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Using advanced technology in automotive sector and relationship of technology management

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In respect of organizations, it is possible to maintain their manufacturing efficiently and productively by making right decisions at the right times. And, they should realize their investments related to advanced technologies to respond to customer needs and expectations and sustainable competition. The process connected with these investments which have high cost is complex and have many unknowns. The comprehension of technology management has become important in recent years to manage successfully that process. This study is focused on the relationship between technology management and advanced production-management technologies. By this aim, a survey done in Turkey Automotive Sector has been given a place. In the search, the situation about technology management is considered by evaluating data related to using advanced technology in organizations. Automotive sector is one of the sectors which are most affected by the changing of economical and social conditions. From the result obtained in this research, it can be stated that the problems are partly present in the implementation of the advanced production and management technologies and that the approach of the technology management was not completely adopted by the organizations. But, that the organizations are trying to realize their technological changes by connecting with also different institution can be stated.

Key words: Advanced technology, technology management, Turkey automotive sector.

INTRODUCTION

Technology is one of the sources that provide competitive advantage in carrying out financial, marketing, distributing and other activities (Yildirim et al., 2001). Advanced technology can be described as a new and can be related to any techniques, when applied, it makes a change in production methods, management systems, product design and manufacturing in an organization (Akat and Budak, 1994). On the other hand, it can be expressed as all of the technologies that is used for the aim of integrating of designing of product and process, planning and controlling of production, production processes with these activities (Eren, 1998; Gerwin and Cododny, 1992).

And, technology management includes the provision of contact between strategies and the implementations of arrangements (Erickson et al., 1990). Technology management is a process that includes planning, management, control and coordination of activities to succeed organization's strategic and operational objectives and to improve their abilities (Liao, 2005). Techno-

logy management is a discipline that has a fifty-year-history. Last twenty years have been a period in which the number of publications has rapidly increased and certificate programs have opened with their professional organizations (PICMET, IAMOT, EITIM, etc.) (Cetindamar et al., 2009). It is different from the classical management approach, because it has the characteristics of determining strategies related to technological change decisions. Technology management is an important fact that forms firm's organization and connects between management and technical departments. Strategic goals are carried out by evaluating required management and technical sub-structure. As the required technical substructure is expressed with the part of item, management processes that are necessary to transport and manage all material things are expressed with the part of knowledge. Technology management process is handled as five steps (Gregory, 1995). These are: 1. Describing of technology; 2. Selection of technology; 3.

Table 1. Advanced production technologies.

Computer Aided Design (CAD)	CAD is the system that realizes production by carrying the product to computer monitor, carrying out changes desired and transmitting the results as a programme to computerized machines (Semiz, 2004).
Computer Aided Manufacturing (CAM)	CAM is the technology that providing data processing support to users, by preparing production planning and programmes for coordinate measuring devices and other programmable devices, can operate by using computer controlled techniques until the raw materials are ready for sale (Aydogan, 1997).
Computer Integrated Manufacturing (CIM)	CIM is the technology that can manage operational relationships between all the levels in many departments, target the integrity of automation and human by using different technologies instead of carrying out completely an automated organization (Erdem et al., 1997).
Cellular Manufacturing Systems (CMS)	CMS is the system that aims at obtaining savings got by flow type production used in mass production in workshop-style productions in industries having simple processes (Atalay et al., 1998).
Flexible Manufacturing Systems (FMS)	FMS is the system in that job parts are carried with material transport systems, coordination is provided with computer system and human factor is minimized in loading and unloading (Capci, 1997).
Robots (R)	Robot is designed as multifunction and reprogrammable technologies that can move special parts, devices, parts and materials with programmed movements (Akin, 2001).

Obtaining of the selected technology; 4. Beneficial usage of technology; 5. Providing specializa-tion in product and production systems and knowledge.

On the other hand, operations are described according to three different levels in implementing technology management in organizations (Phaal et al., 1998). These are organizational, management and operational levels. Sub-operations belonging to every level should be in parallel with the technology management approach.

In the study, the subjects of the technology management and technological competitive strategies have been introduced briefly by describing advanced production and management technologies which are most widely used today. And, the part of the field research, the approach of the technology management in automotive industry which is the sector in which advanced production and management technologies are widely used has been handled. In the field research, the survey which has been prepared for the top managers of the organizations operating in Turkish automotive main industry has been applied. Assessments have been done according to answers which have been given to the survey questions.

ADVANCED PRODUCTION AND MANAGEMENT TECHNOLOGIES

Advanced Production Technologies (APTs) include all technologies that are used in all steps from computer designing level up to computerized integration of machine and equipment during production. The APTs that are most used in nowadays is given in Table 1.

Organizations also need to make a change in their production management technology and apply different management style in parallel with their physical developments. These management styles should be imple-

mented by harmonizing, so that positive results in respect of organizational criteria such as efficiency, quality, productivity, economical etc. can be obtained. Advanced technologies that have been developed with these aims are named Advanced Management Technologies (AMTs). These Technologies are described in Table 2.

TECHNOLOGY MANAGEMENT

Technology management is the management that provides the connection between the management, science and engineering areas in forming and accessing of the goals related to strategic aims and activities of the organization (Betz, 1994). Technology management can be expressed as planning, developing and applying of technological capacity needed in forming strategic and tactical aims of an organization and accessing them (Incelcer, 1995).

The subjects of technology management

Technology management is expressed as the connection between business management and subjects about technical structure by taking into consideration market dimension. Technology management concerns whole organization because its covers a wide area and its content are intensive.

Technological prediction

Technological prediction covers the subjects about how long the today's technology will be used and to which direct it will develop. Healthy decision can be made with technological prediction by analyzing systematically on

Table 2. Advanced management technologies.

Total Quality Management (TQM)	TQMs are the activities, target at improving quality in every area, by considering customer satisfaction, continuous improvement, participation in the administration management with the managers that have leadership formation (Demir and Gumusoglu, 1998).
Just In Time Manufacturing (JITM)	JIT is the system with that the amount needed of each part on a production line is produced by the phase that follows that production line (Karcioglu, 1993).
Reengineering (RE)	RE is radically rethinking the business processes and radically redesigning with the aim of making striking improvements on performance criteria such as cost, quality, serve and speed (Hammer and Champy, 1998).
Benchmarking (BM)	BM is the process of investigating the organizations which have much performance and comparing their own working methods with them and making applications according to results by the aim of increasing of the organizational performance (Camp, 1989).
Organizational Learning (OL)	OL expresses the process of developing the abilities necessary for providing the people in the organization to understand their deeds better and eventually to make activities effectively and of getting information (Barutcugil, 2002).
Human Resources Management (HRM)	HRM is a system that includes applications such as determining personnel requirements, giving advertisement, selecting them, adopting them to organizational culture, workers' motivation, performance evaluation, dispute resolution, providing effective communication, developing of management organization development of a sense of we, training and developing employees (Findikci, 1999).

basic subjects related to developing of organizations (Twiss, 1990).

Technological planning

To provide competitive advantage is to make a plan for the future by determining strategic technologies on product, serve or processes along with considering organizational strategy (Incel, 1995).

Research and Development management

It is described as the creative efforts and knowledge obtained and carried out based on systematic basis which is used in new implementations to increase technological knowledge in an organizations. R&D in organizations is carried out with the aim of developing a new product, increasing quality and decreasing costs (Oner, 2006).

Technology transfer

Technology transfer is the moving of the technology from a place to another place, from an organization to another organization, from a university to an organization, from a country to another country. Different points such as product, method and personnel may be the subject of this transfer. Transfer methods may be long, complicated and dynamic and its success can be affected by many factors stem from various sources (Saad et al., 2002).

Technology executives

The most important factors responsible for determining and implementing of organizational strategies surely belong to managers. It is a difficult and complicated process to integrate technology and strategies and harmonize them directed to same objectives. Managers should take an interest in four dimensions such as especially development process, project selection and determining of advantage, domestic sources allocation and foreign technological investments selection (JPBM, 1996).

Technological competitive strategies

In the cases that the competitive circumstances are fully formed in market, organizations need to apply very different competitive strategies. Strategies that cover new product and different marketing techniques are applied as well as price-focused competitive strategies.

Aggressive strategy

It aims at obtaining the leadership in the technical area and market by developing a new product or production process and presenting it to the market before their competitors (Barutcugil, 1981).

Defence strategies

This is the strategy which is improved to benefit the gap

in the market that have been carried out because of the errors and deficiencies in the products belonging to rival firms (Sarihan, 1998). Their request of risk taking is low and it is based on diversification of products.

Imitator strategy

This strategy is based on following technology leaders in the market (Alpay, 1990). They are exposed to restrictions by dealing with the organizations whose products and technologies are imitated.

Dependent strategy

The organizations accept the sub-institution role or a satellite of a strong organization (Barutcugil, 1981). Changing of product or technological change is in parallel with wishes of main organization on which sub-organization is depended.

Classical strategy

This is the strategy adopted by an organization which does not take into consideration R&D activities and can make design changes which is the meaning of fashion (Sarihan, 1998). The resource of improvement is based on abilities and skills more than scientific studies.

The strategy of monitoring opportunities

In the cases where directly competing is difficult, it is aimed at using the same technology which is used by the rival firm, by not encountering with them, but by analyzing weaknesses of rival firm (Barutcugil, 1981).

A FIELD RESEARCH IN TURKEY AUTOMOTIVE SECTOR

Advancement of automotive sector is in proportional to development of production technologies. Since the beginning of 1900's, production was realized in a few small workshops using labour-intensive and according to order. In this period, cost of unit was high and it was not possible to talk about any standard related to the vehicles produced. In 1908, Henry Ford in American Automotive Industry has uncovered serial production that can get rid of deficiencies carried out in first productions with his T-Model Project. That was the production style that depended on division of labour on an assembly line which moves. On assembly line, unqualified employees were usually made to do simple jobs. So that, standard vehicles of which amount was high was produce. The

elements that did not exist belonging to earlier production style such as sensibility in production, standardization and continuity of production was obtained from this production style.

After 1960's, Japan entered into the market with a new production system which gave them an important share of the market. Japan became powerful and competes with countries like USA and Europe via that system which was named JIT and its production line was designed to customer needs. In later years, countries like USA and Europe also began using that system on which there is a good organization between the raw materials, firm and buyers. In 1980's, changes in demands in market have been managed through facilities belonging to computer technology. It has been provided that the production with speed, flexible and being variety can be achieved through advanced technologies.

The importance and goal of the research

But the automotive sector that is one of the sectors having intensive new technology production should also lead to developments, not only monitor them. By this aim, different strategies are implemented. It is important that the comprehension of technological management to be adopted and applied to manage the problems that have been faced during implementing of strategies. In the research, it is aimed to measure the yield of advanced technologies use in the automotive sector and to determine the relationship between cost and yield. And, approaches about technology management in the sector are evaluated.

The research field, its method and hypotheses

In the research, the organizations produce in Turkey Main Automotive Industry have been determined. The answers gotten from 13 numbers of 17 organizations in active have been evaluated. Four organizations did not join the research due to various causes. It has been paid attention that all of the questions to be answered truly in applications are carried out with one manager in organizations.

In the research, after being determined the selection of Turkey Main Automotive Sector as example size, a survey form was prepared. The application of survey form that was suitable to the area was carried out in a pilot organization. The survey form was rearranged according to lack of monitoring in this application. A survey form was to be filled via the methods of post or face-to-face interview. But, only 13 numbers gave positive answers. Evaluations were carried out according to these 13 organizations. The data in the survey forms was analyzed with the program SPSS (Statistical Package for Social Science) 12.0 for Windows program. Analysis and eva-

evaluations were done according to scales carried out. Care was taken that content of questions or answers given do not invade on the privacy of the organization.

In research, it has been accepted that the automotive main industry which was selected as the research field implemented APTs. While being surveyed, the senior managers have been supposed to have requisite knowledge and the answers given were true in the face-to-face interviews or filling of survey forms sent via post.

Demographic structure of executives participated in survey

Age

Most managers (63.63%) are in the age group of 31 and 40. The ratio of the age between 41 and 50 is 27.27% and the rest of managers are over the age of 51. Most managers are between the age group 31 and 50 (90.9%).

Sex

All the managers in this research are male. It can be stated that most of the top managers in the organizations are male.

Unit at which he works

77% of managers who joined the application are managers of production department. On the other hand, managers of quality, human resources and engineering departments have an equal participation (7.7%). The managers of production department are the managers who know existing technology, apply it, affect at technological decisions.

Educational status

Most managers (84.6%) who joined the search graduated with a bachelor's degree while the rest of them (15.4%) graduated with a master degree.

Evaluating of the findings obtained in the research

By measuring the yield of APMTs of organizations, the relationships between the cost and the yield were evaluated. And, consulting services about technology management and the reasons of technological changes have been handled.

Measuring the yield of the APTs and AMTs

It is important to measure the yield of advanced production and management technologies and to carry out

Table 3. The state of the measurability of yield of APT.

Options	f	(%)
We can measure	7	53.8
We can partly measure	5	38.5
We cannot measure	1	7.7
Total	13	100

Table 4. The state of the measurability of the yield of AMT.

Options	f	(%)
We can measure	4	30.8
We can partly measure	6	46.2
We cannot measure	3	23.1
Total	13	100

subsequent changes in technology according to these evaluations.

53.8% of organizations joined the application expressed that they can measure the yield of using of APT. 38.5% of them can partly measure and 7.7% of them cannot measure as shown in Table 3. It is a positive result that a significant ratio of them can measure, but, as the investment and operating cost of APT are high, it is obliged to measure the yield. Organizations should conduct studies about measurements in a more informed and programmed way.

The distribution about the measurability of the yield of AMT in organizations joined research is seen in Table 4. It is understood that there is much more indefiniteness in AMT than in APT because of that 30.8% of the organizations respond that they can measure the yield, 46.2% of them can partly measure it and of which 7.7% cannot measure it. When measuring about the yields of AMT, the measurements will be facilitated to take data according to a certain period and to test them with comparing first case and last case.

The relationship between the usage costs and the yield of APTs and AMTs

Establishing a relationship between the usage cost and the yield of APT and AMT provide you to see the issues on making technological investment decisions that need to be taken account.

The relationship between the usage cost and the yield of APT is shown in Table 5. 53.8% of the organizations expressed that they exceedingly meet the cost, of which 38.5% meet only the cost and of which 7.7% do not meet the cost in predicted time. Although most (92.7%) expressed that they meet the cost, while productivity, efficiency and quality that are the usage aims of APT increase, costs decrease and it is understood from that, there are matters about realizing of the goals. 38.5% of

Table 5. The relationship between the usage costs and the yield of APT.

Options	f	(%)
Those who exceedingly meet the cost	7	53.8
Those who only meet the cost	5	38.5
Those who cannot meet the cost in predicted time	1	7.7
Total	13	100

Table 6. The relationship between the usage costs and the yield of AMT.

Options	f	(%)
Those who exceedingly meet the cost	7	53.8
Those who only meet the cost	6	46.2
Those who cannot meet the cost in predicted time	-	-
Total	13	100

those state that they meet only the cost and 7.7% of all cannot meet the cost in the predicted time and it can be understood from this that there are problems at the realizing point of main goals of technology applied.

While 53.8% of the organizations use AMT expresses that they exceedingly meet the cost, of which 46.2% state that they only meet the cost as shown in Table 6. There are no any organizations that express that they cannot meet the cost in predicted time. In this case, it can be stated that the organizations succeeds in using AMT and when taking into consideration the main purposes of AMT usage, it is seen that applications should be carried out more careful, because, it has been concluded that an important part of them (46.2%) only meet their cost.

The relationships with the institutions that study about the subjects of technology management

It is aimed at determining how many organizations in the sector receive consulting service and from where they receive it.

The distribution about the state of receiving consulting service from institutions that studied about strategic technology management of organizations is seen in Table 7. According to this, a significant majority (61.5%) do not receive consulting service from these institutions. On the other hand, 38.5% of the organizations receive consulting services. It can be expressed that it will be possible to benefit more productive and efficient from employees by receiving consulting service about especially production management.

The distribution of the institutions from which the organizations received consultancy services about strategic technology management is seen in Table 8. According to this, consulting companies with a ratio of 30.8% are the leading ones of the institutions from which the organiza-

Table 7. The state of having consulting service.

Options	f	(%)
Yes	5	38.5
No	8	61.5
Total	13	100

Table 8. Institutions that they receive consulting service.

Options	f	(%)
Tubitak	2	15.4
Consulting companies	4	30.8
Professional business managers	1	7.7
Technology Development Foundation of Turkey	-	-

zations receive consulting service about the strategic technology management. Then Tübitak comes with a ratio of 15.4%. And the professional business managers are at the level of 7.7%.

In the sector, states of not receiving consulting services present us that the relationships with the consulting institutions are not enough. Although there are the organizations that receive service from consulting companies and Tübitak, this figure is not satisfactory.

The reasons of technological changes

The basic reasons of technological changes were carried out in organizations. So, it is aimed to determine the distribution of the reasons of technological changes.

The reasons of technological changes are seen in Table 9. According to this, international competition has the highest level with the ratio of 84.6%. This situation can be expressed as the indicator that organizations make technological investments that are directed to export. After that, economical environment with 62.2%, customer preferences with 61.5%, rivals' technological level with 53.8% and management's attitude with 46.2% are listed. On the other hand, organizational structure with 30.8%, juristic and political environment with 15.4% and social and cultural environment with 15.4 % are seen to be effected.

It is normal to take into consideration the international competition by the organizations that produce both in domestic and abroad. On the other hand, the relationships with financial institutions that are named as economical environment, the State's attitude and other factors are considerable elements. Anyhow, it is fact that customer preferences are taken into consideration in a significant proportion. Especially, the approaches that top management's forward-looking approaches facilitate making of technological changes. The use of new technologies by competitors is another of the elements that

Table 9. The reasons of technological changes.

Options	f	(%)
Economical environment	9	69.2
Social and cultural environment	2	15.4
The use of a new technology by competitors	7	53.8
Customer preferences	8	61.5
Juristic and political environment	2	15.4
International environment	11	84.6
Organizations' structure	4	30.8
Management's attitude	6	46.2

Table 10. The state of having a technological-improvement department.

Options	f	(%)
Yes	7	53.8
No	6	46.2
Total	13	100

force technological change. Moreover, unproductive and inactive organizations and social and cultural environment force the organizations to be changed even if at low level.

The state of having a technological-improvement department

It is aimed at determining how much rate of technological-improvement department is in throughout the sector.

The distribution about the state of having a technological-improvement department in organizations is shown in Table 10. It is understood that 53.8% of organizations in sector have a technological-improvement department. And, 46.2% of them state that they do not have a technological-improvement department. It is a fact, that when there is not a technological-improvement department in a significant section of the sector there will be a deficiency. However, because of the organizations in the sector manufacture with participating or license of foreign-based organizations, technologic decisions are affected by these organizations. But, it can be stated that it is useful to study and use advanced production management technologies with the aim of benefiting from especially personnel at high level.

CONCLUSION AND RECOMMENDATIONS

Turkish Automotive Sector is the one of the sectors which are most affected by economical and social environments. So, technological investments should be handled

in a sensitive way. Decisions-making processes should be operated as planned, programmed and towards objectives. In the study done, that the some problems are present in operating of these processes and that the sector has been courageous to transfer the APT and AMT can be stated.

As can be seen, there are problems in measuring the yield of the usage of APT, but it can be significantly measured. On the other hand, when evaluating the relationship between cost and yield it is attracted attention that there are partly problems. And, it is seen that there are problems in measuring the yield of the usage of AMT. On the other hand, when evaluating the relationship between cost and the yield, it is understood that the expectations have mostly been realized.

It is seen that the organizations in sector do not significantly receive consulting services from institutions which studied about strategic technology management and they follow the developments via their own structuring or their shareholders. On the other hand, a small part of them receive serves from different consulting institutions.

The organizations make changes because of factors such as economical environment and customer needs. This situation shows us that the organizations are globally progressive and innovative. And, it can be stated that they have an organizational structure that takes into consideration financial position and customer needs.

There are organizations that do not have the technological-improvement section in the automotive sector which uses APT and AMT and it can be expressed as technological change and improvement which occurs mostly through foreign shareholders and brands. Technology-improvement sections in the sector are the sectors that are named as Engineering and R&D sections. These sections mostly operate at operational level.

Following proposals can be stated according to these conclusions:

1. Establishing an appropriate measuring system can help to solve the problems in measuring the yields of APT and AMT of organizations.
2. The problem about analyzing the relationship between the cost and the yield of APT and AMT of organizations can be possible with a well planning and by following the applications. And, making a more careful planning in technological change processes can increase the yield of the new technology.
3. Organizations should especially take notice of the subjects of strategic technology management and receive consultancy services from relevant institutions. These companies that are private or public can serve about subjects on different areas that the organizations need. The institutions such as universities, Tübitak can be considered as the ones of the institutions that serves consulting. It should be paid attention the relationships with these institutions and these relationships should be

improved.

4. Organizations should consider as important R&D activities that is the one of technological innovation and change ways.

5. Organizations should benefit human and physical potential at the highest level in their studies about prediction of the future and being adopted. For this, organizations should show that they can get efficiency from new production and management technologies at the highest level in their organizations' applications.

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