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Identifying and Prioritizing Cleaner Production Strategies in Raw Materials' Warehouse of Yazdbaf Textile Company in 2015

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ABSTRACT

Introduction: Cleaner productions in textile industry is achieved by reducing water and chemicals' consumption, saving energy, reducing production of air pollution and solid wastes, reducing toxicity and noise pollution through many solutions. The purpose of the present research was to apply Strengths, Weaknesses, Opportunities, Threats (SWOT) and Quality Systems Planning Matrix (QSPM) techniques in identifying and prioritizing production in raw materials' warehouse of Yazdbaf Textile Factory.

Materials and Methods: In this research, effective internal and external factors in cleaner production were identified by providing the required information through field visit and interview with industry managers and supervisors of raw materials' warehouse. Finally, To form matrix of internal and external factors 17 important internal factors and 7 important external factors were identified and selected respectively.Then, QSPM matrix was formed to determine the attractiveness and priority of the selected strategies by using results of internal and external factors and SWOT matrixes.

Results: According to the results, the total score of raw materials' warehouse in Internal Factor Evaluation (IFE) matrix is equal to 2.90 which shows the good situation of warehouse than the internal factors. However, the total score in External Factor Evaluation (EFE) matrix is 2.14 and indicates the relative weak situation of warehouse than the external factors.

Conclusion: Based on the obtained results, continuity, monitor, and improvement of the general plan of qualitative control (QC) of raw materials and laboratory as well as more emphasis on quality indexes according to its importance in the production processes were selected as the most important strategies.

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Introduction

Textile industry has a precedent of several thousand years in Iran. In the present time, the textile industry of Iran has been developed so much and a great investment has been made in major parts of it [1, 2].

Textile industry is one of the biggest industries which consumes water a lot and therefore produces sewage more than many industries. In this industry, large amounts of colored sewages are produced which are usually toxic, persistent to biodegradability, and stable in the environment.

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Textile industry includes a long chain of wet processes, each step requires inputs water, energy, and chemicals. These processes make much wastage. Textile industry wastes are divided into three categories of solid, liquid, and gaseous wastes which should be refined, recycled, or disposed in a suitable method [1, 3].

In this regard a wide range of pollutions and wastes are produced that cause adverse effects on health and environment. Consequently, a management plan is required to minimize wastes. Reduction of wasts from source, recycle, re-use, disposal, and elimination of wasts in sanitary methods, and using cleaner methods of production are some methods currently used to minimize wasts in these systems [4].

Application of cleaner production approach has appeared from 1989 through United Nations Environment Programme (UNEP). The strategy based on this approach is prevention of producing pollution. This approach includes continuous use of comprehensive environmental strategy of prevention in processes, products, and services to increase efficiency and reduce risks in humans and the environment. Cleaner production strategy is specified by three characteristics of continuous, preventive, and comprehensive.

Continuity which is in proportion to the term "cleaner" implies the permanent effort of all those who work in a production unit to achieve the minimum possible pollution. Preventive trait indicates prevention of producing pollution at the source and inclusiveness of this strategy is because it includes air, water, and soil. Cleaner production makes a strong relationship between improvement of the environment and economic saving [5].

Cleaner production or waste minimization in the textile industry can be achieved in fields of water and chemicals' consumption, energy saving, reduction of air pollution and solid wastes, reduction of toxicity and noise pollution through many solutions, and also in each of certain processes of industry through many solutions. In order to determine and prioritize these solutions, proper planning, decision making, and management techniques and strategies should be used [6].

SWOT model was introduced by Johnson et al, as a tool used in early levels of decision making. This model is a good technique to analyze an organization's internal and external factors, but it has some defects in measurement and evaluation levels. Since SWOT mainly acts on the basis of qualitative analysis in planning process, an efficient procedure for planning is to create the (QSPM) after evaluation of internal and external factors [7, 8]. Hitherto, SWOT model has been used to evaluate development strategies of various industries such as tourism [9], beverage [10], and automotive industry [8].

QSPM is an analytical method through which the relative attractiveness of strategies is specified. By this method, different strategies among the best strategies' group can be specified objectively. This matrix is used to compare and prioritize internal and external key factors; reduces the possibility of ignorance or inappropriate wightening of these factors [8, 9].

Yazdbaf Textile Factories (Limited Liability Partnership (LLP) were established in 1956 in Yazd with an area of 120 thousand square meters to make factories of spinning, knitting, printing, and completing different kinds of cotton fabrics. This factory includes 12 main parts which respectively include: raw materials' warehouse, spinning hall, yarn warehouse, knitting preparations hall, knitting hall, measurement and control unit, raw fabrics' warehouse, the completion preparation unit, dyeing and printing unit, final completion of fabric, packaging unit, and warehouse of completed fabric [10].

Raw materials' warehouse in the textile industry is a place to store and keep input raw materials including natural and synthetic fibers which includes cotton, polyester, and viscose. The importance of raw materials is so that a high quality production is not possible without appropriate and desirable raw materials and inferior raw materials will produce more wastes. So, factories are required to prepare the desirable raw materials before anything else to reduce their

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problems. In the present research at first, effective internal and external factors on cleaner production were identified by SWOT model in raw materials warehouse of Yazdbaf Textile Factory of Yazd province. Then, the intended strategies were analyzed and prepared. After that, strategies were prioritized by applying QSPM.

Materials and Methods

The current research is a practical and descriptive study to identify and prioritize cleaner production strategies in raw materials' warehouse of Yazdbaf Textile Factory. Based on the conducted evaluations, 13 people (3 supervisors and 10 workers) work in materials' warehouse in 3 working shifts. Thus, the evaluated sample consisted of 8 people including factory production manager, plan and development expert, supervisors of warehouse unit (3 personnels), and workers of warehouse (3 people). The needed data were collected by visiting the raw materials' warehouse and interviewing the managers and supervisors of the warehouse.

Among limitations of the present research the followings can be mentioned: the factory is antiquated and old and new equipment are applied simultaneously in it, there is no adequate and stable market to provide research's budgets, budgets are lacked to be developed and allocated to units like raw materials' warehouse, further, experienced personnel with low education degree and high educated while inexperienced personnel work there which can make some problems in some cases. This research was conducted in two main levels:

1- Preparation of SWOT for raw materials' warehouse

SWOT model or technique is a tool to identify the available threats and opportunities in the external environment of a system and recognize its internal strengths and weaknesses in order to evaluate the situation and prepare the strategy to guide and control that system. Analyzing situation and preparing strategy are conducted through the following levels:

- Recognition and classification of internal strengths and weaknesses of a system;
- Recognition and classification of available threats and opportunities in the external environment of a system;
- Completion of SWOT matrix and preparation of different strategies to guide the system in future [11].

Determination of the effective internal and external factors on cleaner production in raw materials' warehouse

At the first level, to start the work after coordinating with authorities of Yazdbaf Textile Factory, the raw materials' warehouse was visited. According to the conducted visitation, the Operation Process Chart (OPC) was drawn for this part (Table 1) and all input or consumption materials as well as output or producing materials of that were specified. The effective internal (strengths and weaknesses points) and external (threats and opportunities) factors on cleaner production in the raw materials' warehouse were identified and prepared according to the common visitation in the presence of warehouse authorities and with participation of factory personnel and authorities.

Table 1: Operation Process Chart (OPC)

Chemical materials	Color materials	Cotton fibers	Viscose fibers	Polyester fibers
Raw materials' warehouse				
Wastewater from making Dyes and chemicals	Dusty vessels of Raw materials to Make color Materials	Plastic Strap	Metal wire	Knauf (Cotton cloth, Polibrolin fibers, knauf)

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Evaluation of the effective internal and external factors on cleaner production in raw materials' warehouse

After determination of effective internal and external factors on cleaner production, IFE and EFE matrixes were used in this research to apply SWOT model in analysis of internal and external factors[12].

A) Preparation of Internal Factors Evaluation matrix (IFE)

Levels of preparing this matrix are as following:

1-After evaluation of internal factors, strengths and then weaknesses of the system were written.

2- In order to determine the importance of each factor in achieving the intended purposes, personnel, related managers, and authorities gave them importance scores from 1 to 10.

3-The importance average scores of each group were summed and each single score was divided to the resulted digit of sum of importance score. The resulted digit is the importance coefficient and their sum of is 1.

4- To rank strengths factors, scores of 4 and 3 were allocated respectively to excellent or typical traits, while scores of 1 or 2 were given to serious or ordinary weakness points, respectively.

5- The importance coefficient of each factor was multiplied to the related rank and the total score was obtained.

6- The final score was specified by calculating sum of each factor's total scores. Sum score of 4 means organization's excellent reaction with the average score is 2.5; so that if average scores are less than 2.5, it means that the intended part is weak in terms of internal factors. This shows the dominance of weakness points over strength points and if the average score is more than 2.5 that part has dominant strengths [7,11,13].

B) Preparation of External Factors Evaluation Matrix (EFE)

This matrix is formed like the internal factors evaluation matrix with this difference that opportunity and threat factors are evaluated and scored instead of strength and weakness points.

Determination of strategic situation of raw materials' warehouse by using Internal and External Matrixes (IE)

To form this matrix, the resulted scores from IFE and EFE matrices should be placed in its horizontal and vertical dimensions to specify the position (strategic situation) of the intended part[11].

Designing the SWOT model to determine cleaner production strategies in raw materials' warehouse

The SWOT analysis method analyzes each one of strength, weakness, opportunities, and threats factors identified in previous levels in a systematic method and shows strategies related to the situation. In SWOT model after listing each one of strength, weakness, opportunities, and threats factors sequentially, different strategiesare introduced as: offensive strategies (SO), conservative strategies (WO), competitive strategies (ST) and defensive strategies (WT) [14].

2- pritorization of cleaner production strategies by using QSPM technique in raw materials' warehouse

Quantitative Strategic Planning Matrix (QSPM) is one of the useful techniques in evaluation and specification of relative attractiveness of the strategies applied in the decision making level. This technique determines feasibility of the selected strategies and in fact prioritizes them. The identified strategies are evaluated and judged through SWOT model, their relative attractiveness is also determined by QSPM [15].

The formation steps of QSPM:

1- The strength and weakness points as well as opportunities and threats are listed in the first column of QSPM. Then, in the second column the importance coefficients of these factors were entered according to IFE and EFE matrices.

2- The obtained strategies from SWOT model including SO, ST, WO, and WT were composed in above row of the QSPM so that two columns of attractiveness scores and total scores were considered for each strategy.

3- In determination of the attractiveness score, this question should be addressed that how much effect this factor has in selection of the mentioned strategies. Experts and authorities allocate a score to the intended strategy based on the amount of

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effect and attractiveness of each internal and external factor which is called attractiveness score. The attractiveness of each strategy has been given a score from 1 to 4 (1: weak attractiveness; 2: relative attractiveness; 3: medium attractiveness; 4: maximum attractiveness) which is then written in Attractiveness Score (AS) column. If the mentioned factor doesn't have any effect on preparation or selection of the strategy, no score will be given to it.

4- By multiplication of the importance coefficient of each factor in attractiveness score, attractiveness of the strategy is calculated and the resulted digit is written in TAS column.

5- Digits of TAS column of each strategy are summed to obtain total attractiveness of each strategy.

6- Strategies are prioritized from the highest to the lowest scores based on the total attractiveness score of each strategy [16].

In other words, this technique specifies more suitable strategies for cleaner production in the intended unit. In fact strategies are prioritized.

Results

According to the held meetings and visits, strength and weakness points as well as opportunities and threats were specified. Later, IFE and EFE matrices were prepared to determine importance scores. These matrices were completed by production manager, plan and development expert, supervisors, and workers of warehouse. The entered scores are average scores of the given scores presented in tables 2 and 3, respectively.

Table 2: Internal Factors Evaluation matrix (IFE) of raw materials' warehouse

Internal factors	Importance score	Importance coefficient	Rank	Total score
Strength points:				
1- The correct warehousing and storage of bales (Separation and segregation of gossypium hirsutum, bricklaying under bales anetc.)	9.33	0.064	3.67	0.235
2- Proper opening of the wires on cotton bales	6.67	0.045	3.33	0.152
3- Appropriate waste collection for recycling	8.67	0.059	3	0.178
4- Trained worker in utilization, use, and manufacturing dyestuffs and chemicals	9.33	0.064	3.33	0.213
5- Keeping, storing, and utilizing anti-Honeydew dissolved materials' residues for the following days	9.67	0.066	4	0.266
6- Timely discharge of the load in appropriate space	7.33	0.050	4	0.201
7- Control and monitor materials entering the warehouse	10	0.068	4	0.275
8- Make good use of the area space to arrange bales	9	0.061	3.33	0.206
9- Cleaning Warehouse and avoiding to create dust	8.67	0.059	3.67	0.218
10- Timely delivery and correct arrangement of the batting line	10	0.068	4	0.275
Weakness points:				
1- Limited useful space available for storage of raw materials because warehouse is repurposed to maintain fabrics in it	8	0.055	2	0.110
2- Lack of air conditioning and proper heating and cooling system	7.33	0.050	1.67	0.084
3- Old lift trucks are applied in transporting materials to the warehouse	8.67	0.059	1.67	0.099
4- Contamination of warehouse space due to used gasoline lift trucks	9	0.061	1.67	0.103
5- Old carts carrying cotton bales	7.33	0.050	2	0.100
6- Lack of suitable graduated container to make dyestuff and chemicals	7.67	0.052	2	0.105
7- Old dyes and chemical containers and consequently waste of the intended materials	8.67	0.059	1.33	0.079
Total	145.34	1	-	2.907

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Table 3: External Factors Evaluation matrix (EFE) of raw materials' warehouse

External factors	Importance score	Importance coefficient	Rank	Total score
Opportunities: 1.Good quality of imported cotton	10	0.147	3.67	0.539
2.Determination of accurate amount of consumed Tint Color by laboratory	10	0.147	3.67	0.539
3.Quality control of input raw materials, such as cotton and synthetic fibers by laboratory	10	0.147	4	0.588
Threats: 1.Weakness in the customs' warehousing (imported raw materials)	9.67	0.142	1.33	0.189
2.Diversity and poor quality of raw materials	10	0.147	1	0.147
3.Poor quality of dyestuff and chemical storage containers	9.33	0.137	2	0.274
4.Factory's lack of cash to buy desirable raw materials	9	0.132	1	0.132
Total	68	1	-	2.410

According to table 2, the average of IFE matrix total score is more than 2.5 (2.9) which shows dominance of strengths. However, the average of total score in EFE matrix (Table 3) is 2.41. This matter indicates that raw materials' warehouse has weak performance in terms of external factors and threats are dominant on opportunities. So, raw materials, warehouse is placed in the category of competitive strategies (ST) (Figure 1).

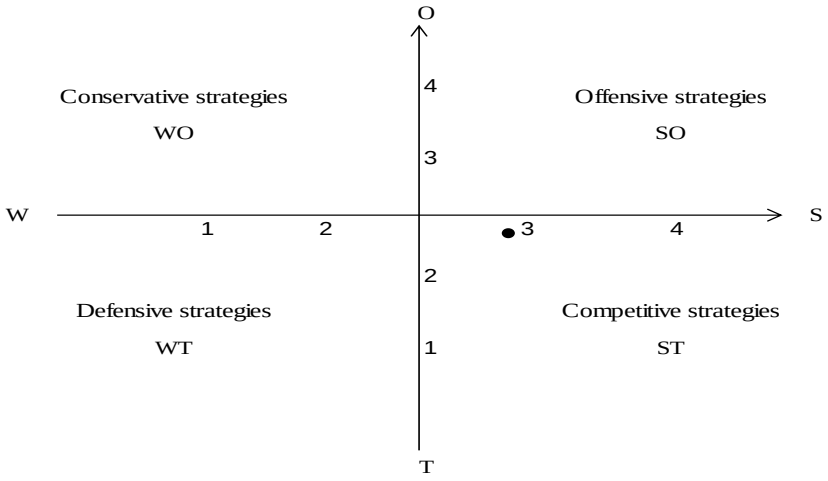


Figure 1: Internal and External (IE) matrices of raw materials' warehouse

Various strategies of cleaner production obtained from SWOT method according to factors of strength, weakness, opportunity, and threat of raw materials, warehouse unit of Yazdbaf Textile Factory are presented in table 4.

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Table 4: SWOT matrix of raw materials' warehouse

Strength, weakness, opportunity, and threat matrix of raw materials, warehouse	Strength points (s) 1- Correct warehousing and storage of bales (Separation and segregation of gossypium hirsutum, bricklaying under bales and etc.) 2- Opening the wires on bales of cotton appropriately and carefully 3- Proper waste collection for recycling 4- Trained worker in the field of utilization, use, and manufacture of dyestuffs and chemicals 5- keeping, storing, and utilizing anti-Honeydew dissolved materials' residues for next days 6- Timely discharge of the load in an appropriate space 7- Control and monitor materials entering the warehouse 8- Make good use of the area space to arrange bales 9- Cleaning Warehouse and avoiding to create dust 10- Timely delivery and correct arrangement of batting line	Weakness points (w) 1- The limited useful space available for storage of raw materials due to the change of use and maintenance of fabrics in warehouse 2- Lack of air conditioning and proper heating and cooling system 3- Frazzle of used forklifts in transporting materials to the warehouse 4- Contamination of warehouse space due to used gasolinic forklifts 5- Frazzle of carrying carts of cotton bales 6- Lack of suitable graduated container to make dyestuff and chemicals 7- Frazzle of dyes and chemical containers and then wasting the intended materials
Opportunities (O): 1- Good quality of imported cottons 2- Determination of accurate amount of consumed Tint Color by the laboratory 3- Quality control of input raw materials, such as cotton and synthetic fibers by the laboratory	SO strategies St1- Using suitable imported cottons in production St2- Continuity, monitor, and improvement of the general plan of laboratory and raw materials' qualitative control (QC) and more emphasis on quality indices according to its importance in production levels	WO strategies: St6-Improvement of transformation equipment and increase of useful physical space of raw materials warehouse St7-Improvement and control of containers and equipment of dyestuff and chemicals
Threats (T): 1-Weakness in the customs' warehousing (imported raw materials) 2- The diversity and poor quality of raw materials 3- Poor quality of dyestuff and chemical storage containers 4- Lack of cash to buy desirable raw materials	ST strategies St3- Make plans and interact with customs to simplify customs' formalities, not discharge goods in customs, and send them to factory St4- Using suitable containers to keep chemicals in factory or by provider or presenting a suitable packing design St5- Improvement of budgeting by cleaner production approach	WT strategies St8- Training personnel of warehouse with improvement of cleaner production culture approach St9- Control of buying and increasing the accuracy in indexes of controlling buy quality

The obtained strategies from SWOT model were prioritized by QSPM (Tables 5 and 6).

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Table 5: Quantitative Strategic Planning Matrix (QSPM) of internal factors of raw materials' warehouse

Internal factors	Importance coefficient	Strategy 1		Strategy 2		Strategy 3		Strategy 4		Strategy 5		Strategy 6		Strategy 7		Strategy 8		Strategy 9	
		AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS
		Strength points (s)																	
1- Correct warehousing and storage of bales (Separation and segregation of gossypium hirsutum, bricklaying under bales and etc.)	0.064	1	0.064	1	0.064	-	-	-	-	-	-	3	0.192	-	-	3	0.192	-	-
2- Appropriate opening of wires on cotton bales	0.045	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.090	-	-
3- Correct collection of wastes for recycling	0.059	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.118	-	-
4- Trained workers in utilization, use, and make dyestuffs and chemicals	0.064	-	-	3	0.192	-	-	1	0.064	-	-	-	-	1	0.064	3	0.192	-	-
5- Keeping, storing, and utilizing anti-Honeydew dissolved materials' residues for the next days	0.066	-	-	2	0.132	-	-	1	0.066	-	-	-	-	2	0.132	2	0.132	-	-
6- Timely discharge of the load in the appropriate space	0.050	-	-	-	-	-	-	-	-	-	-	2	0/100	-	-	2	0.100	-	-
7- Control and Monitor materials that enter warehouse	0.068	2	0.136	4	0.272	-	-	1	0.068	-	-	-	-	-	-	2	0.136	3	0.204
8- Make good use of the area space to arrange bales	0.061	-	-	-	-	-	-	-	-	-	-	3	0.183	-	-	1	0.061	-	-
9- Clean the Warehouse and avoid to create dust	0.059	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.118	-	-
10- Timely delivery and correct arrangement of batting line	0.068	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.068	-	-

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Threats (T)																			
1- Limited useful space available for storage of raw materials due to repurpose of warehouse to maintain fabrics	0.055	2	0.110	-	-	-	-	-	-	3	0.165	4	0.220	-	-	-	-	-	-
2- Lack of proper air conditioning, heating, and cooling systems	0.050	-	-	-	-	-	-	-	-	1	0.050	1	0.050	-	-	-	-	-	-
3- Old lift trucks are applied in transporting materials to the warehouse	0.059	-	-	-	-	-	-	-	-	3	0.177	3	0.177	-	-	-	-	-	-
4- Contamination of ware house space due to used gasoline lift trucks	0.061	-	-	-	-	-	-	-	-	2	0.122	1	0.061	-	-	-	-	-	-
5- Old carts carrying cotton bales	0.050	-	-	1	0.050	-	-	-	-	1	0.050	2	0.100	-	-	-	-	-	-
6- Lack of suitable graduated container to make dyestuff and chemicals	0.052	-	-	3	0.156	-	-	-	-	1	0.052	-	-	3	0.156	-	-	-	-
7- Old dyes and chemical containers and consequently waste of the intended materials	0.059	-	-	3	0.177	-	-	4	0.236	2	0.118	-	-	4	0.236	-	-	2	0.118
Sum	1		0.310		1.043		-		0.434		0.734		1.083		0.588		1.207		0.322

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Table 6: Quantitative Strategic Planning Matrix (QSPM) of external factors of raw materials' warehouse

External factors	Importance coefficient	Strategy 1		Strategy 2		Strategy 3		Strategy 4		Strategy 5		Strategy 6		Strategy 7		Strategy 8		Strategy 9	
		AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS
Opportunities (O):																			
1. Good quality of imported cotton	0.147	4	0.588	4	0.588	2	0.294	-	-	2	0.294	-	-	-	-	-	-	4	0.588
2. Determination of accurate amount of consumed Tint Color by the laboratory	0.147	-	-	3	0.441	-	-	-	-	-	-	-	-	2	0.294	-	-	-	-
3. Quality control of input raw materials, such as cotton and synthetic fibers by the laboratory	0.147	3	0.441	4	0.588	-	-	-	-	-	-	-	-	-	-	-	-	4	0.588
Threats (T)																			
Threats: 1. Weakness in the customs' warehousing (imported raw materials)	0.142	2	0.284	-	-	4	0.568	-	-	-	-	-	-	-	-	-	-	2	0.284
2. Diversity and poor quality of raw materials	0.147	4	0.588	3	0.441	1	0.147	-	-	-	-	-	-	-	-	-	-	4	0.588
3. Poor quality of dyestuff and chemical storage containers	0.137	-	-	1	0.137	-	-	3	0.411	-	-	-	-	4	0.548	-	-	4	0.548
4. Factory's lack of cash to buy desirable raw materials	0.132	2	0.264	-	-	2	0.264	-	-	4	0.528	-	-	-	-	-	-	2	0.264
Total	1		2.165		2.195		1.273		0.411		0.822		-		0.842		-		2.860
Total score attractiveness of strategies			2.475		3.238		1.273		0.845		1.556		1.083		1.430		1.207		3.182

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Based on the calculations in Tables 6, the highest priority is related to strategy 2 with attractiveness score of 3.238 and the lowest priority is related to strategy 4 with attractiveness score of 0.845.

Discussion

In the present research the main purpose was identification and prioritization of cleaner production strategies in raw materials' warehouse of Yazdbaf Textile Factory. To do so, the effective internal and external factors on cleaner production were identified by using SWOT, then the intended strategy was analyzed, and finally the related strategies were prioritized by using QSPM. All aspects of the environment related to the issue of cleaner production were evaluated such as reducing solid waste and sewage production, water and energy consumption, as well as air, and noise pollutions.

Due to the novelty of *cleaner production* issue limited number of studies has been conducted on this topic in Iran. The research was carried out by Khezri et al. in 2008 with the topic of "Minimization systems of wastage in the industry of producing detergents" [4]. Findings of this research indicated that establishment of minimization management system of wastage in sulfonation unit of Behdad chemical Company reduced the consumption of raw materials to 25%, energy consumption 12%, and waste production up to 30% that will totally save 84 million Rials annually.

Also, Nouri et al. conducted a study entitled as "providing minimization management system of wastage in paint industries". of the identified waste resources in Rang Afarin Factory and proposed some ways to minimize them: reduction of wastes in production of resources as well as wastes' recycle and reuse.

Moreover, the amount of wastes in consumption of raw materials, water, and electricity were studied and managing solutions were proposed to reduce them. Findings of this research showed that consumption of raw materials, water, and electricity as well as wastage production can be reduced up to 0.15%, 12%, 15%, and 20%, respectively by applying waste minimization and implementation of proposed solutions. This idea will save 150 million Rials annually in operational costs of the production process.

Therefore, implementation of wastes' minimization methods and techniques is an affordable process in different industries which its final results are in favor of the environment and factory owners. Another study entitled as "Waste minimization in aluminum electrolytic industry" was conducted by Khezri et al. (They evaluated the aluminum industry in one production unit (Anodizing) and drew the general flow-diagram of the process by identification of the mentioned unit's production line. After collection of the required information, various solutions were suggested to reduce materials' consumption and minimize wastes.

In the literature as well as the present study, different aspects of the environment related to cleaner production were evaluated in industries and solutions were proposed. But, these solutions were not prioritized through a specific model.

Conclusion

The sum of internal factors' total scores was calculated as 2.90 according to the obtained results from internal and external matrices which shows the desirable situation of raw materials' warehouse. Also, sum of external factors' total score was equal to 2.41 that indicates weak operation of raw materials' warehouse. Based on the results of QSPM, the proposed strategies in terms of priority, i.e., from the highest to the lowest scores, are as the following:

1- Continuity, monitoring, and improvement of the laboratory and general plan of raw materials' QC as well as putting more emphasis on quality indices according to their importance in production levels (score: 3.238)

2- Control purchase and increase accuracy of purchase quality control indices (score: 3.182)

3- Using suitable imported cottons in production (score: 2.475)

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4- Improvement of budgeting through cleaner production approach (score: 1.556)

5- Improve and control containers and equipment of dyestuff and chemicals (score: 1.430)

6- Plan and interact with customs to simplify customs' formalities, not discharge goods in customs, and send them to factory (score: 1.273)

7-Training warehouse personnel with improvement of cleaner production culture approach (score: 1.207)

8- Improvement of transportation equipment and increase useful physical space of raw materials' warehouse (score: 1.083)

9- Apply suitable containers to keep chemicals in factory or with providers by using a suitable packing design (score: 0.845)

Suggestions

1- Using effective and appropriate software regarding warehouse monitoring and reporting

2- Providing suitable cottons if possible and preparing of input control methods

3- Preparing appropriate methods regarding cleaner production approach and suggesting them to ISO system of the company

4- Proving required trainings based on needs of raw materials' warehouse to control and improve cleaner production culture by a convenient timetable to the management of training unit in company

5- Using appropriate equipment in terms of transportation and physical space as well as applying suitable containers. Preparing controlling check lists of the above cases, submitting them to the warehouse authorities, and receiving reports

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Conflict of interest

We have no competing interests.

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