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An analysis of the effective actions on green supply chain management using ISM method (Studying the petrochemical industry)

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Abstract
Air pollution is increasing every moment and environmental issues have got more and more important as countries in recent years have become industrialized, and because of that, green supply chain management (GSCM) or considering environmental issues in the whole supply chain is now of serious interest and many factories tend to make use of this issue. With regard to the importance of this subject, in the present study and after reviewing the literature, using interpretational structural model (ISM), 8 of the most important effective actions on GSCM were recognized and prioritized. In terms of goal, the present study is applicable and its method is descriptive (Applications and Survey). The population consists of 8 of the experts in the petrochemical industry from 8 different companies and the sampling method was goal oriented sampling (Purposive Sampling). After recognizing the most important and effective actions on GSCM, they were prioritized using ISM and it turned out that: internal environmental management ranked and reverse logistic first level, green supplier and green purchase ranked second, green designing and cooperation with customers ranked third, return on investment (Return Investment) fourth and green innovation ranked fifth.

Keywords: green supply chain management, GSCM, green supply chain management actions, ISM

Introduction
With the increase in global competition ever since the start of twenty first century, companies have witnessed impressive changes in the marketplace such as market instability, the reduction of product life, unidentifiablilty of demand, and supply instability [1]. Because of the heavily competitive atmosphere in the business, made companies to seek a way to reduce operational expenses, serve the customers better, and reducing to a minimum the risk of the disorders in inventories and predicting the future, designing and managing the supply chain effectively [2]. Companies which figure out the way to improve their supply chain management can achieve a lot in the competitive market of the day [3]. SCM, defined as logistics and supply chain management in Christopher's 2010 book: "upper-hand and lower-hand relationship management with customers and suppliers, with the goal of delivering the final product to the customers with a lower price, with the mediating of the supply chain as a whole [4]", and nowadays it's considered one of the main elements in the competitive strategies and plays an important role in increasing productivity, making benefits and organizational success [5]. In accordance with the above, in [6] state in their study in 2012, "nowadays, competition has changed from inter-organization to inter-organizations' supply chain competition, and for this reason, improvement in supply chain has become a basic necessity for the endurance of organizations these days."
On the other hand, and with regard to the great changes in environmental issues in the recent years, such as the social worry about the destruction of the natural environment, control and supervising different companies has increased and these companies are under so much pressure to consider environmental issues in their activities [7]. With the increase in paying attention to utilizing activities along with the environment, many companies have paved the way for making use of GSCM2 [8, 9], because worries about the effects of organizations, esp. industrial organizations, on the environment has doubled [10].

Too many studies have been done on GSCM and scholars have held different definitions for green supply chain management [11] but no single and inclusive definition has been given for GSCM as of yet. In the studies of 2005 by Simpson et al, and also in Handfield et al, GSCM has been defined as: "regarding environmental issues in the decision making process and at every stage, from material management in the organization to transportation and delivery of the product to the customer" [12]. Zhu et al, [13], defined GSCM as an old pattern for organizations in order to get to two simultaneous goals of benefit and market share (Profit and market share), reducing the natural environment dangers and increasing environmental applications of the organization. GSCM is more than some simple activities adaptable with the environment, rather it includes harmonized and general attempts for the improvement of the function of the company, from managerial levels to operational levels [14]. Toke et al [15], defined GSCM as: a unified system that provides raw material, produces goods, delivers the products to the customer and in order to prevent the destruction of the environment and improving productivity and (Profitability) [16].

Adding the concept "green", to supply chain management, scholars have studied the direct relationship between supply chains and environmental issues [9]. The concept of green supply chain management, along with quality revolution in 1980 and supply chain revolution in 1990, came into being [9, 14]. But the first study in this field was done by weblee, asserting the green purchase [15].

As the importance of GSCM become more obvious and the advantages of suing it, developing countries have tended to utilize GSCM in the recent years. In developing countries, many companies and organizations use green methodologies in their business and supply chain, but the aim of using these methods and activities is to decrease the environmental pollution. However, this attitude has to be changed and the aim of using green activities in factories must be preventing pollution and environmental dangers. In other words, using GSCM must be for prevention for environmental issues [16]. It's also necessary to say that in developing countries and especially in Asian countries, little has been studied about GSCM. In south East Asia, green supply chain management is a new concept and most probably few organizations have utilized GSCM [17].

One of the important factors in GSCM is green activities 3. These activities include: "combining and unifying environmental methodologies in the supply chain in order to achieve greener supply chain ad keeping competitiveness advantage" [17]. Since these activities are not al at the same level of importance and the relationship between these activities is different, that is some of these activities pave the way for some other activities and the other way round, therefore we have tried to use ISM to prioritize the relationship between effective activities on GSCM and show their continuum. According to what we just said the aims of the study are: identifying the salient activities on GSCM after reviewing the literature and also seeking the ideas of the experts of petrochemical industry and prioritizing these identified activities using ISM.

2. Literature review

Azevedo et al.'s [18] work on GSCM in 2011 says: "combining and unifying environmental management in the supply chain in order to achieve greener supply chain and keeping competitive advantage", and so many studies have been done in this field and each of the scholars have studied this from a different perspective. The following is a summary of the research and a literature review of local and foreign studies. But the important thing to remember is the relationship between green activities and the level of their importance. Since the level of their importance is not the same, the relationships among these activities are different and on the other hand some of these activities pave the way for some other and in fact facilitate them. Therefore in the present study it's been tried to prioritize the activities effecting green supply chain management and investing these activities using ISM.

In 2000 study about green purchase and its relationship with the function of the company by Carter et al., they found that green purchase is related to (Net income) and the expanse of the sold product [19]. In a study by Zhu and Sarkis in [20], the relationship between green activities (internal environment management, return on investment, green designing and external activities GSCM) and the environmental and economic consequences of green supply chain management were studied. In this study also the quality management and JIT were found to be moderator variable, effecting the relationship between activities and consequences, were examined. Finally it turned out that there is a significant relationship between green activities and the consequences of using GSCM and the two factors of quality management and JIT are effective in this relationship. Autry did an inclusive study on reverse logistics and its consequences in automobile industries in 2005 [21]. Zhu et la [22] studied the actuators (Motivation), activities and the consequences of GSCM in several companies in China in 2005. It was found that activities and actuators are different according to the industry. The actuators in this study are: legal actuators, marketing actuators, supplier-oriented actuators and internal actuators. Also the identified activities were: green purchase, return on investment, cooperating with customers, green designing and internal management. Chen [23] investigated the relationship between green innovation and making green image in the mind of the customers (Creating green image). This study provided a new concept of the application of green activities. Zhu et al. [22] presented

two models for the applicability of the GSCM activities and their relationship with GSCM consequences. The goal of this study was to make known the advantages and disadvantages of companies in using GSCM. The activities that were done included internal environment management, green purchase, cooperation with the customer, design adaptable with the environment and return on investment. The consequences in this study are economic, environmental and functional [24]. In a study by Shang et al in Taiwan and among electronics industries, six important activities were introduced for GSCM. These factors which were identified by factor analysis include: green production and packing, adaptable with environment strategies, green marketing, green suppliers, green inventory, and adaptable with environment green designs [25].

Eltayeb et al [25] investigated companies with ISO 14000 in Taiwan and examined the relationship between three activities and four consequences resulting from GSCM in 2011. These activities included investigation of adaptable with environment green design, reverse logistics and green purchase and the consequences included economic, operational, environmental and untouchable consequences (26). Azevedo et al [18] studied automobile industries in Portugal in 2011 and examined the relationship between different GSCM parts (upper-hand lower-hand, internal) and its consequences. The factors which were considered for the upper- hand supply chain included environmental cooperation with the suppliers, adaptable with the environment purchase and cooperation with the suppliers for better designing the products. Existing factors in the internal supply chain: minimizing the (Waste), reducing consumption of dangerous materials and ISO 14000 certificate. The factors which were considered for the lower- hand supply chain included: reverse logistics, green packing, environmental cooperation with the customers and working with the customers with the goal of changing their taste and regarding the environmental issues of the products. And finally in this study a model was presented that showed the relationship (positive and negative) between green activities and the consequences of supply chain management. Also in this research it turned out that cooperation with the customer, ISO 14000 and green purchase had no relationship with the activities and the consequences of GSCM. In a 2011 study by Lun [26], the relationship between green activities management and the function of the company was investigated. In this study, the positive significant relationship between these factors was affirmed and it turned out that green activities management effects three factors: supporting internal managerial plans, taking out adaptable with the environment operations and cooperating with the supply chain sharer.

GSCM is a new concept in Iran. Olfat et al. [27] identified the necessities (actuators, obstacles, activities and consequences) of supply chain management through reviewing the libraries for the subject inclusively in 1390. Then they prioritized the necessary activities for performing GSCM based on (Topsis Fuzzy) and finally, after prioritizing the actions, adaptable with the environment designs, environmental cooperation with the shareholders and managing (Waste) were ranked first to third respectively. Also in another study by Niknezhad in 1390 [28], after reviewing the literature for GSCM, using library method of research, two successful companies were identified for having used GSCM; Mart Company and Sisko Company.

As it can be inferred from the literature, previous studies on GSCM have mostly dealt with the relationship between activities and consequences or the actuators of GSCM and this has been studied deeply. Since the activities that effect GSCM are not of the same level of importance, and also the relationship between these activities are different, and on the other hand, some of them pave the way to facilitated the others, in the present study it's been attempted to identify the relationship between salient activities effecting GSCM and their relationship with ISM, using ISM and also to prioritize it. Following is the step to step plan for the ISM model in the petrochemical companies that we have presented here.

3. Methodology

In terms of goal, the present study is functional and regarding method, it's descriptive (Survey). Since in ISM, brainstorming or nominal group technique is used 53, the population of the study consists of 8 of the experts in the petrochemical industry from 8 different companies.

The sampling is (Purposive sampling) that includes all the members of the statistical population. The tools for collecting data are a researcher-made questionnaire whose validity has been affirmed by two of the academic experts before the data was collected. Regarding the reliability of the questionnaire it's notable to mention that without a good reliability, the analysis of the data will not be done properly. And finally, we used ISM, one of the operational research techniques to analyse data, for prioritizing, which is following.

4. Interpretive structural modelling ISM

ISM is a mutual learning process. In this method, a set of factors and elements interact with each other directly or indirectly, and they are located in a structured and inclusive model.

The presented model, pictures the structure and complexity in a keenly designed pattern of images and words. ISM is a tested and affirmed method for diagnosing the relationship between the factors of an issue and it's an interpretive structural method proposed by warfield [29]. In this method, through analysing the factors and criteria at different levels, the relationships between the indices are dealt with.

This interpretive structural model can determine the levels of relationship between the indices, related to each other singly or as groups. In other words, ISM can be used for analysing the relationship between several

variables, all of which have been defined for a problem. In this method, first of all the effective factors in a subject are categorized in different levels; then it distinguishes the relationships between these factors clearly and in different levels (in terms of its effect on the case of study) [30]. Designing an interpretive structural model ISM is a method which has priority for investigating the effect of variables on other variables [31]. For this reason in the present study, for identifying the factors and their effects on GSCM, ISM has been employed. The diagram for developing an interpretive structural model has been shown in figure 1. In the following lines the taking out of ISM and its case study has been presented.

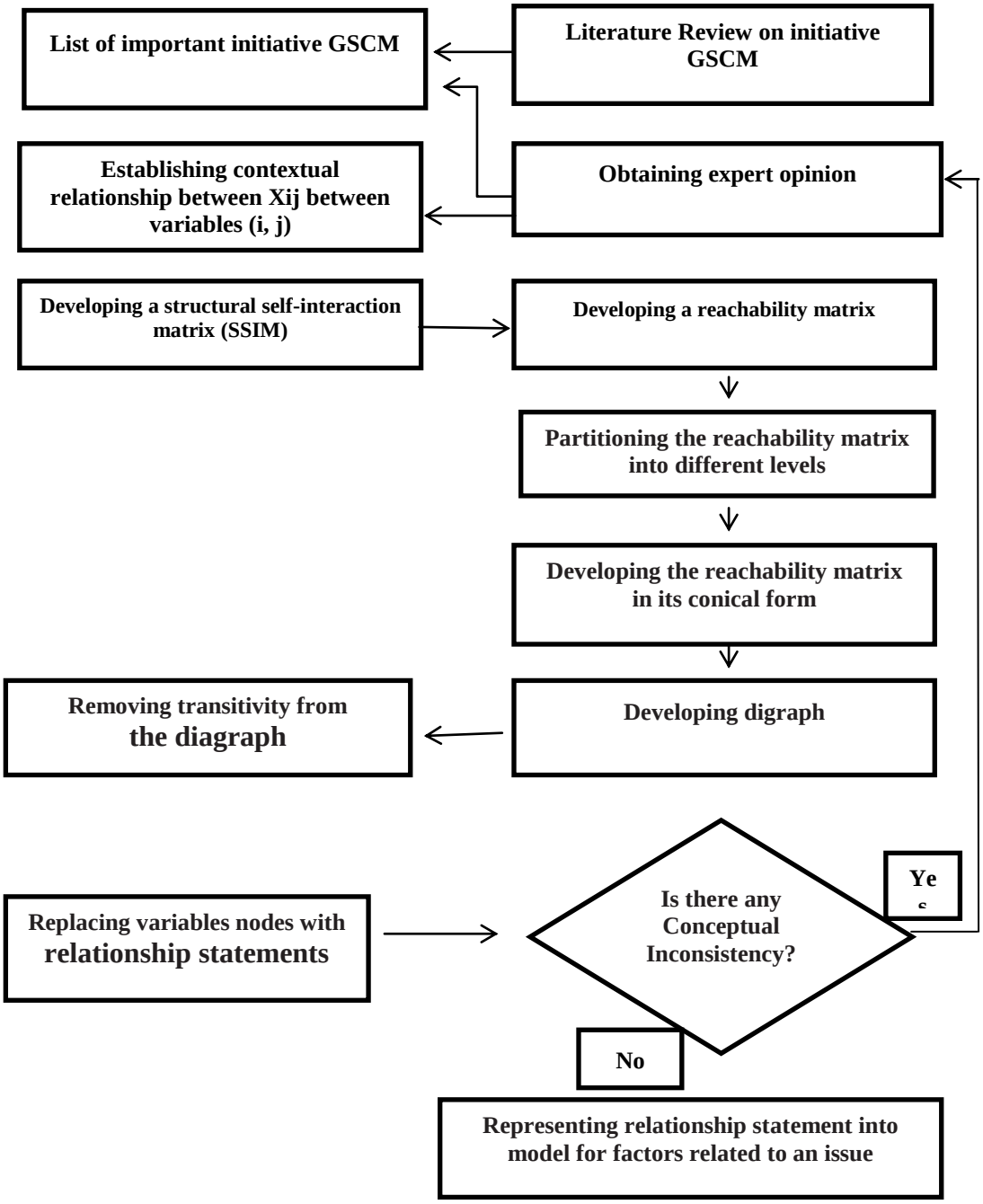

Figure 1: The diagram for developing ISM

First step: identifying the salient activities effecting GSCM

The first step in developing ISM is identifying the factors shaping a model. Therefore through studying the literature, the main activities effecting GSCM were identified and were affirmed by academic and industry experts. Once the literature of the subject was studied, 8 of the main effecting factors on GSCM were identified,

which were used more than others in the studies, and they were carrying more popularity among previous studies. In table 1, the identified activities have been mentioned with their sources.

Table 1: main activities effecting GSCM

Row	Initiative	Reference
1	Green Supplier	Wen (2008) [44], Zhu and Sarkis (2006) [38], Chiou et al (2011) [39], Conding et al (2012) [46].
2	Green Purchase	Zhu et al (2008) [24], Chan et al (2012) [9], Zhu et al (2007) [40], Zhu et al (2011) [41], carter et al (2000) [29], Zhu et al (2006) [32], Zhu et al (2005) [26], Geen et al (1996) [42], Zhu et a (2013)l [43].
3	Green Innovation	Chiou et al (2011) [39], Conding et al (2012) [46], Lampikoski (2012) [44], Seman et al (2012) [45].
4	Green Design	Eltayeb et al (2011) [46], Zhu et al (2008) [24], Zhu et al (2007) [40], Zhu et al (2005) [26], Zhu et al (2013) [46],wu et al(2012) [47].
5	Reverse Logistics	Eltayeb and Zailani (2011) [46], Saman et al (2012) [45], Pokharel (2009) [48], Gonzalez (2004) [49], Eltayeb et al (2011) [18].
6	Customer collaboration	Zhu et al (2007) [40], Chan et al (2008) [9], Zhu and Sarkis (2006) [32], Conding et al (2012) [39], Zhu et al (2008) [24], Zhu et al (2011) [41], Zhu et al (2006) [32], Zhu et al (2005) [26], Zhu et al (2013) [43], Wu et al (2012) [47].
7	Internal Environment (IEM) Management	Conding et al (2012) [39], Zhu et al (2008) [24], Zhu et al (2007) [40], Zhu et al (2005) [26], Eltayeb et al (2008) [18], Saman et al (2012)[45].
8	Return Investment	Zhu et al (2008) [24], Chan et al (2008) [9], Zhu et al (2007) [40], Zhu et al (2005) [26], Zhu et al (2013) [43], Wu et al (2012) [47].

Second step: calculating Structural Self-Interaction Matrix (SSIM)
When the variables were identified, they should be entered in to a matrix called Structural Self-Interaction Matrix (SSIM), which shows the internal relationship of the variables. This matrix, is a matrix with the dimension of variables in whose first line and column the variables are presented respectively and then the relationship between the variables are shown with symbols such as (O, X, A, V) 33. Each of these symbols have their meanings including the following:
V: line factor (i) can pave the way for the column factor (j).
A: column factor (j) can lead to line factor (i).
X: between line factor (i) and column (j) there is a mutual relationship. In other words the two of them can lead to each other.
O: there is no relationship between the two factors (I, j).
According to what was said, a questionnaire was developed to evaluate the variables and in its first line and column, 8 variables were identified, already existing in the studies. Then the participants were asked to fill out the questionnaire according to the symbols (OXAV), and determine the relationship between the elements. And finally, after collecting the questionnaires, the relationship of the variables were determined according to the symbols. The final table, or SSIM matrix, is what came out of the questionnaires in table 2.

Table 2: Internal relationship matrix

Row	Initiative	1	2	3	4	5	6	7	8
1	Green Supplier	2	2	4	8	6	5	6	8
2	Green Purchase	6	7	3	6	2	1	8	6
3	Green Innovation	7	7	7	6	7	8	8	5
4	Green Design	8	5	4	7	8	3	8	4
5	Reverse Logistics	7	8	8	8	8	4	4	3
6	Customer collaboration	2	2	8	7	5	1	6	5
7	Internal Environment Management(IEM)	6	8	1	4	5	0	3	3
8	Return Investment	8	8	4	4	5	1	4	4

Third step: calculating reachability matrix

Translating the symbols from SSIM to numbers one and zero according to the following rules, the reachability matrix can be calculated (table 3). These rules include:

- If blocks (i, j) in SSIM matrix with the symbol V, the block related to it in the matrix takes number 1 and the identical block, (i,j) takes 0.
- If the block (i,j) in the SSIM matrix with the symbol A, the related block in the reachability matrix takes zero and its identical block, (j,i) takes 1.
- If (i,j) block in SSIM block takes X, the related reachability matrix in the block takes 1 and the identical block, (j,i) takes number 1.
- If (i,j) block in the SSIM matrix with the symbol O, the related block in the reachability matrix takes zero and the identical block, (j,i) takes number zero.
-

Table 3. Reachability matrix

Row	Initiative	1	2	3	4	5	6	7	8
1	Green Supplier	0	0	1	1	1	1	1	1
2	Green Purchase	1	1	0	1	0	0	1	1
3	Green Innovation	1	1	1	1	1	1	1	1
4	Green Design	1	1	1	1	1	0	1	1
5	Reverse Logistics	1	1	1	1	1	1	1	0
6	Customer collaboration	0	0	1	1	1	0	1	1
7	Internal Environment Management(IEM)	1	1	0	1	1	0	0	0
8	Return Investment	1	1	1	1	1	0	1	1

Step four: adapting reachability matrix

After calculating primary reachability matrix, its internal adaptability is tested. In internal adaptability, if variable number 1 leads to variable number 2, and it leads to variable number 3, therefore the first variable has to lead to variable number 3 as well and if in the reachability matrix this was not possible, the matrix has to be corrected and relationships which have been ignored must be replaced 50.Several methods have been proposed for the adaptation of the matrix, and in the following lines two of the methods for adapting the matrix has been put forward:

First method: some of the researchers believe that, after collecting data and calculating SSIM and reachability, if in the matrix any kind of inadaptability is observed, the questionnaires should be redistributed and SSIM and reachability must be calculate and this has to be repeated so that the adaptability settles. In the studies by Faisal et al, (51), and Agarwal et al, this has been used.

Second method: in the second method, mathematical rules have been applied for the adaptation of the reachability matrix. The reachability matrix is powered to the power of K+1 and K>_ 1. The empowerment of the matrix has to be based on the rule of bolen. In this rule we have 50:

1x1=1 and 1+1=1

In the present study the second method has been used to adapt the reachability matrix. The results of the adaptability of the matrix has been shown table 4. It is notable to say that in the chart for ISM, the first method has been explained but since getting access to the expert managers of the petrochemical industry who had filled out the forms was not feasible, the second method was employed.

Table 4. Reachability matrix after adaptability

Row	Initiative	8	7	6	5	4	3	2	1
1	Green Supplier	1*	1*	1	1	1	1	1	1
2	Green Purchase	1	1	0	1	1*	1*	1	1
3	Green Innovation	1	1	1	1	1	1	1	1
4	Green Design	1	1	1	1	1	0	1	1
5	Reverse Logistics	1	1	1	1	1	1	1	0
6	Customer collaboration	1*	1*	1	1	1	0	1	1
7	Internal Environment Management(IEM)	1	1	0	1	1	0	0	0
8	Return Investment	1	1	1	1	1	0	1	1

Step five: determining the level and priority of the variables

Now, in order to determine the level and priority of the variables, using the final matrix, we calculate the (Set of input and output) variables all together. The outcome of the variable includes all the 1s that exist in the line of that variable and the (Input) includes all the 1s that exist in the column of the variable. After determining the (Input and Output) the commonalities of these to collections are calculated; whichever of the variables' outcome and commonality was totally similar, is located in the top level of the ISM. Then, in order to find the other parts of the next level, the identified parts of each level are omitted and again the steps that we mentioned are repeated (table 5-8).

5. Analysis, permeability and dependency rate

The variables are categorized to four groups in this stage. The first set consists of autonomous variables whose leading and dependency power is weak. These variables are rather disconnected from the system and their relationship with the system is very low. Dependent variables are the second group with little leading power but high dependency. The third group is linkage variables with high leading power and high dependency. Because any kind of change in any of them can affect the system and in turn, the feedback of the system can affect these variables as well. According to the findings, green purchase, green supplier, green designing, gree, return investment, cooperating with the customers and reverse logistics are placed in linkage (Connective) part. The fourth group is permeability variables with strong leading and weak dependency and are so called key variables. Here, green innovation is considered a key variable. By summing the lines and columns (Row and Column) the permeability and dependency can be calculated. The sum of the columns shows dependency and sum of the lines show permeability.

Table 5: First and second level activity

Initiative	Share	Output	Input
Green Supplier	1,2,3,4,6	1,2,3,4,5,6	1,2,3,4,6,8
Green Purchase	1,2,5,8	1,2,5,7,8	1,2,3,4,5,6,8
Green Innovation	1,3,5	1,2,3,4,5,6,7,8	1,3,5
Green Design	1,4,5,6,7,8	1,2,4,5,6,7,8	1,3,4,5,6,7,8
Reverse Logistics**	2,3,4,5,6,7,8	2,3,4,5,6,7,8	1,2,3,4,5,6,7,8
Customer collaboration	1,4,5,6	1,2,4,5,6	1,3,4,5,6,8
Internal Environment Management (IEM) **	4,5,7,8	4,5,7,8	2,3,4,5,7,8
Return Investment	2,4,5,7,8	1,2,4,5,6,7,8	2,3,4,5,7,8

Table 6: Third level activity

Initiative	Share	Output	Input
Green Supplier**	1,2,8	1,2,8	1,2,3,4,6,8
Green Purchase**	1,3	1,2,3,4,6,8	1,3
Green Innovation	1,4,6,8	1,2,4,6,8	1,3,4,6,8
Green Design	1,4,6	1,2,4,6	1,3,4,6,8
Collaboration with Customer	2,4,8	1,2,4,6,8	2,3,4,8
Return Investment	2,4,8	1,2,4,6,8	2,3,4,8

Table 7: Four level activity

Initiative	Share	Output	Input
Green Innovation	3	3,4,6,8	3
Green Design**	4,6,8	4,6,8	3,4,6,8
Collaboration with Customer**	4,6	4,6	3,4,6,8
Return Investment	4,8	4,6,8	3,4,8

Table 8: Five level activity

Initiative	Share	Output	Input
Green Innovation	3	3,8	3
Return Investment**	8	8	3,8

Table 9: determining linkage and permeability variables

Initiative	1	2	3	4	5	6	7	8	SUM
Green Supplier	1	1	1	1	1	1	0	0	8
Green Purchase	1	1	0	0	1	0	1	1	7
Green Innovation	1	1	1	1	1	1	1	1	8
Green Design	1	1	0	1	1	1	1	1	7
Reverse Logistics	0	1	1	1	1	1	1	1	7
Customer collaboration	1	1	0	1	1	1	0	0	7
Internal Environment Management	0	0	0	1	1	0	1	1	4
Return Investment	1	1	0	1	1	1	1	1	7
SUM	6	7	4	8	8	6	8	6	

Diagram 2: placement of different variables in different places

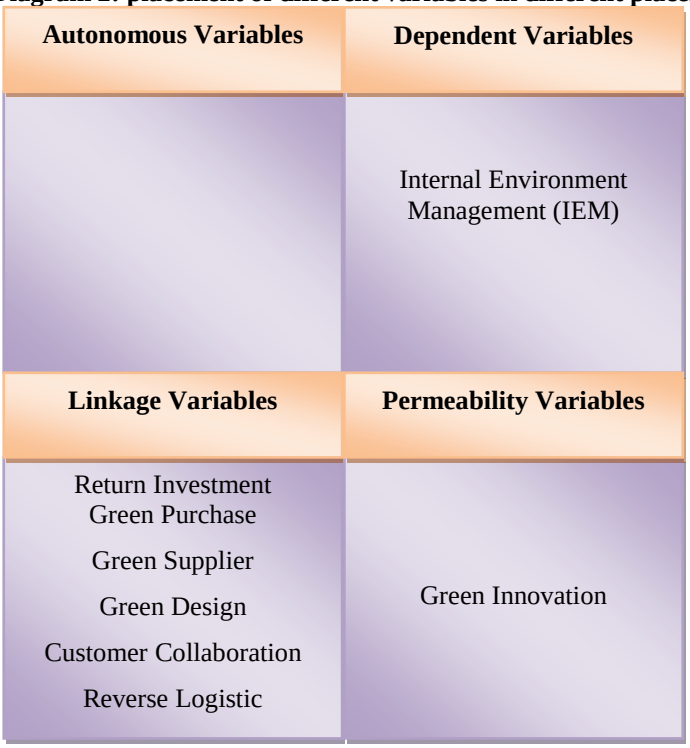

Figure 2. Placement of different variables in different places

Conclusion

In recent years, environmental issues have become a source of basic attention for different industries, esp. those with higher pollution potentials; hence different companies are seeking ways to reduce environmental pollution. One of the ways to help this is GSCM. Since companies' supply chain mostly deals with the main activities and issues of the company, greening the supply chain by itself causes to diminish a lot of the harms to the environment. Further, green supply chain has different parts, each of which with its special importance. In the present study the activities of the GSCM was selected to be studied. Since the activities of GSCM are the key factor for this concept, several studies have been taken

out to investigate different aspects of it. In the present study according to the literature of the subject the main activities were identified and then, using ISM, their priority was determined in petrochemical industry (Figure 3).

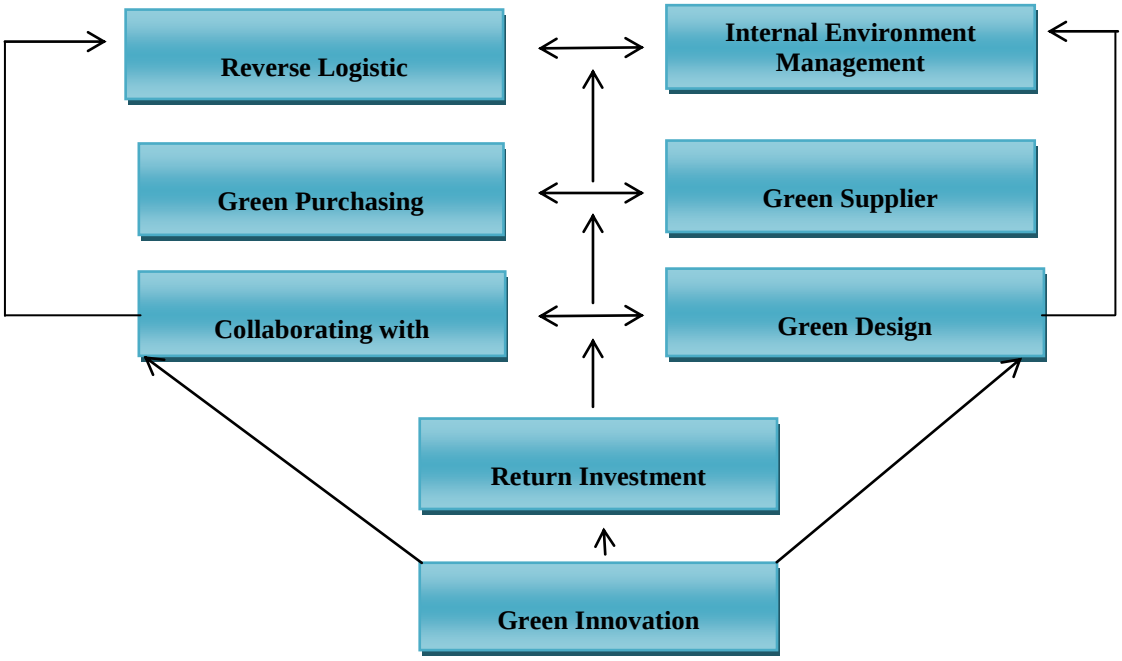

Figure 3. The final priority of the activities GSCM

And finally, after the analysis was done, 10 activities were placed in five levels. Internal Environment Management (IEM) and reverse logistic was ranked in the first level that is this variable is a key factor, affecting eight other variables. In other words it effects the applicability of eight other activities effectively. At the second level green supplier and green purchase, third level green designing and cooperation with the customers, level four return investment and finally green innovation ranked fifth.

Previous studies about prioritizing in the GSCM, mostly factors like obstacles and GSCM actuators have been dealt with. For example Mathyazhagan et al. [32] found the obstacles in the GSCM and used ISM to prioritize them and also Govindan et al. [33], tended to find the obstacles of GSCM in India and used AHP method. In the reviewed literature by Lin [34] the activities of GSCM were prioritized for which they used DEMATEL method, whose activities don't accord with the current findings of our research.

Since oil and petrochemical industries are of the main industries in Iran, and since they do rather great damage to the environment; identifying the main activities effecting GSCM and prioritizing them in petrochemical industries, because of its saliency in the production line, can help managers in better understanding the adaptable with environment activities in their companies' supply chain, and the necessary guidelines for effective investments and logical expanses on adapting with the environment activities are done to them, and this way they reduce the damages to the environment that is caused by this industry in Iran.

Finally it is important to say that the calculated priority in this study is not absolute and it is proper to the petrochemical industry and for researchers who want to figure out similar prioritizing in another industry, have to use their own method of prioritizing and this is the limitation of this study and also suggestion for further studies.

Reference

1. Didehkhani, H. A novel framework for agility assessment in supply chain considering enablers and capabilities, *Kuwait J. Sci. Eng*, 37 (2010) 161-182.
2. Burgess, K., Singh, P.J., Koroglu, R., Supply chain management: a structured literature review and implications for future research. International, *Journal of Operations & Production Management*, 26 (2006) 703-729.
3. Jain, J., et al., Supply chain management: literature review and some issues. *J. Stud. Manufac.*, 1 (2010) 11-25.
4. Christopher, M. Logistics and supply chain management, Financial Times/Prentice Hall, (2010).
5. Seth, A.V. A Conceptual Framework for Supply Chain Competitiveness, *Int. J. Human & Soc. Sci.*, 6 (2011) 5-10.
6. Ugochukwu, P., Engström, J., Langstrand J., Supply Chain: A Literature Review, *Management and Production Engineering Review*, 3 (2012) 87-96.
7. Chan, R.Y., et al., Environmental orientation and corporate performance: The mediation mechanism of green supply chain management and moderating effect of competitive intensity. *Ind. Mark. Manag.*, 41 (2012) 621-630.

8. Seman, N.A., et al., Green Supply Chain Management: A Review and Research Direction. *International Journal of Managing Value And Supply Chains*, 3 (2012) 1-8.
9. Pak, S., A Review of the Literature and a Framework for Green Supply Chain Management in International Conference on Business, Economics, and Accounting: Bangkok - Thailand. (2014)34-45.
10. Walker, H., Di Sisto, L., McBain, D. Drivers and barriers to environmental supply chain management practices: Lessons from the public andprivate sectors. *Journal of Purchasing and Supply Management,*. 14 (2008) 69-85**.**
11. Eltayeb, T.K., Zailani, S., Ramayah, T., Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, conservation and recycling*, 55 (2011) 495-506.
12. Kumar, R. Chandrakar, R., Overview of Green Supply Chain Management: Operation and Environmental Impact at Different Stages of the Supply Chain. 1 (2008)1-6.
13. Zhu, Q., Sarkis, J., Geng, Y., Green supply chain management in China: pressures, practices and performance. *International Journal of Operations & Production Management*, 25 (2005) 449-468.
14. Shukla, R.K., Garg, D., Agarwal, A., Understanding of Supply Chain: A Literature Review. *International Journal of Engineering Science and Technology (IJEST)*, 3 (2011) 2059-2072.
15 Toke, L.K., Gupta, R.C., Dandekar, M. An empirical study of green supply chain management in Indian perspective. nt. *Journal of Applied Sciences and Engineering Research*, 1(2012) 372-383.
16. Davies J., Hochman S., The greening of the supply chain. *Supply Chain Management Review*, 11 (2007) 13.
17. Anbumozhi, V. Kanda, Y. Greening the production and supply chains in Asia: Is there a role for voluntary initiatives. IGES Kansai Research Centre KRC, (2005).
18. Azevedo S.G., Carvalho H., Cruz V. The influence of green practices on supply chain performance: a case study approach. *Transportation research part E: logistics and transportation review*, 47(2011) 850-871.
19. Carter, C.R., Kale, R., Grimm, C.M. Environmental purchasing and firm performance: an empirical investigation. *Transportation Research Part E: Logistics and Transportation Review*, 36 (2000) 219-228.
20. Zhu, Q. Sarkis, J. Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *J. Oper. Manag.*, 22 (2004) 265-289.
21. Autry, C.W., Formalization of reverse logistics programs: a strategy for managing liberalized returns. *Industrial Marketing Management*, 34 (2005) 749-757.
22. Zhu, Q., Sarkis, J., An inter-sectoral comparison of green supply chain management in China: drivers and practices. *Journal of cleaner production*, 14 (2006) 472-486.
23. Chen Y.-S., The driver of green innovation and green image–green core competence. *J. Bus. Ethics*, 81 (2008) 531.
24. Shang K. C., C. S. Lu Li, S., A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan. *Journal of Environmental Management*, 91 (2010) 1218-1226.
25. Eltayeb, T.K., S. Zailani, and T. Ramayah, Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, conservation and recycling*, 55 (2011) 495-506.
26. Lun, Y., Green management practices and firm performance: A case of container terminal operations. *Resources, Conservation and Recycling*, 55 (2011) 559-566.
27. OLFAT.Laaya, Khatami Firoozabadi Seyyed Ali, Khodaverdi, Rouhallah. (1390). Green supply chain management to fulfil the requirements of the automotive industry Ayranfslnamh management of Iran, 6, (2012) 123 -140
28. Niknejad M., Green supply chain (with Case Study). *Journal of Supply Chain Management*: 13, (2013) 12-25.
29. Warfield, J.N. Developing interconnection matrices in structural modeling. Systems, Man and Cybernetics, *IEEE Transactions on Systems, Man and Cybernetics*, 3 (1974) 81-87.
30. Attri R., N. Dev, and V. Sharma, Interpretive structural modelling (ISM) approach: an overview. *Research Journal of Management Sciences*, 2319 (2013) 1171.
31. Taghizade Hooshang. Shokri, Abdolhossein. Interpretive Structural Modeling application of the grading criteria OCB (case study). N*ew Approach in Educational Management*, 5 (2012) 23 -41.
32. Mathiyazhagan, K., NoorulHaq, A., Yong, G. An ISM approach for the barrier analysis in implementing green supply chain management. *Journal of Cleaner Production*, 12 (2013) 1-15.
33. Govindan K., Mathiyazhagan, K., Kannan, D. Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process. *Int. J. Production Economics* 147 (2014) 555–568.
34. Lin R. Using fuzzy Dematel to evaluate the green supply chain management practices, *J. Clean. Prod.* 40 (2013) 32.