry. Six elements of GSC operations were appreciated including GM, GP, GIS, CWC, GL and ED. The results show that except for GP, all of the five components of GSC operations have a significant and positive relationship with o PI. Moreover, GP harms the PI because green materials are costly than non-green materials and companies' morale does not have any significant interest from government in Iraq.

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