



## Presenting the model and prioritization of lean production success drivers with ISM and OPA approaches

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**ABSTRACT:** The purpose of this study is to present a model and prioritize the key success factors of lean production with ISM and OPA approaches. The statistical population and statistical sample of this study consists of 20 all experts (managers) of Iran Khodro production department; The opinions of these people are used to determine the most important indicators and present the model. Also, in order to prioritize the indicators, the opinions of seven experts who were randomly selected among the experts were used. In order to determine the key success factors of lean production, 22 indicators were identified by examining the background of the research. Using the content validity ratio technique, 11 indicators of "project consultants, lean customers, lean suppliers, senior management support and commitment, employee participation, Kaizen team, use of lean concepts and techniques, effective communication, alignment with the organization's strategy, reward system, Training and evaluation" were identified as the most important indicators affecting the success of lean production. In order to collect the required field information from the checklist of 22 questions to determine the most important factors affecting the success of lean production, the questionnaire of 11 questions to rank the key factors of the success of lean production and the checklist of 55 questions to rank the key factors of the success of lean production. used. OPA techniques and interpretive structural modeling were used to test the research questions.

**KEYWORDS:** lean success drivers, ISM and OPA approach, Iran Khodro.

### 1. INTRODUCTION

The lean production system is one of the most advanced planning and control systems, which has been placed at the top of the top production systems in terms of comprehensiveness and influencing other comprehensive management planning. Lean production has become one of the necessary requirements to be present in a dynamic competitive environment and competition to achieve growth, survival and quality improvement (production) in such a way that the lean production system has gained increasing importance in the past two decades. Pure philosophy is an attitude that tries to minimize waste and maximize the efficiency of facilities and human resources and capital. Today, industrial organizations are trying to achieve economic superiority by increasing productivity, eliminating any waste, increasing the quality of manufactured products, reducing the cost price and timely delivery of customer demand, while continuing to survive and influence the global market, and this is important only through movement. It leads to lean production. Lean production is one of the strategies that manufacturers can use to create and develop their advantages and competitive power, and increase their market share. Today, adopting this approach has become one of the common strategies for presence and survival in the highly competitive global markets. The main principles of lean production thinking are: preventing the production of defective products, paying attention to the real needs of customers, implementing the principles of kaizen in the factory, expanding communication within the group, minimizing waste, and obtaining maximum efficiency from facilities and human resources and Fund. These days, due to the lack of proper quality of domestic cars and the dissatisfaction of consumers, the issue of buying a domestic car and its price and quality has become a hot topic in society. The lack of production of quality and competitive cars in global markets by domestic car manufacturing companies is a matter that has been mentioned many times and various reasons have been pointed out for it. Iran Khodro, as one of our national capitals, is an automotive industry that, for any reason, has never wanted or considered it necessary to be present in the arena of global competition.

### 2. STATEMENT OF THE PROBLEM

Today, many organizations face many problems in implementing lean production systems. One of the reasons mentioned in the literature for observing such a situation is the non-alignment of the pure values system with the values governing the organization. Despite the wealth of lean production studies, the effective and efficient use of this system is still facing problems. It seems that the root of these problems lies in the lack of a comprehensive model for evaluating and checking lean production in manufacturing companies. On the other hand, identifying the

key success factors in line with the mission and achieving goals is essential in any organization. In most of the studies that have examined the critical success factors of lean production, a set of factors have been introduced in general in industry and services. However, every organization has its own critical factors. Considering the fact that the automotive industry is a mother industry in a sense, and on the other hand, taking into account the huge potential and importance of the automotive industry in the field of development and job creation, the successful implementation of lean principles in this industry will lead to a significant increase in the competitiveness of production. Domestic producers, by taking advantage of the features of lean production, can continuously reduce costs and prices, which will naturally spread to other industries as well. According to the perspective of the automobile industry until the horizon of 1404, achieving the first place in the region, the fifth place in Asia and the eleventh place in the world, relying on the development of competitiveness, is the main goal of this industry. On the other hand, the industrial trustees of the country, the strategies to achieve the set goals are "creating a car manufacturing and production base with a domestic and joint brand name or a globally recognized name and brand in the region with an emphasis on the export of manufactured products, creating a manufacturing base for the production of parts and Car collections with a reputable domestic or global brand name in the region with an emphasis on competitive advantage, attracting direct or joint domestic and foreign investment and finally creating a base of automotive design, testing and engineering service centers in the region, so that perhaps through this, the industry The car can present its products in the selection basket of buyers at the international level. This strategic document continues to describe 9 strategies with 71 steps for the development of the automobile industry. In order to achieve the goals foreseen in the automotive sector in the vision document 1404, special emphasis should be placed on lean production. Therefore, the question of this study is, how is the presentation of the model and prioritization of the success drivers of lean production of Iran Khodro Company?

## 2. LITERATURE REVIEW AND RESEARCH BACKGROUND

Taghipour et al. <sup>[1]</sup> studied "Risk analysis in the management of urban construction projects from the perspective of the employer and the contractor."

Mahboobi et al. <sup>[2]</sup> discussed "Assessing ergonomic risk factors using combined data envelopment analysis and conventional methods for an auto parts manufacturer", occupational injuries are currently a major contributor to job loss around the world.

Taghipour et al. <sup>[3]</sup> studied "The impact of ICT on knowledge sharing obstacles in knowledge management process (including case-study)."

Khalilpour et al. <sup>[4]</sup> studied "The impact of accountant's ethical approaches on the disclosure quality of corporate social responsibility information an Islamic perspective in Iran."

Mirzaie et al. <sup>[5]</sup> studied "The relationship between social bearing capacities with conflict as a result, in the perception of the visiting historical sites."

Alamdar khoolaki et al. <sup>[6]</sup> studied "Effect of integrated marketing communication on brand value with the role of agencies reputation (including case study)."

Taghipouret et al. <sup>[7]</sup> studied "A survey of BPL technology and feasibility of its application in Iran (Gilan Province)."

Mohammad et al. <sup>[8]</sup> studied "Assessing the effect of the FRP system on compressive and shear bending strength of concrete elements."

Jalili et al. <sup>[9]</sup> studied "Comparative study of Khaje Rashid al-Din views on Rab-e Rashidi Islamic Utopia and Kevin Lynch ideas."

Taghipour et al. <sup>[10]</sup> studied "Insurance performance evaluation using BSC-AHP combined technique."

Rezvani et al. <sup>[11]</sup> discussed "The design of high-rise building with ecological approach in Iran (Alborz Province)."

Taghipour et al. <sup>[12]</sup> studied "The identification and prioritization of effective indices on optimal implementation of customer relationship management using TOPSIS, AHP methods."

Taghipour and Yazdi <sup>[13]</sup> studied "Seismic analysis (non-linear static analysis (pushover) and nonlinear dynamic) on Cable-Stayed Bridge."

Taghipour et al. <sup>[14]</sup> studied "Investigating the relationship between competitive strategies and corporates performance (case study: Parsian Banks of Tehran)."

Taghipour and Moosavi <sup>[15]</sup> studied "A look at gas turbine vibration condition monitoring in region 3 of gas transmission operation."

Rahmani et al. <sup>[16]</sup> studied "Providing health, safety and environmental management (HSE) program in metal mining industry (including case study)."

Taghipour and Vaezi <sup>[17]</sup> studied "Safe power outlet."

Tarverdizadehet et al. <sup>[18]</sup> studied "Predicting students' academic achievement based on emotional intelligence, personality and demographic characteristics, attitudes toward education and career prospects through the mediation of academic resilience."

Azarian and Taghipour <sup>[19]</sup> studied "The impact of implementing inclusive quality management on organizational trust (case study: educatin)."

- Ghadamzan Jalali et al.<sup>[20]</sup> studied “Explain the relationship between intellectual capital, organizational learning and employee performance of Parsian Bank Branches in Gilan province.”
- Mohammadi et al.<sup>[21]</sup> studied “Investigating the role and impact of using ICT tools on evaluating the performance of service organizations.”
- Abdi Hevelayi et al.<sup>[22]</sup> studied “Predicting entrepreneurial marketing through strategic planning (including case study).”
- Arsalani et al.<sup>[23]</sup> studied “Investigating the effect of social media marketing activities on brand awareness.”
- Khorasani and Taghipour<sup>[24]</sup> studied “The location of industrial complex using combined model of fuzzy multiple criteria decision making (including case study).”
- Taghipour et al.<sup>[25]</sup> studied “Risk assessment and analysis of the state DAM construction projects using FMEA technique.”
- Hoseinpour et al.<sup>[26]</sup> studied “The problem solving of bi-objective hybrid production with the possibility of production outsourcing through Imperialist Algorithm, NSGA-II, GAPSO Hybrid Algorithms.”
- Taghipour and Ahmadi Sarchoghaei<sup>[27]</sup> studied “Evaluation of tourist attractions in Bourujerd County with emphasis on development of new markets by using Topsis Model.”
- Hashemi et al.<sup>[28]</sup> studied “The effect of personal factors on increasing the productivity of low-level employees in the General Welfare Department of Tehran Municipality.”
- Safdarpour et al.<sup>[29]</sup> studied “The effect of government support on innovation ability (including a case study).”
- Ganjali et al.<sup>[30]</sup> studied “Strategic analysis of household hazardous waste reduction.”
- Taghipour et al.<sup>[31]</sup> studied “The impact of managerial factors on increasing the productivity of low-level employees (including case study).”
- Ganjali et al.<sup>[32]</sup> studied “Investigating the relationship between environmental awareness and the level of education and occupation of people.”
- Baghipour saramiet et al.<sup>[33]</sup> studied “Modeling of nurses’ shift work schedules according to ergonomics: a case study in Imam Sajjad(As) Hospital of Ramsar.”
- Moradi Lalekaei et al.<sup>[34]</sup> studied “Measurement of the country of origin of the brand of branding and brand loyalty.”
- Taghipour et al.<sup>[35]</sup> studied “Investigating the effect of intelligent ordnance on the level of learning/teaching (including case study).”
- Taghipour et al.<sup>[36]</sup> studied “The study of the effect of smart schools on the level of learning-teaching in high school.”
- Taghipour et al.<sup>[37]</sup> studied “The impact of motives from obtaining ISO 9001 certification on organization performance (including case study).”
- Yaghoubi et al.<sup>[38]</sup> studied “Students learn and learn using the effects of smart schools.”
- Taghipour et al.<sup>[39]</sup> studied “The impact of working capital management on the performance of firms listed in Tehran Stock Exchange (TSE).”
- Habibi Machiyani et al.<sup>[40]</sup> studied “Designing a smart model for managing Iranian chain stores based on business intelligence (case study of proma chain store).”
- Taghipour.<sup>[41]</sup> studied “A review of the sustainability indicators’ application in vehicle routing problem.”
- Pourkhosravani et al.<sup>[42]</sup> “studied “Identifying and prioritizing investment risks in digital markets using multi-criteria decision making techniques and data mining.”
- Sharifzadeh and Taghipour.<sup>[43]</sup> “studied “Evaluating the efficiency of dam construction management and ways to improve it.”
- Moosavi and Taghipour.<sup>[44]</sup> “studied “Turbine vibration condition monitoring in region 3.”
- Molavi and Taghipour.<sup>[45]</sup> “ studied “A survey on electrical cars advantages.”
- Molavi and Taghipour.<sup>[46]</sup> studied “An overview of electric vehicle concepts and its features. ”
- Abolghasemi.<sup>[47]</sup> studied “operational and credit risk model on planning management and efficiency of banks admitted to the stock exchange.”
- Akbarnezhadbaei et al.<sup>[48]</sup> studied “Modeling the application of knowledge management system in order to improve the technology governance in the automotive industry of Iran using the data mining environment.”
- Akbarnezhadbaei et al.<sup>[49]</sup> studied “Determining a model for evaluating the knowledge management system in order to improve industries with the focus on educational technology and applying data mining concepts.”
- Pourkhosravani et al.<sup>[50]</sup> studied “The impact of environmental transformational leadership on organizational citizenship behavior (Case study: Municipality of 22nd district of Tehran).”
- Karimi et al.<sup>[51]</sup> studied “The impact of environmental transformational leadership on organizational citizenship behavior (Case study: Municipality of 22nd district of Tehran).”
- Taghipour et al.<sup>[52]</sup> studied “Evaluation of the effective variables of the value engineering in services”. Journal of Applied Environmental and Biological Science, 2015, Vol 5(12): 319-322.
- Taghipour et al.<sup>[53]</sup> studied “Evaluating Project Planning and Control System in Multi-project Organizations under Fuzzy Data Approach Considering Resource Constraints (Case Study:Wind Tunnel Construction Project)”

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Khodakhah Jeddi et al. <sup>[54]</sup> studied “The Analysis of Effect Colour Psychology on Environmental Graphic in Childeren Ward at Medical Centers.”

Taghipour et al. <sup>[55]</sup> studied “Assessment of the Relationship Between Knowledge Managment Implementation and Managers Skills (Case Study: Reezmoj System Company in Iran).”

Taghipour et al. <sup>[56]</sup> studied “Analysing the Effects of Physical Conditions of the Workplace on Employee’s Productivity (Including Case Study).”

Taghipour et al. <sup>[57]</sup> studied “Study of the Application of Risk Management in the Operation and Maintenance of Power Plant Projects.”

Taghipour et al. <sup>[58]</sup> studied “Evaluation of the Relationship between Occupational Accidents and Usage of Personal Protective Equipment in an Auto Making Unit.”

Taghipour et al. <sup>[59]</sup> studied “Necessity Analysis and Optimization of Implementing Projects with The Integration Approach of Risk Management and Value Engineering.”

Taghipour et al. <sup>[60]</sup> studied “Application of Cloud Computing in System Management in Order to Control the Process.”.

### **3. RESEARCH QUESTIONS**

The present research was conducted in order to provide a model and prioritize the drivers of lean production success with ISM and OPA approaches. This research was done in response to the following questions:

Question 1) What are the most important key factors for the success of lean production?

Question 2) What are the most important key factors for the success of lean production?

### **4. TYPE OF RESEARCH METHOD**

The current research can be considered an applied research in terms of its purpose and a descriptive-survey in terms of data collection, and since it studies a specific society, it is included in the category of case studies.

### **5. SOCIETY, STATISTICAL SAMPLE AND SAMPLING METHOD**

The statistical population and statistical sample of this study consists of 20 all experts (managers) of Iran Khodro production department; The opinions of these people are used to determine the most important indicators and present the model. Also, in order to prioritize the indicators, the opinions of seven experts who were randomly selected among the experts were used.

### **6. TECHNIQUES USED IN RESEARCH**

#### **6.1. OPA method**

This method can be used in individual or group decisions. In the case of group decisions, through this method, the experts and their priorities are first determined; Experts may be prioritized based on their experience or knowledge. After prioritizing the experts, the indicators are prioritized by each expert. Meanwhile, each expert ranks the options based on each feature and sub-indexes if any. Finally, by solving the linear programming model provided by this method, the weight of indicators, options, experts and sub-features is obtained simultaneously. A significant advantage of the proposed method is that from the two-by-two comparison matrix, the decision matrix (without the need for numerical input), normalization methods, averaging methods for aggregating experts' opinions (in group decisions) and does not use language variables. Another advantage of this method is the possibility for experts to comment only on indicators and options of which they have sufficient knowledge and experience. OPA is a technique that can be used to determine the importance of indicators or to rank options. Not depending on linguistic expressions and the small number of questionnaire questions compared to other methods, not needing a decision matrix, not needing a pairwise comparison matrix, not needing normalization techniques, not needing averaging methods to combine experts' opinions, among the advantages of this method is. Another advantage of this method is the possibility for experts to comment only on the features and options of which they have sufficient knowledge and experience.

## 7. SELECTION OF THE MOST IMPORTANT KEY SUCCESS FACTORS OF LEAN PRODUCTION

In order to determine the most important key factors for the success of lean production, the CVR technique has been used.

Table 1: The result of the validity test of the content validity ratio

Result	The number of opposing experts	The number of experts agree	Indicator
Selection	--	20	Training and evaluation
Selection	--	20	Using lean concepts and techniques
Selection	2	18	Project Consultant
Selection	--	20	Support and commitment of senior management
Selection	--	20	Employee participation
Selection	--	20	Kaizen team
Selection	2	18	Reward system
Selection	1	19	Alignment with the organization's strategy
Selection	3	17	Lean suppliers
Selection	4	16	Effective communication
Selection	3	17	Pure customers
rejection	13	7	Willingness to learn
rejection	10	10	Flexibility and workforce improvement
rejection	9	11	In-service training
rejection	8	12	Change in organizational culture
rejection	10	10	Comprehensive maintenance and repairs
rejection	9	11	team work
rejection	7	13	Knowledge sharing
rejection	8	12	Willingness to learn
rejection	10	10	Determining goals and objectives
rejection	11	9	motivating
rejection	10	10	Standardization

As it is clear in Table 1, based on the validity technique of the content validity ratio, the indicators that have at least 15 favorable votes out of 20 votes (the total number of experts are 20) have been selected as the most important indicators.

## 8. FORMATION OF STRUCTURAL SELF-INTERACTION MATRIX

The first step in interpretive structural modeling is the formation of the structural self-interaction matrix. At this stage, the relationships between the design stages of the lean production success model are analyzed using interpretive structural modeling and using four symbols.

In order to determine the relationships between the design components of the lean production success model, these factors are compared in pairs and the respondent determines the relationships using the above symbols. In this part, the observations of 10 experts of the organization have been used, which are given below and in Table 2 after the seventh iteration of determining the level of the steps.

Table 2 shows the seventh iteration of determining the level of lean production success model design steps:

Table 2 - The seventh iteration of determining the level of factors of the design stages of the lean production success model

Agents	Collection خروجی	Collection ورودی	Collection مشترک	level
Management support and commitment ارشاد	4	4	4	Seventh level

After determining the level of the factors, the interpretive structural model of the lean production success model design stages can be drawn. This model has 7 levels:

- Level 1: Employee participation
- Level 2: training and assessment, use of lean concepts and techniques, effective communication
- Level 3: Kaizen Team, Lean Customers
- Level 4: Lean suppliers
- Level 5: Project consultant, alignment with the organization's strategy
- Level 6: Reward system
- Level 7: Support and commitment of senior management

In the following, the power of influence and the degree of dependence of each factor are analyzed. At this stage, the design stages of the lean production success model are classified into four groups.

Figure 1 shows the power of penetration-dependency diagram of the design stages of the lean production success model:

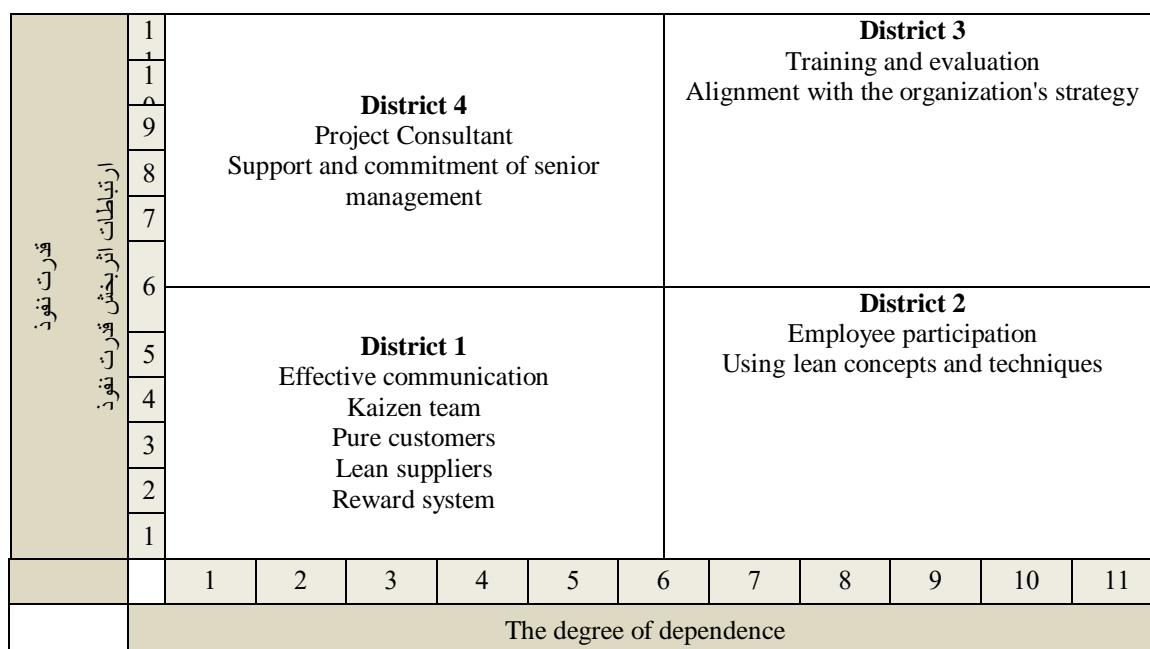


Diagram 1- The power of influence-dependency

### 9. INDEX RANKING BASED ON OPA METHOD

In order to rank the indicators based on the OPA method, the following steps must be taken:

2- Prioritizing experts' opinions:

1- Prioritizing indicators based on the opinions of each expert:

Table 3 shows the characteristics of the experts:

Table 3- Ranking of experts

Rank	Score	Work experience	Education	Expert number
1	100	27	P.H.D	Expert 1
1	100	22	P.H.D	Expert 2
1	100	25	P.H.D	Expert 3
2	90	15	Masters	Expert 4
2	90	18	Masters	Expert 5
2	90	16	Masters	Expert 6
2	90	16	Masters	Expert 7

It should be noted that in order to determine the ranking of experts, a maximum of 40 points for education (doctorate: 40 points and master's degree: 30 points) and 60 points for work experience (over 20 years of experience: 60 points; 15 to 20 years of work experience: 50 points and work experience of 10 to 15 years: 40 points) is considered. Based on this, experts who scored above 90 were assigned rank 1; Experts who scored between 80 and 90 were assigned 2nd rank.

## 10. RESEARCH RESULTS AND FINDINGS

Question 1) What are the key success factors of lean production?

By reviewing the research literature, the following 22 indicators were identified: training and evaluation, use of lean concepts and techniques, project consultant, support and commitment of senior management, employee participation, Kaizen team, reward system, alignment with the organization's strategy, lean suppliers, effective communication, pure customers, willingness to learn, flexibility and improvement, workforce, in-service training, change in organizational culture, comprehensive maintenance and repairs, team work, knowledge sharing, willingness to learn, setting goals and objectives, creating motivation and standardization.

Question 2) What are the most important key factors for the success of lean production?

Based on the content validity ratio technique and based on the opinions of the statistical sample members, the following 11 indicators were identified as the most important indicators affecting the success of lean production: training and evaluation, use of lean concepts and techniques, project consultant, support and commitment of senior management. Employee participation, Kaizen team, reward system, alignment with organization strategy, lean suppliers, effective communication, lean customers.

## 11. SUGGESTIONS FOR FUTURE RESEARCHERS

1. Presenting the success model of lean production with a hybrid approach
2. Presenting the lean production success model with thematic analysis approach
3. Presenting the lean production success model with the foundational data theory approach
4. Application of quality house matrix to provide lean production success solutions
5. Analysis of the importance-performance of lean production success indicators

### Author contributions

Conceptualization, AR and JA; methodology, JA and MT; software, AR and MT; validation, JA and MT; formal analysis, AR and JA; investigation, JA and MT; resources, AR and MT; data curation, JA and MT; writing—original draft preparation, JA and MT; writing—review and editing, AR and JA; visualization, AR and JA; supervision, JA and MT; project administration, AR and MT. All authors have read and agreed to the published version of the manuscript.

### Conflict of interest

The authors declare no conflict of interest.

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