

# Proposal Of New Turkish Production System “NTPS”: Integration And Evolution Of Japanese And Turkish Production System

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## ABSTRACT

*The authors propose a New Turkish Production System (NTPS) with the objective of the integration and evolution of the Toyota Production System, the leading Japanese production system, and the Traditional Turkish Production System, for the growth of the next-generation automobile industry in the Republic of Turkey.*

**Keywords:** New Turkish Production System, Japanese production systems, Traditional Turkish Production System

## INTRODUCTION

Amidst the rapid progress of globalization, the Republic of Turkey, one of the most prominent of Europe's newly emerging economies, is expected to achieve significant growth, centering on its manufacturing industries. Given its strong international competitiveness in terms of labor and raw materials, the country's automobile industry has particular potential for growth.

Therefore, as an opening move in Turkey's new global production strategy, the authors proposed a New Turkish Production System (NTPS). The NTPS has been developed by integrating the Advanced TPS, itself an evolved model of the current Toyota Production System, the leading Japanese production system, with the Advanced Turkish Production System, which is an evolved model of the current Traditional Turkish Production System. The integration of these two models was then further evolved to form the NTPS. As an opening move in Turkey's new global production strategy, therefore, the authors propose a New Turkish Production System (NTPS), which would represent the integration and evolution of the Advanced TPS, which is itself an evolved model of the current Toyota Production System, the leading Japan production system, and the Advanced Turkish Production System, which is an evolved model of the Traditional Turkish Production System cultivated to date.

## CURRENT STATUS OF TURKEY'S AUTOMOBILE INDUSTRY – INTRODUCTION OF THE TOYOTA PRODUCTION SYSTEM

Turkey currently ranks 16th in the world for production of automobiles, one of the highest rankings among the newly industrialized countries. The strategic advantages of its location, in terms of production and distribution, have enabled the Turkish automobile industry to establish its own unique production system of which reflects local industries, known as the Traditional Turkish Production System, while achieving steady growth at the same time.

In recent years, in an opening move in the global production strategy of the Turkish automobile industry, leading overseas companies have become increasingly active in local production. For example, since 1994, Toyota Motor Manufacturing Turkey (TMMT) has been conducting training in the Toyota Way at Toyota in Japan and has introduced the TPS (JIT, automation (*jidoka*)).

In the background to this is an undercurrent that Turkey has an environment that is amenable to the introduction of a Japanese- style production system, given the similarities in character between the Turkish and Japanese people and their belief that “success will come if one works hard.”

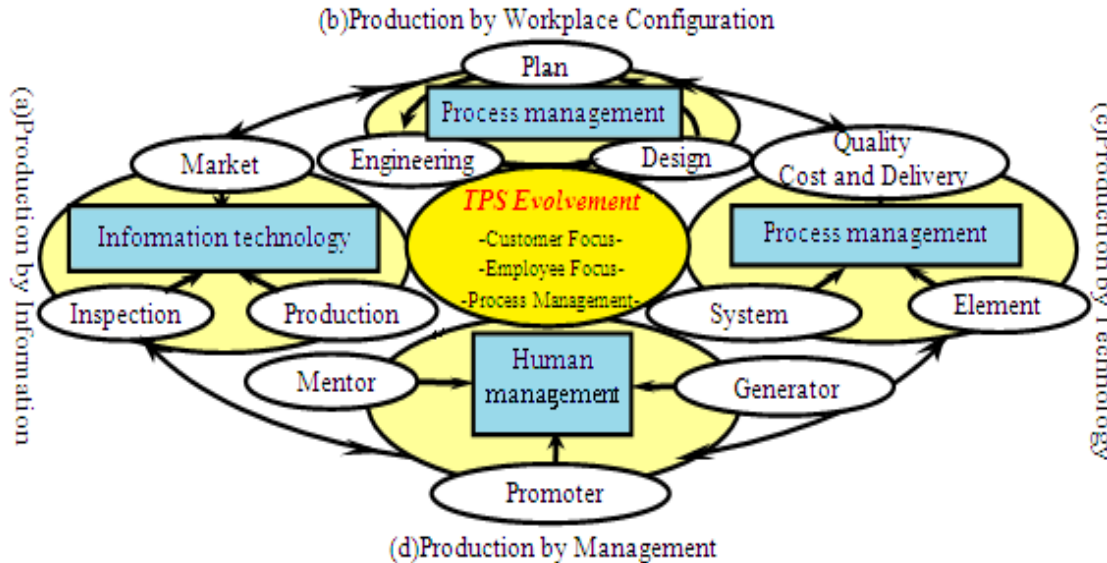


Figure 1: TPS Model

## THE JAPANESE PRODUCTION SYSTEM, TPS, AND ITS EVOLUTION

### Development of the TPS

The Toyota Production System (TPS) lies at the core of manufacturing in Japan. In recent years, it has progressed as a core technology of “New JIT”, a new principle of next-generation production management technology (Amasaka, 2002, 2009). Its main focus is to enable the strengthening and enhancement of the policies of “customer-first, emphasis on employees, and process management” through the incorporation of the four elements (a) to (d) shown in Figure 1. As the diagram shows, the fundamental principle of TPS is to realize the strengthening and enhancement of customer-first, emphasis on employees, and process management policies through the incorporation of the four key elements: (a) production based on information, (b) production based on workplace configuration, (c) production based on technology, and (d) production based on management.

The first element that must be deployed is production based on information (a). This means innovation of the production management system that gives priority to quality information available both inside and outside of the company. This requires reformation of the production philosophy in order to break free from the conventional practices. Production based on workplace configuration (b) entails the creation of a rational production process and reform of the workplace configuration in accordance with this. Production based on technology (c) involves reinforcement of production technology through QCD research activities that utilize the latest production technology. Finally, production based on management (d) requires understanding the importance of human management and creating a highly creative and active workplace which utilizes and nurtures individuals’ innate abilities.

### The Evolved Model of the TPS: Advanced TPS

The authors (Amasaka, 2007 and Amasaka, 2010) proposed Advanced TPS, an evolved model of TPS for the strategic deployment of global production (see Figure 2), and have verified its effectiveness at Toyota.

The objective of this model is the systemization of a new, next-generation Japanese production management system, which involves the high-cyclization of the production process for realizing the simultaneous achievement of QCD requirements. The mission of Advanced TPS is to contribute to worldwide uniform quality and simultaneous launch (production at optimal locations) as a strategic deployment of global production and to realize Customer Satisfaction (CS), Employee Satisfaction (ES), and Social Satisfaction (SS) through high quality assurance manufacturing.

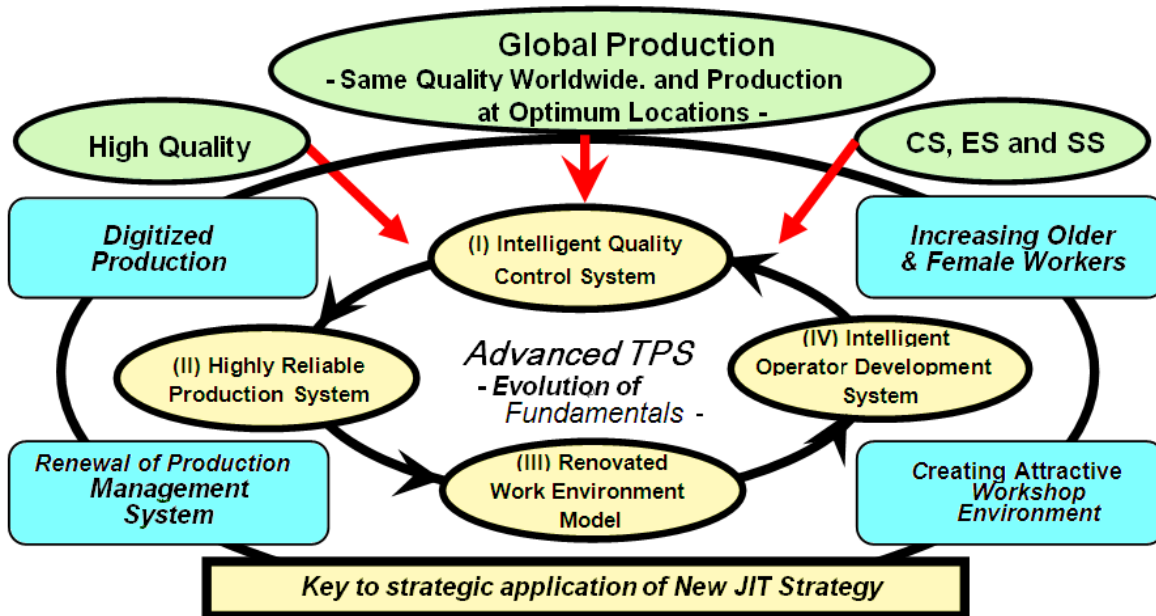


Figure 2: Advanced TPS

In order to make this model a reality, it will be necessary to adapt it to handle digitalized production and reform it to realize an advanced production management system. Furthermore, other prerequisites for realizing this include the need to create an attractive working environment that can accommodate the increasing number of older and female workers at the production sites and to cultivate intelligent production operators. These measures need to be organically combined and spiraled up in order to make the simultaneous achievement of QCD possible. One of the technical elements necessary for fulfilling these requirements is the reinforcement of maintenance and improvement of process capabilities by establishing an intelligent quality control system. Second, a highly reliable production system needs to be established for high quality assurance. Third, reform is needed for the creation of a next-generation working environment that enhances intelligent productivity. Fourth, intelligent production operators need to be cultivated who are capable of handling the advanced production system, and an intelligent production operating system needs to also be established. Worldwide uniform quality and simultaneous launch (production at optimal locations) are being achieved through strategic management of these elements (Amasaka & Sakai, 2010).

**PROPOSAL OF THE NEW TURKISH PRODUCTION SYSTEM**

Having investigated the actual situation in Turkey, the authors propose a New Turkish Production System (NTPS) with the objective of the integration and evolution of traditional Turkish production systems and the aforementioned Japanese production system.

### Concept of NTPS

Based on the research of Ramarapu et al (1995) and of Amasaka et al (Amasaka, 2004, 2007a, 2007b, 2008a, 2008b, 2009; Ebioka et al., 2007; Yamaji, et al., 2007, 2008; Amasaka, 2007; Amasaka et al, 2008), the authors (Mustafa, 2009) proposed, in Figure 3, a concept for NTPS.

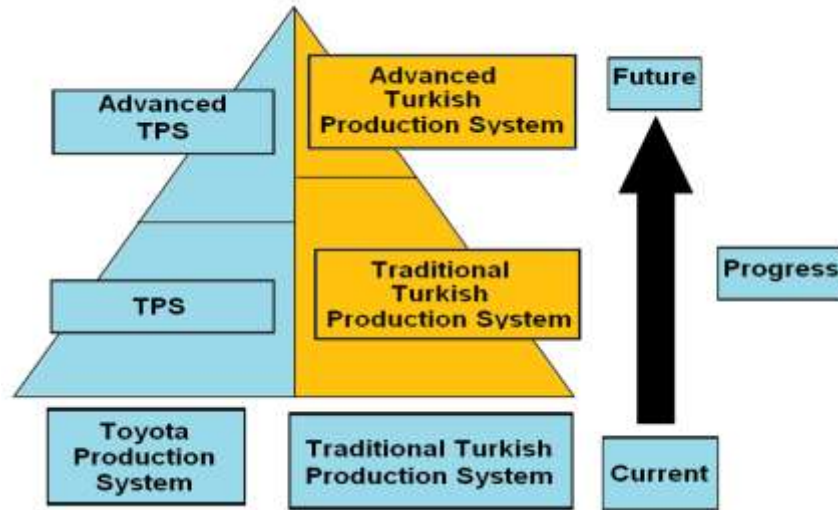


Figure 3: NTPS Concept

The left side of the diagram shows the hierarchy of the Toyota Production System (TPS), which forms the foundation of Japanese-style production systems and its evolved model, Advanced TPS. Similarly, the right side of the diagram shows the Traditional Turkish Production System and its evolved model, the Advanced Turkish Production system.

In order to integrate and evolve the concepts of these two production systems, the common factors (elements) among the various production elements, such as JIT and the Lean System, in Turkey and Japan, as well as those factors (elements) that are unique to Turkey, must be taken into consideration.

### Extraction of Important Keywords for NTPS

In order to extract the common factors (elements) and the Turkey-specific unique factors (elements) required for the NTPS, the authors (Mustafa, 2009) conducted field surveys of Japanese (Toyota Motor Corporation, Honda, Denso, Central Motors, Nihon Spring, and others) and Turkish local manufacturers (TOFAS, OYAK-Renault, FORD OTOSAN, TOYOTA Turkey, and DENSO Turkey).

In these surveys, approximately 500 language data were obtained from interviews, findings obtained from manufacturing plant tours, on-site case studies and reference literature. An affinity diagram of the data thus obtained, based on 5M-E (man, machine, material, manufacturing, measuring, environment), was used to investigate the relationships between the data based on empirical technologies.

As shown in Figure 4, the authors were able to extract, as important keywords for the NTPS, ten common factors - four unique factors specific to Turkey and two unique factors specific to Japan.

Common Factors	Turkey-Specific Factors
1. Quality Assurance	11. Turkish-Style Human Resources Education
2. SQC Education	12. Production, Quality Logistics, and Information Harmony with European Manufacturers
3. QCD Activities	13. Focused Kaizen
4. Kaizen Activities	14. Production Management through WCM
5. Creativity Proposal Programs	<b>Japan Production Distinct Keywords</b>
6. Improvement through Environmental Regulations	15. Digital Engineering/CAE
7. Automatic Management Methods	16. New, People-Focused Production Approaches
8. Global Partnering	
9. Safety	
10. Definition of Awareness and Elimination of <i>muda</i> (waste)	

**Figure 4: Important NTPS Keywords Obtained from Affinity Diagram**

- The factors common to Turkey and Japan are (1) quality assurance, (2) SQC education, (3) QCD activities, (4) kaizen activities, (5) creative proposal programs, (6) improvements through environmental regulations, (7) automatic management methods, (8) global partnering, (9) safety, and (10) definition, awareness and elimination of *muda* (waste).
- The Turkey-specific factors are (11) Turkish-style human resources education, (12) production, quality, logistics and informational harmony with European manufacturers, (13) focused kaizen, and (14) production management through World-Class Manufacturing (WCM).
- The Japan-specific factors are (15) digital engineering/CAE, and (16) new, people-focused production approaches.

**Text Mining Analysis**

The authors further used text mining analysis to explore in more detail the relationships between the language data obtained in 4.2.

Examples of the results of analysis of the 5M-E keywords for the NTPS are explained below. First, the relationships between TPS and Advanced TPS (necessary keywords that each should possess) are shown clearly in Figure 5. Further, in a similar manner, the relationships between the Traditional Turkish Production System and the Advanced Turkish Production System are shown clearly in Figure 6.

Figure 5 shows that TPS, JIT, workplace environment, SQC, and standard work orientation have a high degree of relationship and that the key elements (factors) that should be present in Advanced TPS include worker education, assurance of high quality, DE, CG, SQC, Global Production, Virtual Plant, simulation and partnering.

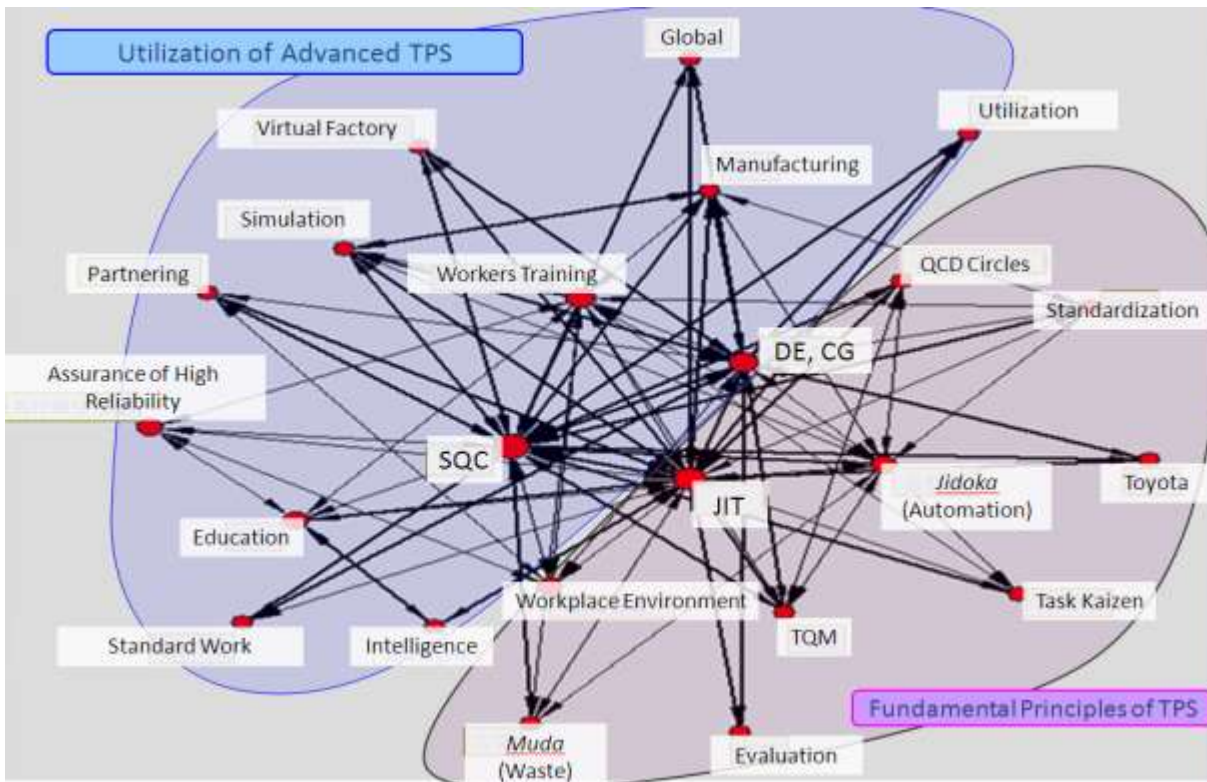


Figure 5: Relationships between TPS and Advanced TPS

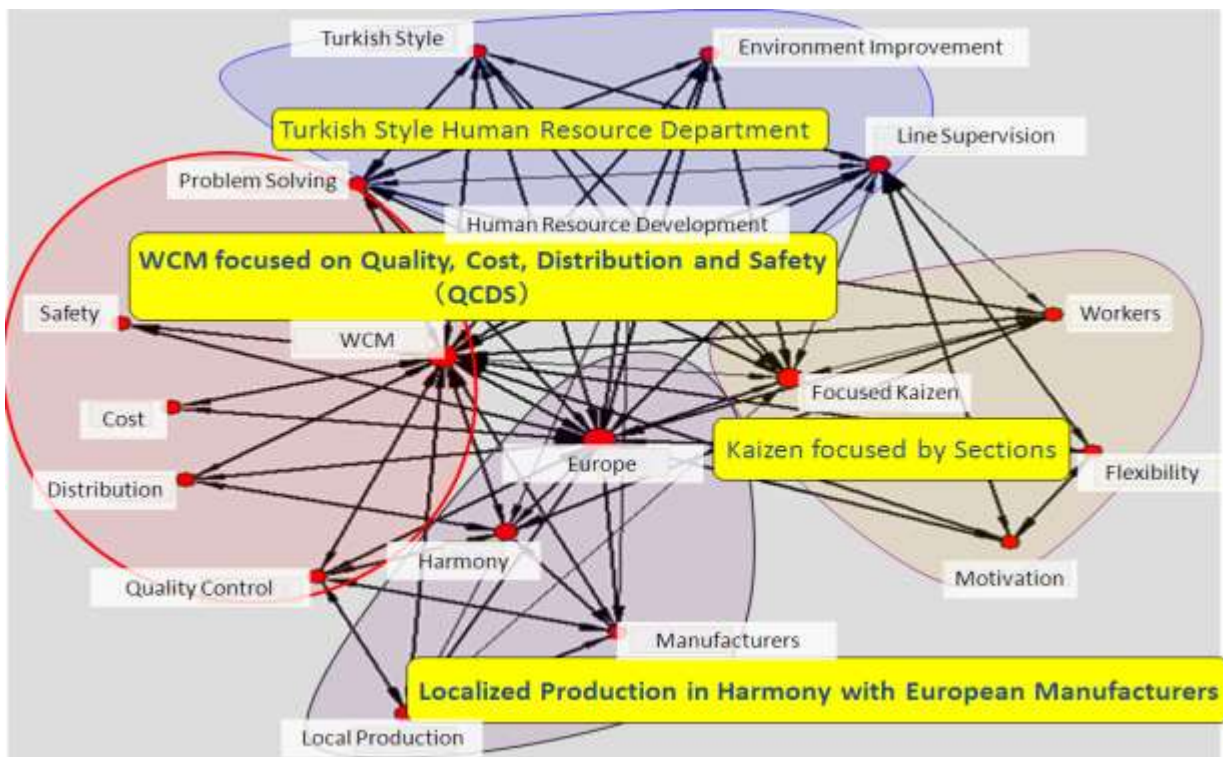


Figure 6: Connections of “Traditional Turkish Production System” and “Advanced Turkish Production System”

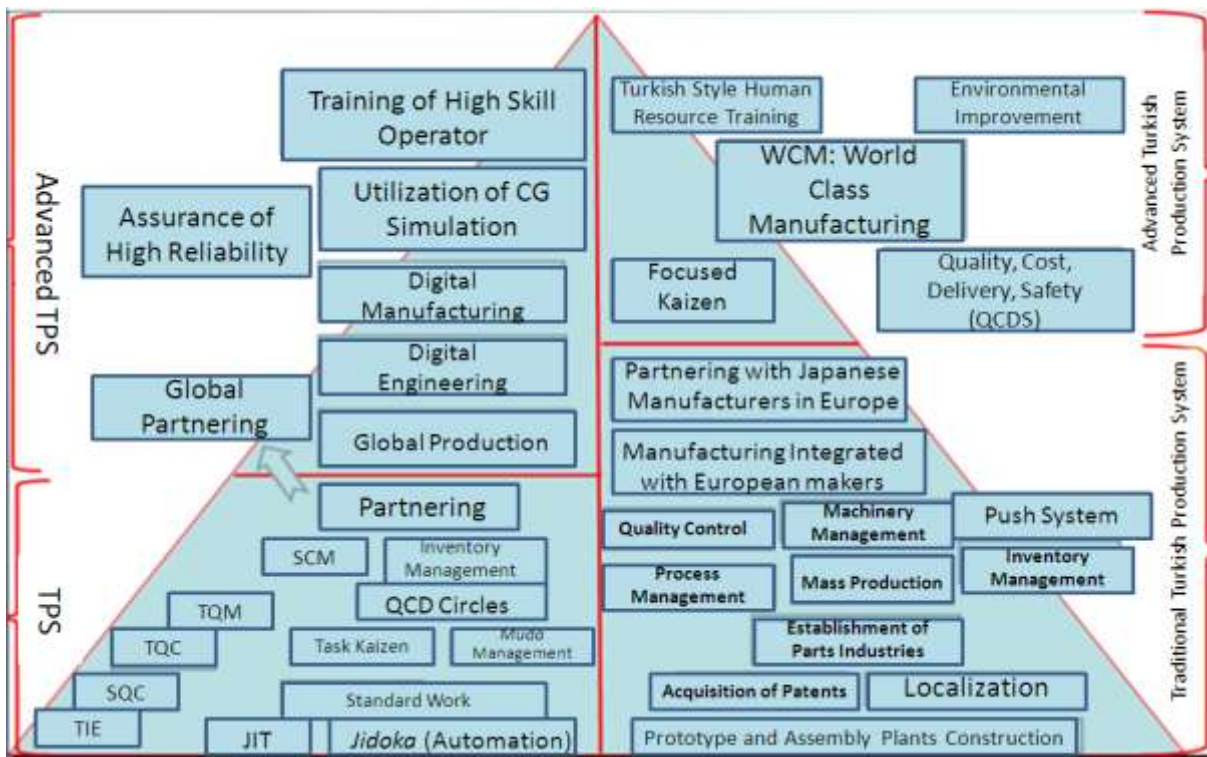
**Proposal for New Turkish Production System (NTPS)**

Based on the results of analysis obtained, as described above, and the findings from same, the authors (Mustafa, 2009) have proposed, in Figure 7, a New Turkish Production System (NTPS).

The New Turkish Production System (NTPS) represents the integration and evolution of the Advanced TPS, which is itself an evolved model of the current Toyota Production System, and the Advanced Turkish Production System, which is an evolved model of the Traditional Turkish Production System cultivated to date.

As shown in the diagram, from the perspective of 5M-E, factors that are common to Japan and Turkey, Turkey-specific factors, and Japan-specific factors have been considered as the technological elements (factors) required for production.

Not only will this enable the Turkish automobile industry to enhance its technological capabilities and increase production, but it will also lead to expectations of the production of high-quality products and the development of flexible production systems in the future.



**Figure 7: New Turkish Production System**

**CONCLUSION**

This paper proposes a New Turkish Production System (NTPS), with the objective of the integration and evolution of the Toyota Production System (TPS and the traditional Turkish Production System, for the growth of the Turkish automobile industry.

Hereafter, the authors will conduct verification research into the effectiveness of the proposed New Turkish Production System.

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