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## ORIGINAL RESEARCH ARTICLE

# Modeling Brand Resilience in Iran's Handwoven Carpet Industry Using Background Knowledge and Data Mining in Critical Conditions

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## ABSTRACT

**B**rand resilience knowledge helps companies maintain customer trust and strengthen relationships through proper planning and strategies. This research was conducted to model brand resilience in Iran's handwoven carpet industry using background knowledge and data mining in critical conditions. In brand resilience, knowledge analysis is considered highly significant for identifying key factors and effective patterns. This mixed research has been done based on qualitative data techniques in NVIVO software and quantitative data mining method in MATLAB software. 12 people were selected purposefully from carpet industry experts. Interviews were analyzed, coded, according to Strauss and Corbin method, and compared with the data mining method of the trained model and the MLP method. Based on the proposed model, 6 categories, 15 core codes, and 41 primary codes were identified. The proposed model could predict 98% brand resilience in crisis conditions. This model can help brands to maintain their business interests and implement appropriate strategies for active development, internal resistance, creative support, and production under sanctions. Furthermore, this model can help brands strengthen their capabilities and brand value, and identity in critical situations. ©authors

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## 1. Introduction

In critical situations, industries need brand resilience knowledge to maintain competitive advantage (Merlo et al., 2023).

In the existing competitive business world, companies must have the ability to be resilient in the face of critical conditions to survive and grow (Shepherd & Williams, 2023).

Brand resilience means the ability of a brand to continue its activities and maintain its competitive power facing various problems and crises (Shimul, 2022). Knowledge of brand resilience plays a significant role in creating and strengthening this ability (Biedenbach et al., 2022).

Knowledge of brand resilience helps companies identify and analyze possible risks in the business environment. This identification and analysis allows companies to seriously deal with risks and adopt appropriate strategies to manage them (Majumdar et al., 2022). It also helps companies to plan comprehensively and accurately and make correct predictions conditions of their brand and industry using previous data and information (Friedman et al., 2022).

These forecasts allow companies to implement appropriate plans in the face of crises and sudden changes (Suhardi et al., 2022). Industries use brand resilience knowledge to create resistance strategies against crises and risks (Gómez-Rico et al., 2023). These strategies can include financial, marketing, human resource management, and other strategies related to the performance of different company units (Williams & Murphy, 2021).

In critical situations, customers' trust in the brand is noteworthy (Esan et al., 2018). Brand resilience knowledge helps companies maintain customers' trust and strengthen their relationships with them with proper planning and strategies (Jraisat et al., 2015). Therefore, brand resilience knowledge helps companies face critical situations and maintain the strength and competitive power of their brand. Using data mining and data analysis techniques, this knowledge can help companies make effective and timely

decisions and improve performance and brand performance (Kang et al., 2021).

In brand resilience, knowledge analysis is considered highly important for identifying key factors and effective patterns in realizing brand resilience (Ngo et al., 2021). But despite the large amount of data and information related to the brand and the business environment, it may be manual and time-consuming to examine and derive knowledge and be inefficient in terms of efficiency and effectiveness (Loureiro, 2023).

In these cases, data mining as an effective and powerful method can help analyze brand resilience knowledge (Liu-Thompkins et al., 2022). Data mining, using different algorithms and techniques, can extract important and usable information from massive data and identify hidden patterns and connections within them (Hemsley-Brown, 2022). Data mining in crisis conditions is very important for brand resilience analysis.

In times of crisis, brands face many challenges and threats that can have a direct and indirect impact on their competitiveness and survival. In these cases, data mining as an efficient and powerful tool can help brands in crisis analysis and management (Bilro and Loureiro, 2020).

By analyzing data, data mining can identify risks and opportunities in crises. With accurate and up-to-date information about existing risks and exploitable opportunities, brands can adopt appropriate strategies in line with their brand resilience and exploit their opportunities (Loureiro et al., 2021), and it also helps brands make more effective decisions in a crisis. Moreover, brands can identify patterns, connections, and relationships in data that help them make better and smarter decisions about brand resilience strategies, measures, and activities (Ong et al., 2017).

It is even possible to discover patterns and information about crises and threats (Choi et al., 2022). By obtaining information, brands can plan appropriately for crisis management, react to preventive measures, and improve their brand performance in difficult situations (Prentice et al., 2019). Brands can gain a competitive advantage too.

With a detailed knowledge of customers, markets, and competitors, brands can implement appropriate strategies to maintain and improve their competitive power in crisis and give importance to increasing market share and attracting customers (Golob et al., 2022). By using data mining in the knowledge analysis of brand resilience, consequential questions can be answered, such as:

1. Identifying key factors in brand resilience: by analyzing data, it is possible to identify patterns and connections effective in realizing brand resilience which are of great importance.

2. Predicting risks and crises: By analyzing data, patterns can be discovered to indicate possible risks and crises in the future. This information can be used to plan and make effective decisions facing threats.

3. Evaluating the performance and effectiveness of strategies: by analyzing data, it is possible to evaluate the performance and effectiveness of strategies and measures adopted in the direction of brand resilience and to identify strengths and weaknesses so that more optimal decisions can be made based on them (Swaminathan et al., 2020).

Therefore, using data mining in analyzing critical knowledge in the brand resilience model is of great importance and can help companies in effective planning, making strategic decisions, and improving the performance of different units. Therefore, the purpose of this research is to obtain the following purposes:

- Identifying effective factors in brand resilience in Iran's handwoven carpet industry using background knowledge and data mining in critical conditions.

- Data mining of brand resilience model in Iran's handmade carpet industry using background knowledge and data mining in critical conditions.

## 2. Literature Review

Brand resilience means a brand's ability to deal with changes, crises, shocks, and threats that affect it (Allard et al., 2020).

This ability of the brand to maintain and improve its recognition and value in the face of adverse conditions and rapid changes in the market, industry, and society leads to the

explanation of brand resilience (Whelan & Dawar, 2016).

Brand resilience includes several abilities to face crises and complex changes (Gumparathi and Patra, 2020). These abilities include the following:

Resilient brands have the power to adapt and change meeting market changes and changing customer needs (Bruhn et al., 2012). Resilient brands can adapt to new conditions, make decisions, and implement necessary changes in response to rapid and unforeseen changes in the market and industry (Barros-Arrieta et al., 2021).

Also, brands with high resilience can establish potent and effective communication with their customers, and in crises, they manage the ability to provide information and correct communication with customers well (Loureiro et al., 2012). Resilient brands can maintain a constructive relationship of trust with their customers, and in crises, they create the ability to maintain customer loyalty for themselves (Fritz et al., 2017). Brand resilience is significant because brands must maintain and improve their position in the face of environmental changes, competitors, shocks, and crises to perform effectively in a competitive and dynamic market (Chang et al., 2021).

Merlo et al. (2023), regarding brand resilience, showed that in today's connected market, brands face more than ever negative press that can test their customer relationships. Building and strengthening the positive aspects of the brand-customer relationship (such as brand commitment, brand love, and self-association with the brand) may offset some of the impact of negative information on customers. Biedenbach et al. (2022) showed that brand resilience is an important component of business resilience. Nunes et al. (2021) showed that the most important aspect of brand innovation is increasing brand resilience in crises. Shafie et al. (2022), in a research titled commercial branding of Iranian handmade carpet; A study with a semiotic approach determined that the examination of background knowledge such as semiotics leads to a better identification of customers' tastes, economic, cultural

variables and market segmentation in the examination of local, spatial and historical knowledge. The review of past studies shows that the domestic market of handmade carpets in Iran has not yet been able to improve the necessary efficiency in its marketing department and be considered as a product with a brand name. Based on this, from the customers' point of view, this type of carpet is known in Iran based on a series of brand names that have been transferred since ancient times. This is while its close competitor, the machine carpet, has advanced to a great extent in branding. Therefore, the main goal of the current research is to investigate the ways of creating, developing and positioning the brand necessary for it by examining the marketing situation of Iranian handwoven carpets. It seems that the domestic market of handmade carpets in the country can have higher potential capacities than its current situation. This can be achieved through systematic branding. In this regard, selected production units in the west of the country have the necessary advantage for this purpose. The purpose of choosing this part of the country is the presence of many producers of handmade carpets. Also, the practical results of this research can improve the necessary conditions for the development of employment in these areas.

Based on this, the importance of examining brand resilience in Iran's handwoven carpet industry based on the conditions of the embargo as a crisis-causing situation becomes doubly important since a general review shows that the embargo crisis only affects the commercial position of the brand of this industry at the market level. International has not shaken, but it has affected other aspects of handwoven carpet management, from the stage of market studies to after-sales services, and with the continuation of this situation, we will witness the worsening of the critical situation of Iran's handwoven carpet industry in taking over the share of global markets, with a review of the scientific studies and researches carried out in the field of brand management of Iran's handwoven carpet industry, an attitude gap in the field of brand management of this industry is identified in the face of the upcoming risks

and crises. In recent years, the brand structure of Iran's handwoven carpet industry has been studied from the perspective of the consumer's approach, and the study of harmful threats caused by sanctions in the aspects of brand management of Iran's handwoven carpet industry has not been given much attention by researchers. Utilizing a mixed approach (qualitative, quantitative) to explain and identify the effective components of realizing brand resilience in the handwoven carpet industry of Iran. By using this theoretical framework and implementing data mining techniques, it is possible to acquire and use vital knowledge related to brand resilience in Iran's handwoven carpet industry in crisis.

### 3. Methodology

This mixed research has been carried out through two qualitative (Grounded theory) and quantitative (data mining) phases. The proposed methodology for studying brand resilience in Iran's handwoven carpet industry in critical conditions can be based on two techniques, grounded theory, and data mining. The participants in the current research are subject matter experts in the field of handwoven carpet brands. In addition to willingness and preparation, the conditions for entering the interview of these people are to have background and experience, to be well-known, and also to have a specialized field of teaching, authoring, or holding workshops in this field, as well as having experience in branding or brand consulting in the handwoven carpet industry. It is a leading manufacturing and exporting company. Sampling in this purposeful research depends on the criterion; At first, the researcher makes the best choices based on his judgment from the best sources of information, such as interviews, observations, or written sources, and then looks for examples that complete the created theory. The data collection tool at this stage of the research was semi-structured interviews. In this research, 12 people were interviewed to reach the theoretical saturation index. Out of 12 people, 3 people had a marketing doctorate, one had a doctorate in industries and one had a doctorate in planning in geography, one had a doctorate in textiles,

one a doctorate in communications, one had a master's degree in research, and three people were doctoral students in public administration at Allameh Tabatabai University, media management. He was a doctoral student in management and a senior expert in economics majoring in e-commerce. The foundation data technique was performed in NVIVO software and the data mining technique was performed in MATLAB software, and this method includes the following steps:

#### 1. The grounded theory technique

a) Examining and analyzing the concepts of the foundation theory: In this step, the concepts and principles of the foundation theory are examined in the field of brand resilience. This includes examining the definition of brand resilience, its components, influencing factors and the relationships between them.

b) Identification and selection of components of brand resilience: In this stage, the key components of brand resilience in Iran's handmade carpet industry are identified and selected in critical conditions. These components can include factors such as brand strength, customer trust, marketing strategy, organizational flexibility, and response speed.

c) The relationship and interference of components: In this step, the relationships and interference between the components of brand resilience in the handwoven carpet industry of Iran are investigated. This analysis can help explain the role of each component and its effect on other components.

#### 2. Data mining method

a) Data collection: In this stage, data related to Iran's handwoven carpet industry and critical conditions are collected. This data can include market information, financial data, customer data, competitor data and other data related to the handwoven carpet industry.

b) Data pre-processing: In this step, the collected data are pre-processed. This includes cleaning data, capturing incomplete or missing data, normalizing data, and performing similar operations.

c) Selecting and extracting features: In this step, important features related to brand resilience in the handwoven carpet industry of

Iran are identified and extracted from the data. This can include features expected by customers, competitive factors, market factors, and other important features.

d) Implementation of data mining algorithms: In this stage, appropriate data mining algorithms are implemented to analyze data and extract knowledge about brand resilience in the handwoven carpet industry of Iran. These algorithms can include association exploration, decision tree, predictive models, and cluster analysis.

e) Data analysis and knowledge extraction: using data mining algorithms, data is analyzed and knowledge related to brand resilience in the handwoven carpet industry of Iran is extracted in critical conditions. This knowledge can include patterns, relationships between attributes, predictions, and other findings related to brand resilience.

f) Interpretation and use of knowledge: In this stage, the knowledge extracted from the data about brand resilience in the handwoven carpet industry of Iran is interpreted and used as a guide for strategic decision-making and improving brand resilience in the industry.

## 4. Findings

In the following, interviews have been analyzed based on the data technique of the Grounded Theory Foundation. 12 interviews were entered into NVIVO software and analyzed. Open, central, and selective coding were done respectively based on the Strauss-Corbin approach. Below is a part of the conducted interviews:

Brand resilience is a very important factor in the carpet industry. The hand-woven carpet industry in Iran is known for famous and long-standing brands such as "Pars Risheh", "Mohammadi" and "Gonbad". These brands focus on high-quality and unique designs. Individually, they have been able to conquer international markets."

*"Brand resilience in the carpet industry means that the brand has the ability to deal with critical situations and is able to maintain customer satisfaction, maintain the quality and added value of products, maintain the brand's reputation and credibility in the market, and deal with competitors and challenges in the industry."*

"The carpet industry is known for focusing on high quality and using high-quality raw materials. Brands must guarantee the quality of their products and always strive to improve quality and customer satisfaction."

"In the carpet industry, designs and motifs are very important. Brands should be able to offer new and attractive designs and always seek innovation in design".

"Brands must implement strong and intelligent marketing strategies. Establishing

direct relationships with customers, attending international exhibitions, using social media, and using modern technologies are effective marketing strategies."

"In branding, reputation, and brand reputation are very valuable. Brands must maintain their reputation and reputation in all stages of production, marketing, and after-sales service, and have effective crisis management in the event of a crisis".

**Table 1.** Selective, central and primary categories based on the Strauss-Corbin model

Selective encoding	Axial coding	Basic coding	
Causal conditions	Competition in the business ecosystem	Global developments	
		Competitive advantage of the brand	
		Competitive complexity	
		Brand diplomacy	
		Brand learning	
	Development of knowledge and technology	Brand dynamics	
		High level technology	
		Technology capabilities	
	Internal politics	internal resistance	
		Internal disability	
Contextual factors	Environmental sustainability	Political intervention	
		Brand recognition	
	The nature of the brand	Environmental restrictions	
		Brand power	
		Brand risk models	
		Brand resilience	
	Sanction pressure	Customer satisfaction	
		Ability to withstand sanctions	
interfering factors	Brand consumption challenges	The impact of sanctions	
		Anti-brand	
	Features of the hand-woven carpet brand	Consumer attitude	
		Durability of quality	
		Brand market share	
		Brand positioning	
	Strategy	Active development	Brand influence
			Brand ability
internal resistance		Brand future research	
		Comprehensive brand management modeling	
Creative support		Strengthening the industry	
		Development of knowledge management	
Production under sanctions	Brand networking		
	Innovation and creativity		
Consequences	Commercial interests	Anti-sanction policies	
		Production capability	
	Brand capabilities	short term benefits	
		Long-term benefits	
	Strengthening brand value and identity	Brand marketing	
		Development of brand marketing capabilities	
		Increasing brand equity	
		Brand Identity	

Based on the identified components, using data mining techniques and the use of organizational data, the brand and its resilience in critical conditions in the carpet industry were examined. The data of the years

of the coronavirus epidemic from 2020 to 2022 were considered.

To train and evaluate the algorithm, the leaving-one-out method has been used. This method is such that in each step, one data is selected as test data and other data are used to

train the model. This process is repeated for all data. That is, each data is used as test data separately. The advantage of this method is that all data are used for testing and it is ensured that each data is included once as test data. The Leaving-One-Out method is a general evaluation method in machine learning machines, where each data is used once as test data and the other data is used to train the model. In this method, it is assumed that the data are independent and distinct from each other, so each data is considered test data alone. The process of implementing the Leaving-One-Out method is that for each data, the model is trained using other data. Then, using test data, we predict the output of the model and compare it with the actual output to evaluate the performance of the model. This process is repeated for all data so that all data are used as test data.

In short, in the Leaving-One-Out method, all the data alone are used as test data, and the other data are used to train the model. This method is very useful and used for evaluating

and training machine learning models. The coding in the software is shown below:

```

Assuming you have a dataset X and corresponding labels y
%Initialize the predictions array
predictions = zeros(size(y));
%Perform leaving-one-out
for i = 1: numel(y)
% Remove the i-th data point from the dataset
X_train = X([1:i-1, i+1:end], :);
y_train = y([1:i-1, i+1:end]);
% Train your model using X_train and y_train
% Make a prediction on the left-out data point
x_test = X(i, :);
y_pred = yourModel.predict(x_test);
% Store the prediction in the predictions array
predictions(i) = y_pred;
end
%Evaluate the performance of your model using
the predictions and actual labels
accuracy = sum(predictions == y) / numel(y);

```

Figure 2 shows a view of the implementation of the data in the MLP model in MATLAB software:

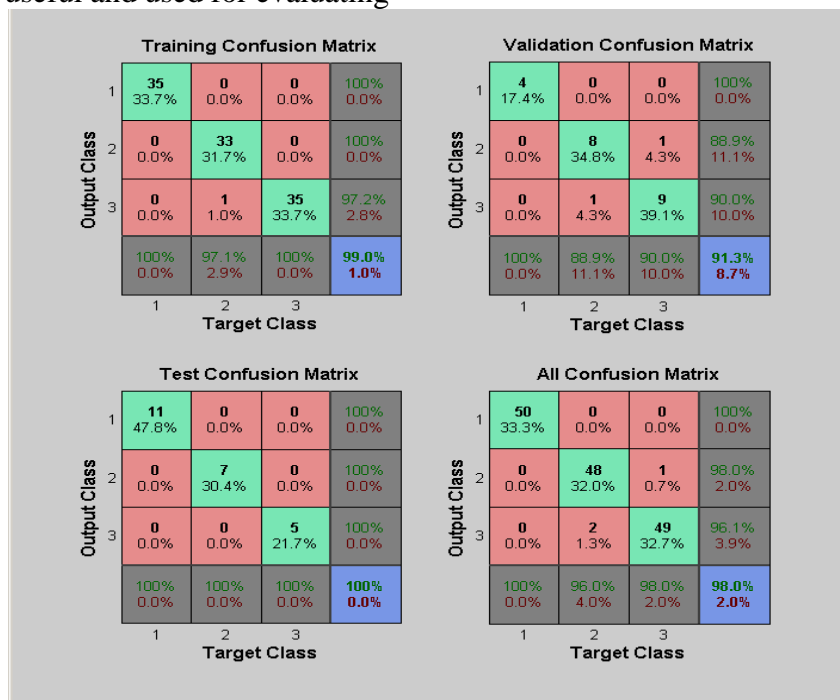


Figure 2. Implementation of the data in the MLP model

Table 2. The results of the proposed model and the functional reality of brand resilience in crisis conditions

Methods \ Measure	MSE	MAE	MAPE	RMSE	R2
MLP	433.24	24.13	3.25	20.14	0.87
TRAINING MODEL	355.14	17.22	3.43	17.54	0.98

Based on the proposed model, resilience can be predicted up to 98%. Therefore, the proposed trained model is effective.

## **5. Discussion**

Based on the proposed model, six categories, fifteen core codes, and 41 primary codes were identified. The causal conditions had three core codes of competition in the business ecosystem, development of knowledge and technology, and internal politics. The business ecosystem includes all factors and entities related to a brand in the business environment. This includes competitors, customers, suppliers, business partners, and relevant laws and regulations. In the model of brand resilience, the brand must adapt to the changes and crises occurring in the business ecosystem. For example, when faced with competitors, the brand must implement appropriate competitive strategies and respond to changes in supply and demand. The development of knowledge and technology plays an important role in brand resilience against critical conditions. Brands that can generate and update their knowledge and technology can maintain their sustainability with rapid changes in the environment and deal with related technology crises. Close connection with organizations and research centers, development of innovative products and services, and updating of own technologies are some of the strategies used in this field. In the proposed model, the internal policy of the brand should strengthen the ability to deal with critical situations and maintain environmental sustainability. This includes determining and implementing crisis strategies, employee readiness to manage crises, organizational self-confidence, and organizational flexibility. The brand based on critical conditions, these three factors should be examined and evaluated harmoniously, and the brand should implement strategies and strategies that will perform optimally against critical conditions according to the business ecosystem, knowledge and technology development, and internal policy. and maintain its environmental sustainability.

Contextual factors had the core codes of environmental sustainability, brand nature,

and sanctions pressure. In the model of brand resilience, the nature of the brand plays an important role in creating environmental sustainability and dealing with critical situations. Brands that have a positive and distinguishable nature are often able more to deal with crises and maintain environmental sustainability. For example, brands that care about environmental and social issues and perpetuate sustainable values in all aspects of their activities are usually better able to withstand crises and external pressures. In the model of brand resilience, checking and dealing with the pressure of sanctions is also part of the evaluation. Brands that can manage and respond to the pressure of sanctions and can still operate and maintain their market in critical conditions can improve the sustainability of their environment. Therefore, the model of brand resilience based on critical conditions to maintain environmental sustainability requires the examination and evaluation of the nature of the brand and the ability to manage the pressure of sanctions. Considering these two factors, the brand can design and implement plans and strategies to deal with crises and maintain its stability in times of crisis. Cavallo and Kryvtsov (2023) emphasized the importance of sanctioning conditions in brand management.

## **6. Conclusion**

Modeling brand resilience in Iran's handwoven carpet industry using background knowledge and data mining in critical conditions can help Iranian handwoven carpet brands to perform better and maintain their environmental sustainability in the face of sanctions, economic problems, and other critical challenges. This model can help brands to maintain their business interests and implement appropriate strategies for active development, internal resistance, creative support, and production under sanctions. Also, this model can help brands strengthen their capabilities and brand value, and identity in critical situations.

By following these suggestions, Iranian handwoven carpet brands can strengthen their brand resilience in critical situations and

achieve environmental sustainability and sustainable growth:

Considering that the production and design of handwoven carpets are formed at the national level according to the cultural, economic, and social identity of different parts of the country, the creation of regional study and research organizations to carry out brand and marketing studies based on the infrastructure of each region can play a significant role in recognizing Vulnerable points and provide operational solutions in this area.

Compilation of pathological plans based on a case study with emphasis on the brand performance of the handwoven carpet industry of Iran in different international markets, taking into account the effects and damages caused by the imposition of sanctions and also examining the performance of traditional and emerging successful competitors of the handwoven carpet industry using the method New research and relying on prominent researchers in the field of brand science

With a detailed field investigation of the performance of the branding of Iran's handwoven carpet industry in global markets, it is determined that due to the lack of attention to the importance of explaining the scientific approach and research support in the field of brand management of the handwoven carpet industry, the necessary mechanisms to manage the crises caused by Iranian brands have not adopted and encouraged the boycott of the brand of this long-standing and deep-rooted industry, which over time has led to the loss of a significant share of international markets, and as a result, wide-ranging economic, cultural and social consequences at the national level. On this basis, it is expected that the Ministry of Security as one of the most important pillars of the policy maker in the field of the handwoven carpet industry with the cooperation and synergy of the National Carpet Center, while reviewing the current state of brand management of the handwoven carpet industry, the necessary measures to create a platform and prepare software and Hardware required for the entry of research centers and specialized research institutes in

the field of handwoven carpet industry into the process of cultivating specialized, experienced and committed human resources with the aim of fundamental training of handwoven carpet industry activists based on the principles and axioms of branding science, training teachers and researchers with the approach of new methods of market studies. and consider the branding of the handwoven carpet industry as well as the use of experts and experts in other sciences related to the field of branding and marketing with the approach of effective management of the effects of sanctions on the body of this ancient industry, in other words, the current approach governing the brand management of the handwoven carpet industry It does not rely so much on the knowledge of the world, and the traditional procedures in the marketing and branding aspects of this industry are visible, which undoubtedly is possible to change this situation by drawing the vision and providing the necessary infrastructure from the policy-making authorities.

In addition to creating a new approach in the development of brand literature, this research can provide effective and practical solutions in the field of branding and brand management in the handwoven carpet industry, as well as the results of this research by managers, consultants and brand researchers of different companies active in the field. It enables the production of export-oriented products to have a correct understanding of the facts governing brand management and branding by knowing the factors and effective factors of brand resilience in the conditions of the embargo, and on this basis, while reviewing the current process, regarding policy-making based on the space created for the brand. Iran's high-end commercial products can operate in global markets.

In the following, some suggestions for background knowledge in the carpet industry are stated:

Background knowledge in the field of carpet design can help to discover new and creative ideas that have not existed in the market so far. Unique designs and patterns can differentiate your products from competitors and make them more attractive.

Knowledge about the types of threads, textures and raw materials used in carpet production can help improve the quality of products and increase customers' trust in your brand.

Knowledge in the field of modern technologies and advanced machinery can help improve efficiency and accuracy in production and update processes, as well as reduce costs.

Knowledge about the needs and preferences of customers, marketing trends and competitors can help you improve your marketing and advertising strategies and increase the profitability of your business.

Background knowledge about inventory management and supply chain optimization can help increase productivity and reduce costs, thereby increasing profitability.

Knowledge in the field of market analysis and selection of target markets can help you attract new customers and expand the geographic scope of sales.

Background knowledge in the field of management, production, quality control and support can help create optimal processes and increase productivity.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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