Modern business applications in forest products industry: Case study for Turkey

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ABSTRACT

Forest products businesses must also switch to implement modern business applications in order to ensure sustainability, like all other industries, as required by intense competition conditions of the present business world. Besides creating substantial competitive advantages, these applications bring along many important improvements such as manufacturing/product/service quality, service periods, production rate, rate of meeting customer demands, cost control, product traceability and post-sales support. Combined with proper determination of the business structure, purpose and needs, performance of proper selections and a well-supported management; modern business and manufacturing methodologies make businesses stronger in structural terms. This study looks through modern business applications in forest products industry, and the impact thereof on industrial development. All findings and assessments have been made through the case study for Turkey, discussing the conditions for popularizing modern business applications further. In consequence of the researches, it has been found out that 54.3% of the businesses implement ISO 9001, 48.9% of them implement MRP, 34.8% of them implement ERP, 33.7% of them implement MRP II and 30.4% of them implement CRM.

Keywords -*Modern business, forest products industry, Turkey, business management.*

I.   INTRODUCTION

Today's businesses strive hard to maintain their existence at their respective markets. Intense and challenging competition conditions require the businesses to always refresh and keep themselves up-to-date. When we look through all industries today, we can list the top-ranking modern manufacturing/management applications as follows: Total Quality Management (TQM), Just In Time (JIT), Statistical Process Control (SPC), ISO 9001, ISO 14001, ISO 18000, Total Productive Maintenance (TPM), Material Requirements Planning (MRP), Manufacturing Resource Planning (MRP II), Enterprise Resource Planning (ERP), 5S, Lean Manufacturing, Supply Chain Management (CRM), Failure Modes and Effects Analysis (FMEA), Six Sigma, Customer Relationship Management (CRM).

Innovation and innovation management are two old terms; however, the meanings attributed to these terms have always changed in parallel with the changes experienced across the industry and market structure. The current paradigm of innovation and innovation management is not limited to only products and technological improvements, it also covers all improvements made in methods, processes and services, and stipulates management of innovation activities through strategies based on R&D, marketing, and integration of manufacturing functions. It is important to have information flow systems to enable internal and external information flow and management for innovation management intended for ensuring sustainability in businesses [1].

When the forest products industry in the world and Turkey is looked closer, many successful examples can be seen in modern manufacturing / business applications. SMEs should increase the responsibilities assumed by their employees in decision-making processes in order to attain their strategic purposes, create a culture where information and experience are shared, and arrange a system to overcome all challenges experienced in innovation process by taking the entire process into account.

Thereby, businesses take advantage of being the first across the market with more plain and smooth process components, enabling maximum competitiveness, sustainability and profitability [2].

Competitive SMEs are able to create and manage extended networks by operating in global value chains and approaching innovation through the entrepreneurial innovation model identified by the European Union. To be sustainable those strategies require information and communication technologies, where ERP systems support advanced process management and increase

interoperability, while web-based solutions for communication and product (document) management are also implemented in supply chain and commercial sales networks [3]. A research has revealed that different industries, ERP utilization year and features of different ERP programs do not make any difference with respect to ERP performance factor [4].

According to a research carried out across the SMEs maintaining their operations in furniture industry, computer integrated modelling approaches have significant role to play in enabling decision-making in responsive manufacturing organizations. Enterprise models and simulation models have played a key role to enable manufacturing planning and control process (PPC) decision-making by using the proposed computer integrated unified modelling approach. The design of a PPC system needs to cater for current and future product variance and enable new product introduction. [5].

According to a research conducted with a leading furniture manufacturer in Egypt which works on tailored orders, RFID application can improve the overall performance of the installation [6].

In consequence of a study conducted with a wooden furniture manufacturing business in Sweden, which needs technological developments to maintain its competitive power, it has been detected that the business needs to focus on flexible automation solutions. It has been seen that adoption of a process-oriented approach and identification of utilized materials unleash the improvement potential. As a result of the case study, it has been determined that organizational resources and human resources should be taken into account before initiation of manufacturing changes and automation applications [7].

In consequence of a study conducted with top 500 large industrial enterprises of Turkey, selected by Istanbul Chamber of Commerce (ISO), it has been seen that the companies have established supply chain management, and that the focus fields are procurement of products, timely/accurate delivery of orders, shipping and inventory management. Being aware of the importance of technology utilization in supply chain management (SCM) application, businesses have emphasized that they utilize the cutting-edge information system technologies in their inventory management, logistics management, customer requirements and shipping activities. Adoption of SCM applications has a positive impact on SMC results, creating customer value [8].

ISO 9000 standard intends to help businesses of all sizes from all industries to implement and run an effective quality management standard by boosting their capabilities to design, produce and distribute high-quality products and services. 73.6% of the participants have been holding the ISO 9000 standard certificate, and trying to implement such standard for more than three years. This finding shows that ISO 9000 standard is becoming increasingly popular among the SMEs maintaining their operations across manufacturing industry in Turkey. There are five critical factors to achieve success in effective implementation of ISO 9000 across SMEs, namely; corporate internal motivation, qualifications of employees, corporate qualifications, features of external environment and requirements of quality system [9].

A study, carried out to determine the organizational factors which have an impact on implementation and adoption of advanced manufacturing technologies, has revealed that communication, project management and set-up team have an important role in adoption and smooth operation of the technique. It has been determined that the only factor, which has an impact on both implementation and adoption, is project management. Providing information with employees regarding support of senior-management, organizing meetings, delivering trainings and announcing that employees will be rewarded if advanced manufacturing technologies prove to be successful have all had substantial impacts on adoption of these applications [10].Achieving success in advanced manufacturing technologies is possible only if the senior management provides support, relations with customers are maintained, and the underlying purpose is laid down clearly [11].Under the scope of a study conducted with 133 SMEs operating in Erzurum, the level of utilization of manufacturing technologies of the participating SMEs has been analyzed in a manner to establish comparative results for five years before and after, revealing that there is not any substantial increase which is caused by high costs incurred to have more advanced manufacturing technologies.38.1% of the participating SMEs maintain their business operations in forest products industry fields such as wooden, furniture and door [12].

According to a study carried out with 365 SMEs operating across manufacturing industry in Istanbul; out of 32.1% of the SMEs which have been maintaining their business operations for 0-10 years, 3.8% of them are industrial enterprises operating in forest products and furniture industry, and 6.3% of them are industrial enterprises operating in paper, paper products and printing industry. It has been determined that 66.6% of SMEs utilize MRP, 64.4% of them utilize JIT, 64.1% of them utilize MRP II, 59.5% of them utilize ERP, 57.5% of them utilize Computer Aided Design (CAD), 49.9% of them utilize Computer Aided Manufacturing (CAM), 27.7% of them utilize Computer Numerical Control

(CNC) while 26.3% of them utilize Flexible Manufacturing Systems (FMS) among the advanced manufacturing technologies. It has been found out that SMEs utilize software-based technologies as much as they utilize machinery-based advanced technologies [11]. A study, conducted with industrial enterprises operating across Marmara and Black Sea regions of Turkey, has revealed that the ratio of utilization of advanced-level software increases as the size of enterprise increases. 40.5% of small-sized enterprises utilize computer-integrated manufacturing system technologies while 18.9% of them utilize MRP II, and 25.9% of medium-sized enterprises and 30.2% of large-sized enterprises utilize ERP. The most utilized software across medium- and large-sized enterprises are MRP and MRP II [13].

A study conducted with 214 enterprises has intended to reveal the current situation of variables in innovation management and innovative manufacturing processes across furniture industrial enterprises in Kayseri. Achieving success in innovation management lies in communication factors such as information exchange and feedback with employees. It has been seen that such applications as CAD, CAM, MRP, ERP, Flexible Manufacturing, TQM, JIT are commonly implemented [14].

Under the scope of this study; modern business applications across forest products industry and industrial development impact thereof have been emphasized, basis for discussion has been formed upon performance of case study for Turkey, and recommendations have been developed specifically for the industry.

II. MATERIAL AND METHOD

This study utilizes some of the data as covered under a doctoral thesis [15].

Under the scope of this study; *sampling* method, under which data are collected from a pre-determined number of units (samples) to be selected among the units to be analyzed, has been used as data collection method. While selecting units to be analyzed among populations which are impossible to be observed entirely due to various reasons, random sampling method has been preferred among the two alternative sampling methods [16]. *Survey* method has been used as information collection method.

Alpha (α) Model (Cronbach Alpha Coefficient), one of the reliability analysis models, has been used to assess reliability of the survey. Cronbach's Alpha is a measure of internal consistency of questions based on correlation.

Cronbach's Alpha value shows the total level of reliability of questions listed under factor. If Cronbach's Alpha value is 0,70 or above, it is considered that the measure is reliable [17]. With respect to the Alpha Model; reliability of the measure is interpreted basing on Alpha (α) coefficient as follows [18]:

- In case of $0.00 \leq \alpha < 0.40$, the measure is not reliable;
- In case of $0.40 \leq \alpha < 0.60$, the measure is slightly reliable;
- In case of $0.60 \leq \alpha < 0.80$, the measure is quite reliable;
- In case of $0.80 \leq \alpha < 1.00$, the measure is highly reliable.

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.950	362

Figure 1: Reliability level of the data set, assessed on SPSS environment, as per Alpha Model.

When the data set has been assessed through the SPSS Alpha Model, the Alpha (α) value has been found as 0.950 (Figure 1). Since the resulting value corresponds to (α =0.950) $0.80 \leq \alpha < 1.00$, the survey is highly reliable. With respect to the survey; population has been determined as the enterprises maintaining their business operations across Forest Products Industry in Turkey. Samples have been selected on random basis among the enterprises, satisfying the criteria, by taking into account the indicators of their sizes, in a manner to represent the entire industry. A statistical assessment has been performed with respect to appropriateness of the preferred method and reliability of the survey (Figure 1), revealing that the survey is highly reliable.

Questions as covered under the survey have been replied by senior executives, business owners or senior executives in charge of manufacturing operations of 92 enterprises among the enterprises, which maintained their business operations actively between 2013-2014

across the forest products industry in Turkey, either by e-mail or face-to-face meetings.

Data, which have been addressed during the study, comprise of demographic information intended to determine the features of enterprises, as well as remarks assessing the status of awareness and implementation for the business concepts and applications across enterprises. 15 outstanding items have been listed as modern business applications and methods at the present time. The enterprises have been asked to give their replies to their utilization of the specified methods, with the following statements:

- We have not yet dealt with this issue.
- We are interested in this issue; however, we have not developed any project to that end.
- We have an implementation project. (within 6 months-1 year)
- We are implementing a project for this issue.
- We have initiated to implement a project; but, we have given up.

It has been thought that 92 (n) surveys would represent population of 1022 (N) enterprises with the reliability ratio of 95% [15]. When we assess the sample size [19] in line with the formula;

$$n = \frac{Z^2 \times N \times P \times Q}{N \times D^2 + Z^2 \times P \times Q}$$

n=sample size
N= Population size
Q= 1-P
Z= Reliability coefficient (1.96 considered for the reliability ratio of 95%.)
P= Probability of existence of measured feature in population (considered to be 95%.)
D= Accepted sampling error (estimated to be 5%.)

It has been found out that the value "n" corresponds to 68. In accordance with this result; the data set for 92 enterprises, covered under the study, represents population at 95%.

Microsoft Office Excel 2013 has been used for assessment of data, and SPSS 21 package programs have been used in statistical analyses.

III.   FINDINGS

III.I.DEMOGRAPHIC INFORMATION

As a result of classification of the participating enterprises by taking their headquarters as the basis, it has been found out that Istanbul-based enterprises constituted the majority with a ratio of 48%. Istanbul is followed by Duzce, Kayseri, Bursa, Izmir and Kastamonu in terms of participation rates. When the ratio of participants is assessed in terms of geographical location, it is seen that the enterprises, residing in Marmara Region, takes place on the top with a ratio of 63%. While the enterprises, residing in Black Sea Region, rank second with a ratio of 14%, the enterprises, residing in Central Anatolia Region, rank third with a ratio of 12%.

The average age of the participating enterprises in 24. When we analyze the age distribution of the enterprises, we see that the enterprises of 16-30 years old constitute the majority with a ratio of 42%. Such enterprises are followed by the enterprises of 6-15, 31-50, 0-5 and 50-above years old with a ratio of 31%, 11%, 9% and 7%, respectively. When the enterprises are assessed in general terms, it is clear that 73% of the enterprises are 6-30 years old. It is seen that the enterprises, established after 2000s, constitute 36% of them. 83% of the enterprises, maintaining their business operations across forest products industry in Turkey, represent the enterprises which have been established as of 1981. It can be seen, through analyses of the profiles of the participating enterprises, that they are important and leading companies which have long years of experience and a say across the industry. 43.5% of the enterprises consider their technological level *high* while 54.3% of them consider this level *medium* and 2.2% of them consider the same *low*. 66% of the participating enterprises are in furniture / decoration group, 13% of them are in board group (particleboard, fiberboard, plywood, etc.), 11% of them are in pallet group while 10% of them are in the other group.

III.II. ASSESSMENT OF BUSINESS APPLICATIONS

Under this section; the enterprises have been asked to assess the status of awareness and implementation for the commonly-implemented 15 business concepts and applications. Questions whether they are implemented, or not, as well as the assessment rates of the enterprises are provided in Table 1.

Table 1. Assessment of the status of awareness and implementation of business concepts and applications across the enterprises (%).

	We have not yet dealt with this issue.	We are interested in this issue; however, we have not developed any project to that end.	We have an implementation project (within 6 onths-1 year)	We are implementing a project for this issue.	We have initiated to implement a project; but we have given up.
Total Quality Management (TQM)	28,3	37,0	6,5	26,1	1,1
Statistical Process Control (SPC)	40,2	32,6	3,3	19,6	1,1
Just In Time (JIT)	35,9	29,3	4,3	27,2	2,2
ISO 9001	15,2	15,2	6,5	54,3	7,6
ISO 14001	51,1	16,3	3,3	23,9	1,1
ISO 18000	51,1	12,0	8,7	22,8	1,1
Total Productive Maintenance (TPM)	37,0	28,3	9,8	21,7	2,2
Material requirements planning (MRP)	15,2	21,7	10,9	48,9	3,3
Manufacturing Resource Planning (MRP II)	27,2	26,1	9,8	33,7	2,2
Enterprise resource planning (ERP)	29,3	23,9	8,7	34,8	3,3
5S	57,6	10,9	10,9	17,4	2,2
Lean Manufacturing	54,3	18,5	4,3	21,7	1,1
Failure Modes and Effects Analysis (FMEA)	48,9	16,3	8,7	23,9	1,1
Six Sigma	67,4	17,4	4,3	8,7	1,1
Customer Relationship Management (CRM)	34,8	20,7	13,0	30,4	1,1

Based on the replies; it has been seed that the enterprises have mostly turned their steps towards ISO 9001, MRP, ERP, MRP II, CRM, JIT, TQM applications. Six Sigma and 5S have become the least-preferred methods across the enterprises maintaining their business operations across forest products industry in Turkey (Figure 2).

It has been stated that the projects, the enterprises plan to implement within a period of 6 months to 1 year, are CRM (13%), 5S (11%), MRP (11%), MRP II (10%) and TPM (10%) projects.
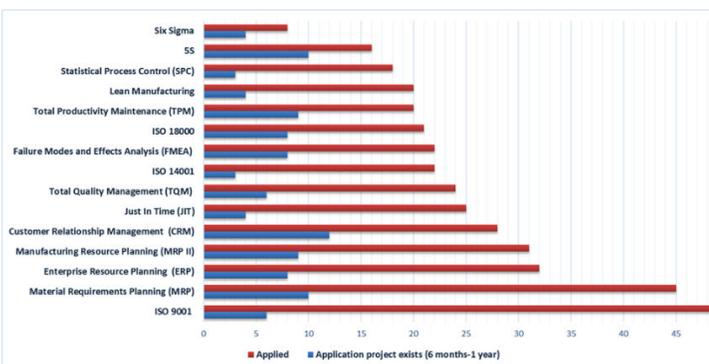

Figure 2. Ratio of business applications applied and businesses with an application project.

The enterprises have been asked to evaluate their own manufacturing technologies as low, medium or high by taking the existing industrial technologies into account. Accordingly; we can list the most utilized applications of enterprises basing on their technological levels as follows:

The most-preferred applications of the enterprises with high level of technology: TPM, Six Sigma, TQM, ISO 14001, ERP, ISO 18000, 5S.

The most-preferred applications of the enterprises with medium level of technology: Lean Manufacturing, ISO 9001, FMEA, SPC, MRP II, MRP & JIT.

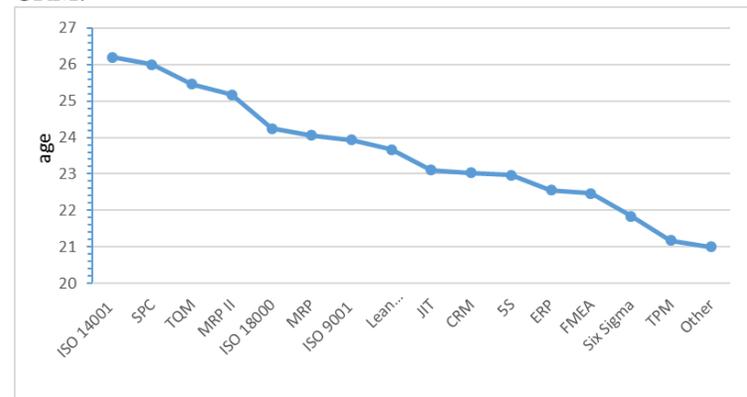The most-preferred applications of the enterprises with low Level of Technology: 5S, MRP, FMEA, ERP & CRM.

Figure 3. Average age of the enterprises giving the replies "We have an implementation project" and "We are implementing a project for this issue" for each modern business method

Considering that average age of the participating enterprises is 24, it has been determined that the enterprises aged 25 and above utilize ISO 14001, SPC, TQM, MRP II, ISO 18000 while the enterprises aged 24 and below utilize MRP, ISO 9001, Lean Manufacturing, JIT, CRM, 5S, ERP, FMEA, Six Sigma, TPM, as can be seen from the graphic (Figure3). We can say that the younger the enterprise is (i.e. as the average age decreases), the more new and current business applications are preferred.

IV. CONCLUSION AND RECOMMENDATIONS

Enterprises should turn their steps towards modern systems and methodologies, as required by constant changing environment, and to select the most appropriate one for themselves in order to maintain their existence under harsh competition conditions of today's business world. Although each of modern methodologies involves common basic concepts and purposes, they are

different from each other in their targeted criteria. In order to be able to select the accurate methodology or method, enterprises should first know their own structures well, and set their own targets and future expectations clearly and accurately. It is clearly seen that the enterprises, which derive successful results from the application, are the ones with a pre-determined corporate culture and structure. It is important for enterprises to have an effective communication structure. Since leadership by senior management in all matters, and making their supports felt by all levels of the enterprise will boost internal motivation of the enterprise, they play a critical role for the methodologies, which are being implemented or decided / planned to be implemented, to achieve success.

Total Quality Management (TQM), Statistical process control (SPC), Just In Time (JIT), ISO 9001, ISO 14001, ISO 18000, Total Productivity Maintenance (TPM), Material Requirements Planning (MRP), Manufacturing Resource Planning (MRP II), Enterprise Resource Planning (ERP), 5S, Lean Manufacturing, Failure Modes and Effects Analysis (FMEA), Six Sigma, Customer Relationship Management (CRM), Flexible Manufacturing Systems, Lean Six Sigma, and Supply Chain Management (SCM) are among the most preferred modern business applications at the present time.

It has been seen that the projects, the enterprises plan to implement in a period of 6 months to 1 year, are Customer Relationship Management (CRM) (13%), 5S (11%), Material Requirements Planning (MRP) (11%), Manufacturing Resource Planning (MRP II) (10%), and Total Productivity Maintenance (TPM) (10%). Accordingly; it can be said that the enterprises have understood the importance of customers, the key point of today's world, and faced towards CRM applications to show them the due care and value, and also that they have arranged their manufacturing systems and faced towards such methodologies as MRP, MRP II, TPM and 5S to systematically monitor and improve the processes. We can say that the younger the enterprise is (i.e. as the average age decreases), the more new and current business applications are preferred.

It is clear that the enterprises have mostly focused on, and faced towards resource and manufacturing planning systems such as ISO 9001, Material Requirements Planning (MRP), Enterprise Resource Planning (ERP) and Manufacturing Resource Planning (MRP II), as well as the applications such as Customer Relationship Management (CRM) and Just In Time (JIT). These applications generally appear as the applications requested / expected by customers who ask for provision of any manufactured good or service by enterprises.

Here, implementation of these techniques is mandatory for the enterprises to sell their products / services, which means that the enterprises are still far behind the point as wished by customers / customers' expectations. It is seen that the enterprises, engaging in forest products, face towards the applications, which are required first under the laws or market conditions to improve their processes, due to their complex and variable structures. When we analyze the applications, preferred by the enterprises of three different levels of technology (high, medium, low), it is seen that the common points of such applications are effective utilization, planning and monitoring of resources in manufacturing system.

With respect to the case study for Turkey; it is found out that the matters, which are not dealt with yet by the enterprises, are mostly such applications as Total Quality Management (TQM), Lean Manufacturing, 5S, Failure Modes and Effects Analysis (FMEA) and Six Sigma among modern business applications. When we analyze the demographic structure of the enterprises in detail, we can see that the enterprises, which have not yet attained the sufficient size and corporate level, do not prefer modern business applications. Based on this, one can say that these enterprises are not ready for international competition at the present time. Since these enterprises go through the development process, adoption of such kind of modern business approaches will play a determinant role in making important moves by the enterprises. In this matter; the most important move is made by senior management of enterprises. Senior management of enterprises should adopt development and improvement idea, believe in underlying need and benefit of such idea, provide support in applications, and adopt decision to allocate resources of the enterprise therefor.

It is seen that the rate of Customer Relationship Management (CRM) application is at medium level. In fact; the current most important determinant factors for existence and position of the enterprise across the market are identification of values by customers and customers' demands which have become a key concept. Receiving both needs and demands of customers through CRM applications is a great opportunity for enterprises to develop their products/services and eliminate any error to arise. Accordingly; the forest product enterprises of 56%, which do not have an application project, points out that there is still a long distance to be covered in this matter.

Based on the consequences revealed; it can be seen that in fact, forest product enterprises have taken initiatives for modern business applications, but they are now at start-up phase. Modern business applications, as utilized all around the world, are required to have been

integrated into the business system, and be at a level that can be utilized effectively in order for enterprises to be able to find a place at the international market, to be integrated into the market, and to compete at international arena with not any guard wall.Just at this point, efficiency and prevention of any error before occurrence, shortening the manufacturing period, being able to offer or manufacture any product when customer requests so, being able to manufacture with competitive prices, implementation of solutions as appropriate to customers' needs rapidly, and ensuring customer satisfaction by providing unconditional support for all errors to arise come to the forefront as determinant parameters.

Besides popularization of modern business applications all around the world, ensuring integration between the applications is a major field to focus for researches, like the case in Turkey.

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