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Full Length Research Paper

A research relating to innovation activities on enterprises using advanced manufacturing technologies

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This study is aimed at determining and evaluating the usage levels of advanced manufacturing technologies (AMTs) and their applications relating to innovation activities. In addition to this, determination of innovation types and causes are also considered. In the study, the screening method has been used and the study group is consisted of 265 small and medium scale enterprises using advanced manufacturing technologies, in provinces which are randomly selected in Turkey. The findings obtained via answering of the survey questions have been evaluated in accordance with frequency, mean and standard deviation. Wilcoxon test has been used in measuring the AMTs in enterprises to see if the change in the usage levels is significant. In the study, according to scale difference (small-medium) of enterprises, independent groups' t-test analysis relating to difference in evaluations has been used. In the scale used in this study, Friedman two-way Anova test has been done. In this study, in the evaluations relating to innovation activities of enterprises, Mann-Whitney U test analysis relating to difference in their evaluations according to variable of market areas (domestic; domestic + foreign) has been used. In reviews relating to innovation activities of enterprises using AMTs, one-way analysis of variance (ANOVA) has been conducted to determine if there were differences in evaluations according to variable of operating periods. LSD test has been used to determine in which groups, the possible differences of the groups lie between. In testing the differences between the groups, significance level has been considered as $p < 0.05$. At the result of the study done, it is seen that there was a significant increase in the usage levels of AMTs in enterprises in the last three years. It can be stated that enterprises are more focused on marketing and service innovations. Changing customer demands and requirements is the leading of the innovation causes.

Key words: Advanced manufacturing technologies, innovation, production industry in Turkey.

INTRODUCTION

The concept of change, which is one of today's magic words that humans face in all the fields of their lives, in recent years, is gradually increasing its importance with the impact of its advances in technology as well. When considering that 90% of all scientific discoveries made throughout history were realized in 30 - 40 years, the importance of change and innovation that comes with this change becomes more prominent (Noori, 1990).

A new process in which there is a transition to a new paradigm of "fast fish eats slow fish" from the paradigm of "big fish eats little fish" is being experienced. When considering that this rapid change and development covers all areas of life, enterprises cannot be expected to remain unconcerned with these innovations. At the present day, in which competition became a global characteristic, it is seen that enterprises and countries determine their position with their abilities to follow the technological developments and implement them. Small and medium-size enterprises (SMEs), which perform 61% of the total employment and 56.5% of the total investment in Turkey, are also affected by these innovations and changes (Elibol and Şaklak, 2007).

In the world, intense competition is experienced in markets along with globalization. Advanced manufacturing technologies is one of the most important developments used in developing product and process

technologies in this intense competitive environment. Use of advanced manufacturing technologies, which increase the abilities of enterprises for lower cost, more quality product, increased productivity and ensure quick delivery of appropriate products to customers have become essential (Ömürbek and Yilmaz, 2009). Organizations operating under global competition, rapid technological changes and resource scarcity should innovate to grow, be effective or even to survive (Damanpour and Wischnevsky, 2006). The way of achieving sustainable competitive advantage in an environment, which is dominated by intense competition and characterized by uncertain and complex market conditions, is to innovate (Lynch, 2000; Wickham, 2001).

In the studies done on innovation activities of SMEs in Turkey, it is seen that the business managers have adopted the approach of "innovation activities as suitable for large enterprises, but, there may be more cost for SMEs". However, most innovative and different products and services come out from SMEs in USA and EU. Innovation activities provide SMEs with competitiveness, originality, differentiation and growing (Ateş, 2006; Yavuz, 2007).

Innovation has become one of the main elements which lead the competition in many industries such as automotive, electronics and chemistry. Another most comprehensive technology and innovative policy documents of EU is the report which is named "Green Paper on Innovation" and published in 1995. In the report, three objectives have been determined in order to gain competence about the subjects of technology and innovation along with creating a new technology and innovation policy design for EU countries. These objectives are (Taymaz, 2001);

(1) Providing more resources for 'research and development' (R and D) and technology-innovation activities.
(2) Ensuring coordination between research and innovation activities in various stages.
(3) Ensuring conversion of the scientific research results into industrial and commercial use.

Constantly, developing technology has gradually occupied more places in all areas of human life. As a result of this, its positive or negative effects begin to emerge. For enterprises, technological innovations and developments have closely become necessity in order to survive and to increase profit margin in this age of speed and change. It can be stated that the decision of technology refresh and selection has become much more important in countries such as Turkey, which mainly consume technology.

ADVANCED MANUFACTURING TECHNOLOGIES

The concept of advanced manufacturing technologies came into literature at the end of the 1980s and has rapidly been spread with an increase in the actual applications (Patterson et al., 2004). During the 1980s, information technologies and advanced manufacturing technologies have been used as synonyms in industrialized countries. Information technologies can be considered as a mix of computer and communication technologies. In a plant, taking the orders, purchasing raw materials and side inputs for manufacturing, production process, production planning, quality control and delivery are knowledge-based processes. In this case, taking advantage of information technology is inevitable (Karakaş, 2009).

AMTs are computer-based technologies which are used by manufacturing enterprises (Dean and Snell, 1996). Computer-aided technologies provide access to necessary information easily and in a short time, a better forecasting and improve the system's management and control. Therefore, the productivity of machines increases, less space and stock are required, production of defective products is minimized, the speed of production and delivery increases, and stopping or breakdowns of machines are less, and as a result, they can even be forecasted (Jelinek and Golhar, 1983). Thus, to be able to respond quickly and accurately to market changes, have access to new markets and being able to compete increasingly becomes easy. Advanced manufacturing technologies are the integral part and strategic resource of organizational capabilities of manufacturing enterprises (Pandza et al., 2005).

The descriptions done about AMT vary widely. AMT is "all of the technologies which are used for product and process design, production planning and control, production process and integration of these activities" (Gerwin and Kododny, 1992). When it is applied, that is, a new and related technique which leads to the change in current production methods, management systems and design and production of product can be expressed (Pike et al., 1988). AMT also includes process technologies and management systems towards increasing the capacity of design and production functions of the enterprise (Kazan and Uygun, 2002). AMT expresses the technologies group of integral hardware and software-base, which are designed to increase activity and productivity in manufacturing any product in the enterprise (Ghani and Jayabalan, 2000). AMTs include new production techniques in the production process, the machines equipped with information technology, microelectronic and new organizational applications. They ensure productivity, quality increase and cost reduction which are the requirements for competition in global markets (Deruntz and Turner, 2003).

AMTs have developed, especially with the implementation of computers in the manufacturing process and are spread throughout the fields of both production and management. Particularly, with the force of changing market conditions, the use of computer- controlled

manufacturing technologies has rapidly been started instead of the traditional assembly line applications. Reflections of advances in computer technology on the production process in enterprises are emerged as computer-aided design (CAD), computer-aided manufacturing (CAM), computer numerical control (CNC), flexible manufacturing systems (FMS), robots (R), group technology (GT), cellular manufacturing systems (CMS) and computer integrated manufacturing (CIM) (Akın, 2001; Patterson et al., 2004).

AMT implementation is discussed as a process which is formed from three stages. The first stage is before the application and is the phase in which positive and negative factors affecting technology purchasing decisions are evaluated and decisions are made. The second stage is the implementing and placement stage. It begins with technology purchasing and ends up with successful placing and running. The last stage is the stage in which the enterprise both tries to increase the competitiveness in the market by using AMT and makes the necessary changes and arrangements to use the technology more efficiently and effectively (Tekin et al., 2000). Increasing global competition has increased interest in implementation, development and transfer of advanced manufacturing technologies. AMTs, which increase the business skills to obtain lower cost and enables rapid deployment of appropriate products to customers, constitute the foundation stone of many new production strategies (Hottenstein et al., 1997). This shows that administrative support is needed to improve the effects of AMT implementations on business performance (Patterson et al., 2004).

The expected benefits of AMT implementation are: development of design and analysis capabilities, lowering project costs and engineering time, decreasing part of the programming time, customer demands are met more quickly, increasing material/fixed costs, reducing stock and labour costs, improving product quality, decrease in maintenance costs, decrease in the use of factory site, increase in market share, more efficient production process planning, more effective control, improving customer service, providing more intense participation of workforce, more effective integration of sub-systems, realizing more rapid and accurate flow of information, providing an increase in competitiveness, providing an increase in productivity and providing a decrease in costs (Tekin et al., 2003; 2000; Sauer et al., 2000; Moriones and Cerio, 2004).

Technologies, which are considered as AMT in literature, include both computer-aided technologies and management approach and philosophy. AMT is divided into (main) parts. According to the general trend in literature, production management methods and techniques are considered as “management technologies” and computer-aided techniques and equipment as “engineering technologies”. AMT separation is seen in Figure 1. This research has been conducted in enterprises using engineering technologies, which is one of the advanced manufacturing technologies (Tekin and Zerenler, 2002). These technologies are described in Table 1.

INNOVATION

Technological changes can be one of the determining factors of competition in a sector. The enterprises which do not provide necessary technological development fail in competitive race or are forced to withdraw from the race. At the result of globalization, technology in competition too, increasingly becomes important with the increasing use and importance of technology (Balim, 2001). While innovation is an important element in all periods of economic life, in today’s competitive environment, it became the basic element for enterprise to survive and constantly renew their products, processes and organizational structures (Cozijnsen et al., 2000). Today, innovation is considered to be an important element in obtaining a competitive advantage and a means of survival for enterprises (Batory et al., 2005). First, the study which examined the concept of innovation in the scientific sense is placed in the book entitled “Theory of Economic Development” written by Schumpeter in 1912 (Freeman and Soete, 2003).

An enterprise has to innovate in their products to maintain its competitive situation (Simmonds, 1985). Technological innovation is not only limited to product, production style and some innovations and improvements in the use of products, but at the same time, it includes new developments in some topics such as management, information, organization and finance. It is closely related to the implementation of economics, business and other social sciences to the industry and firms (Gattiker, 1990). Technological innovation refers to the use of information in finding new technologies and applying them. A technological innovation can be related to product and process technology (Cleand and Bidanda, 1990). Top management should encourage innovation and provide sources and support for it, because, according to employees, supporting management is a supporter (sponsor) which provides them with any kind of sources (Christensen, 2005; Smith, 2007). Technological developments can have a substantial impact which may mainly lead to the radical change in size and structure of product markets. Some forms of technological changes have more common effect on innovation than others. When considering technological developments in communication and logistics technology, it is seen that these remove the barriers between markets and bring competitive pressures against previously protected areas (Gürak, 2001).

Technological decisions should be made at the right time and place. There are three alternative ways in which organizations can make these decisions (Barutçugil, 1979):

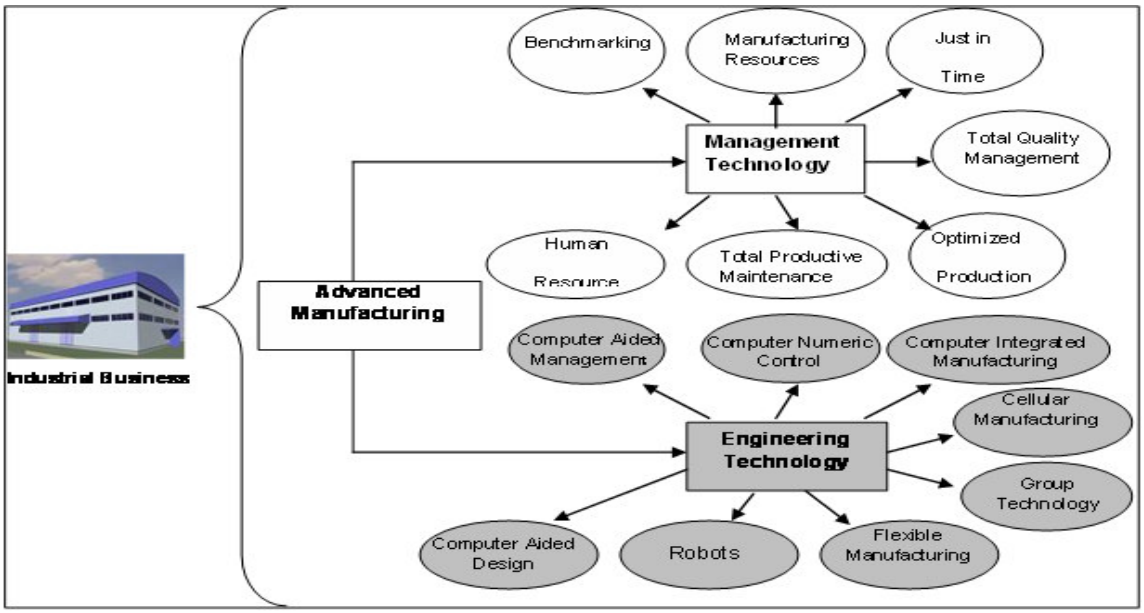

Figure 1. Separation of advanced manufacturing technologies.

Table 1. Advanced manufacturing technologies.

Computer aided design (CAD)	Computer-aided design defines the usage of computers as a process by which the design and analysis of product to be produced is made. Desired design changes can be made by carrying the product to the computer monitor with CAD. In order to realize the production, these changes are transmitted as a programme to CNC machines.
Computer aided manufacturing (CAM))	CAM is a controlled production technique in which a material ready for sale is made with all the preliminary steps of this technique. The aim of CAM is the programming and running of machines with computers in the production process.
Computer numeric control (CNC)	It is named numeric control (NC) in that the implementation of input signals which have been coded according to a certain number system of appropriate logic circuits in a control system provides the desired output in accordance with the instructions in a certain tolerance (Donaldson et al., 1993). Moreover, CNC is used in getting system functions when it is benefited from computer (Aslan, 1994).
Computer integrated manufacturing (CIM)	The aim of computer technology in the production field is to gather engineering and operating activities under one roof (Anlağan and Kılınç, 1992). CIM aims human integrity with using different technologies rather than creating a completely automated business. It is an organ which remarks operational relations between all levels in many departments of enterprises (Erdem et al., 1997).
Cellular manufacturing systems (CMS)	CMS which is emerged with a different approach according to traditional production systems is more advantageous in respect of cost and quality, than traditional manufacturing systems. It is created towards two main objectives. The first one is in industries having simple processes, for obtaining savings which are equal to savings got by flow type production, and used for mass production in workshop-style productions, in which there are stops. The other one is to create better infrastructure which will be useful in developig relations between employees (Atalay et al., 1998).
Group technology (GT)	It is described as production management philosophy which finds reasonable solutions to structuring problems emerged in establishing CMS (Atalay and Birbil, 1999). CMS also can be defined as workshop layout implementation of GT which is established to increase production efficiency by identifying and grouping together similar parts (Gökşen, 1997).
Flexible manufacturing systems (FMS)	The increase in amount and types of demand enterprises have a need for a system where economic, activity and productivity are provided on market conditions in which customer demands are unstable. As a result of this, they developed from the FMS. Because FMSs prevent loss of time related to operations such as carrying, loading and unloading, they are provided greatly to increase productivity (Browne et al., 1984).
Robots (R)	Robots, which are an important element in creating effective automation in the environment, also ensure short production time in addition to high and consistent quality. Industrial robots are defined by the Robotics Institute of America (RIA) as “reprogrammable and a multifunctional manipulator which is designed to move various special parts, devices, parts and materials with programmed movies to be able to fulfill a particular task” (Akın, 2001).

1. Technology selection: It is purchasing the appropriate technology to business objectives as knowledge, machinery or equipment inside or outside the country. When alternative technologies are concerned, it is clear that there will be a need to make a choice between them.
2. Technology transfer: In the event of the lack of needed technology within the country, this technology, which has been developed in a foreign country is transferred in a variety of ways and methods, and is applied to country and business conditions.
3. Technology production: Research, development and production of the technology within the enterprise's own possibilities. The concept of innovation is defined with different means (that is, wide and narrow).

In the widest sense, it is defined as all processes that include activities operating in developing a new or improved product (goods or services) and a production style, which makes it to be commercial (Şahin, 2009). Innovation is both a process and a result. As a process, innovation includes a special case of organizational change and activities done to produce a new product; and as a result, it defines new or improved goods and services obtained as a result of innovation activities (Schermerhon, 2007; Narayanan, 2001). This is due to the fact that innovation is meant to find new sources, customers and markets or create a new composition of existing sources, customers and markets (Hitt et al., 2002). The concept of innovation is defined in another source as "providing an important change which is turned into a commercial benefit with using new ideas or applying existing knowledge in very different ways (Garcia and Calantone, 2002). In references to Drucker, innovation is "knowledge which allows opportunity to people and make people with different knowledge and skills working together in an organization to be productive" (Durna, 2002). Innovation is increased by presenting knowledge or opinion to the market or by increasing sales and decreasing costs. In addition, it provides conversion of this knowledge or opinion into product, service and process, or a replacement of existing products, system and resources (Schermerhon, 2007; Galanakis, 2006; Popadiuk and Choo, 2006; Afuay, 2003; Bird, 1989).

The concept of innovation is gathered under four heads; product, process, marketing and organizational innovations.

1. Product innovation: Product innovations in services include significant improvements done in providing services (for example, in terms of productivity or speed), adding new functions or specialities to existing services or presenting entirely new services to the market (OECD and Eurostat, 2006).
2. Process innovation: Process innovations also include new or significantly improved software, equipment and techniques to help and support activities such as purchase, calculation and maintenance (OECD and Eurostat, 2006). Process innovation serves three different purposes. These, respectively, are; reducing production or delivery costs, improving quality and producing significantly improved products or delivering them (Kanter, 2006).
3. Marketing innovation: Marketing innovations target is to meet customer's needs more successfully, create new markets or position a firm's product in the market in a new style. Marketing innovation includes important changes in designing and packing, positioning, promoting or pricing of products (Armstrong and Kotler, 2007).
4. Organizational innovation: Organizational innovations in commercial applications include the implementation of new methods relating to organization of routines and procedures for the conduct of the study (OECD and Eurostat, 2006).

Firms can obtain all of these different types of innovation in various ways. It is possible to gather them under three general headings as purchase, transfer and self-improvement. Each of these alternatives has its own pros and cons. Although, purchase and transfer are less costly and risky, the most common one is internal development. To develop cost, great contributions must be made to social and economic development in a long term. Those who develop an innovation and sell it in world markets gain significant advantages (Tekin and Omurbek, 2004). Moreover, strategic direction as a result of innovation allows one to focus on increasing and strengthening the capability to obtain innovative skills and capacity (Hornsby et al., 2002).

Innovation provides many benefits for the success of an organization in addition to opportunity definition, providing opportunity to create value, gaining competitive advantage and bringing change. Some of these benefits can be defined as (Mische, 2001); Innovation is one of the basic techniques that are used to create an organization with high performance and re-create the environment. Innovation improves employees' skills and makes them excited. This is because, being a part of something new and creative and doing something that is totally unique, is exciting. Innovation encourages learning and knowledge sharing. Innovative organizations always share new ideas and knowledge and they have always, learning orientation. Innovative organizations allow employees the freedom for growing, improving and occupational diversity.

Research goals

This study is aimed at determining and evaluating the usage levels of AMTs and their applications related to new activities. According to this basic objective, it is possible to determine the sub-objectives as follows.

1. At what level of usage did AMTs changed in the last three years?

2. What are the types of innovations and the causes of innovating for enterprises using AMTs?
3. Do the types and causes of innovations done by enterprises using AMTs vary according to the size of enterprises?
4. Do the types and causes of innovations done by enterprises using AMTs vary according to market areas of enterprises?
5. Do the types and causes of innovations done by enterprises using AMTs vary according to the duration of business activities?

MATERIALS AND METHODS

Study methodology and data analysis

In this study, towards demonstrating the existing situation, descriptive method based on screening model was used. Data used in the study have been collected by a tool improved by researchers. In improving the measuring tool, the relevant literature has first been investigated. In creating scale items, it has benefited from scales used in the studies of Johannessen et al. (2001), Güleş and Bülbül (2004) and TurkStat (2009). After these studies, a 25-item draft on the scale has been formed. That 25-item draft formed has been presented to expert opinions and various changes and corrections on items have been made according to that. Cronbach's Alpha internal consistency coefficient has been calculated also for the validity study of the scale.

The search has been done on SMEs using AMTs in Turkey. Even if, different definitions and classifications are done for organizations, they are generally evaluated with the number of employees and sales revenues. According to the number of employees, they are classified as micro (1-9), small (10-49), medium (50-249) and large (250 or more employees) (KOSGEB, 2009). The research has been applied to enterprises in the months of February - March in 2009. In the context of the research, the questionnaires which are the research materials have been distributed by hand or via mail to 265 enterprises in cities which are randomly selected. However, 172 of them have responded to the questionnaire with a positive approach. The return rate of the questionnaire has been realized as 64.9%. Data collected through the questionnaire have been entered into the computer and analysed in the SPSS 15.0 (SPSS, Inc., Chicago, Illinois) environment.

The findings obtained, via answering of survey questions, have been evaluated according to frequency (%), mean ($\overline{X}$) and standard deviation (S.D). In order to measure whether the changes are significant or not in usage levels of AMTs in enterprises, Wilcoxon test has been used. Wilcoxon T test is dependent on a two-sample test. It is used to test the significance of the difference between scores belonging to two related sets of measurements. That test takes into account its amount in addition to the direction of different scores belonging to the two related sets of measurements (Büyüköztürk, 2002; Özdamar, 2002). Friedman two-way ANOVA test has been done in the scale used in the research and has been used to compare two or more samples that are related with each other (Ergün, 1995). In the study, in the evaluations relating to innovation activities of enterprises, Mann-Whitney U Test analysis relating to difference of evaluations according to the variable of market areas (domestic-domestic+foreign) has been used. As the number N in the groups of independent variables is not close to each other, Mann-Whitney U Test has been done (Alpar, 1998). Independent groups' t test analysis, related to difference in evaluation of innovation activities according to differences in scale of enterprises, has been used. In order to determine if there are differences in the assessments, according to the variable of activity period in their views on innovation activities of enterprises using AMTs, one-way analysis of variance (ANOVA) has been done. LSD Test has been used to determine in which groups the possible differences of the groups are among. LSD Test (Fisher's significant difference test) is a test that is used in binary comparisons and a multiple comparison test, which is the modification of t test (Özdamar, 2002). In order to test the difference between the groups, significance level has been considered as $p<0.05$.

Reliability tests

In order to measure the reliability and internal consistency of the scales, Cronbach's Alpha coefficients have been used. Cronbach's Alpha, when measuring differences, tests the reliability and internal consistency of the scale (Cronbach, 2004). Cronbach's Alpha internal consistency coefficient of the scale has been 0.72 and the item total correlations have been realized between 0.30 and 0.56. According to that, it can be stated that the measurements obtained as a result of pre-application are fairly reliable results (the scale of $0.60 \leq \propto < 0.80$ is fairly reliable) (Özdamar, 2002).

RESULTS AND DISCUSSION

Demographic profiles of respondents

Demographic information of respondents and enterprises are seen in Table 2. It is seen that 33.1% of respondents are product managers, 30.8% are data processing managers and 26.7% are research-development managers in enterprises. About 48.3% of enterprises have joined the search produce in metal products and machinery industry, 27.9% in food industry, 14% in plastic and petroleum industry and 9.9% in textile industry. About 45.9% of enterprises are small-scale, while 54.1% are medium-scale. Some 32% of these enterprises have been operating for 9 - 11 years, while 31.4% for 6 - 8 years. About 75.6% of enterprises which have joined the study manufacture products for domestic and foreign markets and 24.4% for only domestic market. The enterprise which produces only for the foreign market has not been seen during the study. The height of the production rate towards the export is parallel with the increase of Turkey's export in recent years.

According to the findings in Table 3, 47.1% of enterprises has trademark; 24.4%, copyright; 15.1%, patent; 9.9% industrial design and 3.5% of them have no copyrights. It can be stated that the rates of patents and industrial design that enterprises have (25%) is lower than in developed countries. It is seen that almost all business (97.1%) have ISO 9000:2001 certificate. It can be stated that this situation has an important effect for settlement of quality-oriented corporate culture. The enterprises, which have joined the study, state that 47.1% of their technologies are at the medium level, and 40.1% are of new technologies. When taking into account capital structures and activity period of SMEs, it can be expressed that the technology refresh rates are at the level of medium.

Table 2. The demographic findings related to research.

Variables		Frequency	Percentage
Titles	Factory director	4	2.3
	Product manager	57	33.1
	Research and development manager	46	26.7
	Data processing manager	53	30.8
	Marketing manager	12	7.0
Total		172	100.0
Field of activity	Textile	17	9.9
	Food	48	27.9
	Metal products and machinery industry	83	48.3
	Plastic and petroleum products	24	14.0
Total		172	100
Number of employees	10 - 49	79	45.9
	50 - 99	93	54.1
Total		172	100
Activity period	0 - 2 years	-	-
	3 - 5 years	29	16.9
	6 - 8 years	54	31.4
	9 - 11 years	55	32.0
	12 - + years	34	19.8
Total		172	100
Market field	Only domestic	42	24.4
	Only foreign	-	-
	Both of them (domestic + foreign)	130	75.6
Total		172	100

Table 3. The findings related to enterprises in which the study was done.

Variables		Frequency	Percentage
Copyrights	Patent	26	15.1
	Industrial design	17	9.9
	Trademark	81	47.1
	Copyright	42	24.4
	None	6	3.5
Total		172	100.0
ISO 9000 certificate	Available	167	97.1
	Unavailable	5	2.9
	Reference was made	-	-

Table 3. Cont'd.

Total		172	100
Nature of technology	Very old	-	-
	Old	18	10.5
	Medium	81	47.1
	New	69	40.1
	Very new	4	2.3
Total		172	100

Table 4. The usage levels belonging to the past three years and recently of AMTs in enterprises.

Advanced manufacturing technologies	Three years ago		Currently		Change	Wilcoxon test	
	Mean	S.D.	Mean	S.D		Z	p
Computer aided design (CAD)	1.70	0.91	2.81	0.81	1.11	-10.06	<0.001
Computer aided manufacturing (CAM))	1.69	0.86	2.76	0.82	1.07	-10.19	<0.001
Computer numeric control (CNC)	0.96	1.05	1.86	1.15	0.90	-10.24	<0.001
Computer integrated manufacturing (CIM)	1.40	0.65	2.38	0.65	0.98	-11.36	<0.001
Cellular manufacturing systems (CMS)	0.30	0.49	0.36	0.52	0.06	-2.40	<0.05
Group technology (GT)	1.10	0.74	1.60	1.02	0.50	-9.16	<0.001
Flexible manufacturing systems (FMS	1.81	0.68	2.59	0.60	0.78	-9.84	<0.001
Robots	0.28	0.48	0.48	0.62	0.20	-4.63	< 0.001

(i) n = 172, (ii) On the scale, 0 means "it is never used", 4 "it is used at a level that is too high".

The usage levels belonging to the past three years and recently in AMT used in enterprises that have participated in the study are seen in Table 4. On the scale, "0" means "it is never used" and 4 "it is used in a level that is too high".

As can be seen in Table 4, Flexible Manufacturing Systems ($\overline{X}$=1.81), Computer Aided Design ($\overline{X}$=1.70) and Computer Aided Manufacturing ($\overline{X}$=1.69) are the technologies which are most widely used by the enterprises using AMT three years ago. Robots ($\overline{X}$=0.28) and Cellular Manufacturing Systems ($\overline{X}$=0.30) are the least used technologies, and today, Computer Aided Design ($\overline{X}$=2.81), Computer Aided Manufacturing ($\overline{X}$=2.76) and Flexible Manufacturing Systems ($\overline{X}$=2.59) are the most widely used AMTs. It is seen that Cellular Manufacturing Systems ($\overline{X}$=0.36) and Robots ($\overline{X}$=0.48) are the least used AMTs in SMEs. In line with these results, it is seen that computer technology is used at a high rate, especially in product design stages in SMEs. It can be stated that using Computer Aided Design and Computer Aided Manufacturing at a significant rate is affected by installation costs of technologies, which are low. Additionally, it is seen that the usage of Computer Numeric Control technology at the medium level is affected by lower installation and operating costs. Also, the presence of labour, with which this technology will be used, is affected as well.

According to the results of Wilcoxon test, it is seen that the increase in the last three years in using AMTs in enterprises is statistically significant. Although, SMEs have limited resources in respect to finance, their use of AMTs at the level of medium can be stated. It is thought that the usage level belonging to robots, of which investment cost is high, is related to capital and the quality of products manufactured. When taking into account 75% of enterprises which have participated in the study's export, it can be stated that enterprises operating in the global competitive environment increase the usage of AMTs in increasing their quality and productivity, thereby reducing costs.

The enterprises were asked to answer a 9-item scale to determine the structure of their innovations. On the scale, "0" means "never made" and "4" "the most made". The findings relating to the innovations made by enterprises using AMTs are in Table 5.

When examining Table 5, it is seen that SMEs using AMTs have given importance to innovation activities. It can be stated that they form innovation activities in accordance with their technical and financial possibilities. It is seen that "making marketing innovation" ($\overline{X}$=2.91),

Table 5. The structure of innovations in enterprises using AMT.

Activities	$\overline{X}$	S.D.	S.E
Developing a new product	2.02	0.76	0.05
Making innovation in production processes	2.29	0.77	0.05
Making organizational innovation	2.72	0.76	0.05
Making marketing innovation	2.91	0.83	0.06
Developing of input supply and distribution channels	2.50	0.86	0.06
Developing and improving of existing products	2.49	0.76	0.05
Making service innovations	2.89	0.70	0.05
Making innovation in processes of logistics, delivery and distribution	2.25	0.86	0.06
Making innovations in processes related to support activities (care systems, purchasing, computing, accounting etc.)	2.66	0.78	0.05

(i) n=172; (ii) On the scale, 0 means "never made", 4 "the most made"; (iii) According to Friedman two-way Anova test, the results (K^2 = 177.101; $p < 0.001$) are statistically significant.

"making service innovation" ($\overline{X}$=2.89) and "making organizational innovation" ($\overline{X}$=2.72) are the most important innovations done in enterprises using AMTs. In general, it can be expressed that common characteristics of these innovations do not bring too much burden in financial terms to enterprises, and as a result, "developing a new product" ($\overline{X}$=2.02), "making innovation in production processes" ($\overline{X}$=2.29) and "making innovation in processes of logistics, delivery and distribution" ($\overline{X}$=2.25) are seen to be the least innovation activities. In these innovation activities, it is seen that there are species in need of more financial support. It is seen that as a priority, enterprises imply innovative strategies in accordance with developing and improving existing products instead of developing a new product. Bülbül (2007) states that a very smal portion of new products takes place in the new product class (in real terms of the world). Cost and risk of progressive product innovations are low, and it is the easiest way to offer new product to the market. It is seen that the innovations are accordingly done in enterprises that have participated in the study.

The findings relating to the change in accordance with the difference in the size of the enterprise's innovations, in enterprises using AMTs, are seen in Table 6. In innovation activities done in small (10 - 49) and medium scale (50 - 99) enterprises using AMTs, significant differences, according to the variable of enterprises' size, are not seen [t(170)= -1.574; p>0.05], [t(170)= 0.695; p>0.05], [t(170)= 1.194; p>0.05], [t(170)= -0.20; p>0.05], [t(170)= 0.180; p>0.05], [t(170)= 1.592; p>0.05], [t(170)= -1.57; p>0.05], [t(170)= -0.651; p>.05], [t(170)= 0.702; p>0.05]. It is understood from these evaluations that small and medium scale enterprises have made innovation activities at rates in which they are close to each other. In this case, it can be said too, that the business strategies are similar. According to this, it can be stated that the difference in the number of employees in small and medium scale enterprises is not a variable which will create a difference in innovative strategies.

The findings relating to change according to differences in the market to be addressed by innovations in enterprises using AMTs are seen in Table 7. According to this, when examining the assessments of enterprises addressing only domestic market or both domestic and foreign markets; it can be said that significant differences exist in activities of "developing a new product" [U=2276, p<0.05] and "making marketing innovation" [U=2116, p<0.05]. Subsequently, significant differences have not been found in other verdicts [U=2656, p>0.05], [U=2674, p>0.05], [U=2465, p>0.05], [U=2588, p>0.05], [U=2557, p>0.05], [U=2467, p>0.05], [U=2696, p>0.05]. The significant differences that come out shows that innovation activities directed to developing a new product are applied more in enterprises producing for domestic and foreign markets. When taking into consideration the competition in the international market, a necessity of activities directed to new products gain more importance. Moreover, significant differences come out in activities that are directed towards making marketing innovation, which occurred in favour of enterprises producing for only domestic markets. It can be stated that these enterprises have been more focused on innovation activities towards the domestic market.

The findings relating to the differences in operating periods of enterprises, in views of innovations in enterprises using AMTs are seen in Table 8. When examining the findings; the activities of "developing a new product" [F(3,168)=3.010; p<.05], "making innovation in production processes" [F(3,168)=2.896; p<0.05], "making organizational innovation" [F(3,168)=2.147; p<0.05], "developing of input supply and distribution channels" [F(3,168)=2.048; p<.05] and "developing and improving of existing products" [F(3,168)=3177; p<0.05] have come out significantly according to operating periods at the level of 0.05. However, in activities of "making marketing innovation" [F(3,168)= 1.422; p>0.05]; "making

Table 6. T-test results according to the size of the enterprise's innovations done in companies using AMTs.

Activities	Number of employees	N	$\overline{X}$	S	t	p
Developing a new product	10 - 49	79	1.92	0.85	-1.57	0.125
	50 - 99	93	2.10	0.66		
Making innovation in production processes	10 - 49	79	2.34	0.86	0.695	0.488
	50 - 99	93	2.25	0.69		
Making organizational innovation	10 - 49	79	2.79	0.82	1.194	0.234
	50 - 99	93	2.65	0.71		
Making marketing innovation	10 - 49	79	2.91	0.89	-0.20	0.984
	50 - 99	93	2.91	0.78		
Developing of input supply and distribution channels	10 - 49	79	2.51	0.95	0.180	0.857
	50 - 99	93	2.49	0.78		
Developing and improving of existing products	10 - 49	79	2.59	0.85	1.592	0.120
	50 - 99	93	2.40	0.67		
Making service innovations	10 - 49	79	2.88	0.76	-1.57	0.875
	50 - 99	93	2.90	0.64		
Making innovation in processes of logistics, delivery and distribution	10 - 49	79	2.20	0.95	-0.65	0.516
	50 - 99	93	2.29	0.78		
Making innovations in processes related to support activities (care systems, purchasing, computing, accounting etc.)	10 - 49	79	2.70	0.84	0.702	0.484
	50 - 99	93	2.62	0.72		

*The mean difference is significant at the 0.05 level.

service innovation" [F(3,168)=0.384; p>0.05], "making innovation in processes of logistics, delivery and distribution" [F(3,168)=0.876; p>0.05] and "making innovations in the processes related to support activities" [F(3,168)=1.129; p>0.05] have not been found to be significantly different according to the variable of operating periods. In accordance with the result of LSD test which was done to determine which group has the significant difference, it is seen that in activities directed to "developing a new product", enterprises operating for 12 years or more, innovate more than the ones in the range of ($\overline{X}$=2.35), 3 - 5 years ($\overline{X}$=1.82), 6 - 8 years ($\overline{X}$=1.98) and 9 - 11 years ($\overline{X}$=1.96). In also making innovation in production processes, the enterprises operating for 12 years or more innovate than the ones in the range of ($\overline{X}$=2.61), 6 - 8 years ($\overline{X}$=2.20) and 9 - 11 years ($\overline{X}$=2.16). Moreover, in making organizational innovation, the enterprises operating in the range of 6 - 8 years and 9 - 11 years give more importance to innovation activities than the ones operating for 12 years ($\overline{X}$ = 2.83, $\overline{X}$ = 2.80) and over 12 years ($\overline{X}$ = 2.44). In making innovation in activities of existing products, enterprises operating in the range of 9 - 11 years and 12 years and over ($\overline{X}$=2.69, $\overline{X}$=2.58) focus more on that activity than the ones in the range of 3 - 5 years ($\overline{X}$=2.20). In order to determine the innovation causes of enterprises using AMT that have joined the study, they were asked to respond to the 9-item scale. On the scale, 0 means "not important at all" and 4 "much more important". Information on the innovation causes of enterprises using AMTs are in Table 9.

When examining Table 9, it is seen that the most important factor that encourages enterprises to innovate is "changing customer demands and requirements" ($\overline{X}$ = 3.65). After that, "due to competing enterprises" ($\overline{X}$ = 3.58) and "decline in demand for older products in the markets" ($\overline{X}$ = 3.23) are the most important ones of all the causes that encourages enterprises to innovate. It is evaluated that "obtaining image and prestige" ($\overline{X}$ = 2.96) and "the change in the structure or the price of inputs" ($\overline{X}$ = 3.14) are less effective causes in innovating when compared with other factors. When evaluating in general,

Table 7. Mann Whitney U Test directed to differences in market innovations of enterprises using AMT.

Activities	Market field	N	Mean rank	Sum of ranks	Z	Mann-Whitney U	p
Developing a new product	Domestic	42	75.69	3179.0	-1.760	2276	**0.048***
	Domestic + Foreign	130	89.99	11699.0			
Making innovation in production processes	Domestic	42	84.74	3559.0	-0.284	2656	0.777
	Domestic + Foreign	130	87.07	11319.0			
Making organizational innovation	Domestic	42	87.82	3688.5	-0.217	2674	0.828
	Domestic + Foreign	130	86.07	11189.5			
Making marketing innovation	Domestic	42	101.12	4247.0	-2.345	2116	**0.019***
	Domestic + Foreign	130	81.78	10631.0			
Developing of input supply and distribution channels	Domestic	42	80.20	3368.50	-1.007	2465	0.314
	Domestic + Foreign	130	88.53	11509.50			
Developing and improving of existing products	Domestic	42	83.13	3491.5	-0.546	2588	0.585
	Domestic + Foreign	130	87.59	11386.5			
Making service innovations	Domestic	42	90.62	3806.0	-0.680	2557	0.496
	Domestic + Foreign	130	85.17	11072.0			
Making innovation in processes of logistics, delivery and distribution	Domestic	42	92.75	3895.5	-0.996	2467	0.319
	Domestic + Foreign	130	84.48	10982.5			
Making innovations in processes related to support activities (care systems, purchasing, computing, accounting etc.)	Domestic	42	85.70	3599.5	-0.125	2696	0.893
	Domestic + Foreign	130	86.76	11278.5			

*The mean difference is significant at the 0.05 level.

the data in Table 9, it is seen that all the factors have an important effect to innovate for enterprises. However, there are differences in importance of rankings. Changing customer expectations, that lead the innovation causes in SMEs using AMTs, becomes much more important on today's ruthless competition. When taking into consideration that almost all enterprises (97.1%) have ISO 9000 certificate, it can be expressed that innovation activities which are institutionally oriented to customer satisfaction are aimed. Enterprises also make innovation activities in order to use their resources efficiently and develop production capabilities. It can be stated that significant advantages can be obtained in competitiveness through increasing quality, and as well as reducing costs by increasing operational efficiency.

The findings, according to the difference of innovation causes in enterprise size, that are related to the changes on enterprises using AMTs are seen in Table 10. When examining the findings between "small" and "medium" scale enterprises, the causes of significant differences at the importance level are "due to competing enterprises" [t(170)= 2.009; p<.05], "due to the development of current technology" [t(170)= 2.203; p<0.05], "due to the decline in demand of older products in the markets" [t(170)= 2.641; p<0.05], "in order to enter new markets" [t(170)= 1.938; p<0.05], "in order to use existing resources efficiently" [t(170)= 2.410; p<0.05] and "in order to obtain image and prestige" [t(170)= 2.157; p<0.05]. Moreover, no significant differences have come out from the causes of "due to changing customer demands and requirements" [t(170)= 1.494; p>0.05], "due to the change in the structure or the price of inputs" [t(170)=0.517; p>0.05] and "in order to develop production capabilities" [t(170) =0.919; p>0.05]. However, the significant differences that came out occurred in favour of small-size enterprises. In assessments that are related to the important causes of making innovations, the small scale enterprises have a higher means than the medium size ones. It can be stated that the scale difference is a variable which will create a significant difference in assessments, relating to innovation causes in enterprises.

Table 8. ANOVA results relating to differences in operating periods of enterprises, in views on innovations of enterprises using AMT.

Activities	Variance source	*KT*	*SD*	*KO*	*F*	*LSD p < 0.05*
Developing a new product	Between groups	5.096	3	1.699	3.010	4-1, 4-2,
	Within groups	94.811	168	0.564		4 - 3
	Total	99.907	171			
Making innovation in production processes	Between groups	5.010	3	1.670	2.896	4 - 2,
	Within groups	96.868	168	0.577		4 - 3
	Total	101.878	171			
Making organizational innovation	Between groups	3.715	3	1.238	2.147	2 - 4,
	Within groups	96.889	168	0.577		3 - 4
	Total	100.605	171			
Making marketing innovation	Between groups	2.963	3	0.988	1.422	
	Within groups	116.729	168	0.695		
	Total	119.692	171			
Developing of input supply and distribution channels	Between groups	4.551	3	1.517	2.048	3 - 2
	Within groups	124.444	168	0.741		
	Total	128.994	171			
Developing and improving of existing products	Between groups	5.421	3	1.807	3.177	3 - 1,
	Within groups	95.573	168	0.569		4 - 1,
	Total	100.994	171			3 - 2
Making service innovations	Between groups	.573	3	0.191	0.384	
	Within groups	83.543	168	0.497		
	Total	84.116	171			
Making innovation in processes of logistics, delivery and distribution	Between groups	1.975	3	0.658	0.876	
	Within groups	126.275	168	0.752		
	Total	128.250	171			
Making innovations in processes related to support activities (care systems, purchasing, computing, accounting etc.)	Between groups	2.065	3	0.688	1.129	
	Within groups	102.377	168	0.609		
	Total	104.442	171			

*The mean difference is significant at the 0.05 level.
(1) 3 - 5 years, (2) 6 - 8 years, (3)9 - 11 years, (4) 12 - + years

The findings relating to change according to the difference in the market being addressed by innovation causes in enterprises using AMTs are seen in Table 11. According to this, there is no significant difference in the causes of “due to competing enterprises” [U=2098, p<0.05], “decline in demand of older products in the markets” [U=2260, p<0.05], “in order to enter new markets” [U=2297, p<0.05] and “in order to obtain image and prestige” [U=1873, p<0.05].

Moreover, no significant differences have come out from other items [U=2656, p>0.05], [U=2674, p>0.05], [U=2645, p>0.05], [U=2701, p>0.05], [U=2553, p>0.05], [U=2624, p>0.05], [U=2677, p>0.05]. However, the significant differences that came out occurred in favour of enterprises producing for only domestic market. It can be expressed that these enterprises focus on increasing their competitiveness by making more innovation when compared with their domestic competitors. It is predicted that they develop such a strategy in order to enter into the foreign markets by developing themselves.

In Table 12, the findings relating to the difference in operating periods of enterprises, in views on innovation causes of enterprises using AMTs are seen. When examining the findings, the causes of “developing current

Table 9. Innovation causes of enterprises using AMT.

Innovation causes	$\overline{X}$	S.D.	S.E
Due to competing enterprises	3.58	0.59	0.05
Due to changing customer demands and requirements	3.65	0.52	0.05
Due to the development of current technology	3.19	0.61	0.04
Due to the change in the structure or the price of inputs	3.14	0.73	0.05
Due to the decline in demand of older products in the markets	3.23	0.75	0.05
In order to enter new markets	3.17	0.65	0.04
In order to use existing resources efficiently	3.28	0.67	0.05
In order to obtain image and prestige	2.96	0.77	0.05
In order to develop production capabilities (quality, cost, time, flexibility and service)	3.41	0.57	0.04

(i) n = 172; (ii) Ölçek 0 means “Not important at all, 4 “Much more important”; (iii) According to Friedman two-way Anova test, the results (K^2 = 207.889; $p < 0.001$) are statistically significant.

Table 10. T-test results according to differences in enterprises’ size on innovation causes of enterprises using AMT.

Innovation causes	Number of employees	N	$\overline{X}$	S	t	p
Due to competing enterprises	10 - 49	79	3.68	0.54	2.009	0.046*
	50 - 99	93	3.50	0.61		
Due to changing customer demands and requirements	10 - 49	79	3.72	0.52	1.494	0.137
	50 - 99	93	3.60	0.51		
Due to the development of current technology	10 - 49	79	3.30	0.64	2.203	0.029*
	50 - 99	93	3.09	0.57		
Due to the change in the structure or the price of inputs	10 - 49	79	3.17	0.81	0.517	0.606
	50 - 99	93	3.11	0.65		
Due to the decline in demand of older products in markets	10 - 49	79	3.39	0.68	2.641	0.009*
	50 - 99	93	3.09	0.78		
In order to enter new markets	10 - 49	79	3.27	0.65	1.938	0.050*
	50 - 99	93	3.08	0.63		
In order to use existing resources efficiently	10 - 49	79	3.41	0.69	2.410	0.017*
	50 - 99	93	3.17	0.63		
In order to obtain image and prestige	10 - 49	79	3.10	0.76	2.157	0.032*
	50 - 99	93	2.84	.76		
In order to develop production capabilities (quality, cost, time, flexibility and service)	10 - 49	79	3.45	0.52	0.919	0.359
	50 - 99	93	3.37	0.60		

*The mean difference is significant at the 0.05 level.

technology” [F(3,168)=1.331; p<0.05], “decline in demand of older products in the markets” [F(3,168)=3.453; p<0.05] and “obtaining image and prestige” [F(3,168)=2.304; p<0.05] have come out significantly at the level of 0.05 in accordance with operating periods. However, in other causes, significant difference has not been found according to the variable of operating periods [F(3,168)=1.567; p > 0.05], [F(3,168)=1.049; p> 0.05],

Table 11. Mann Whitney U Test directed to the difference in the market, on innovation causes of enterprises using AMT.

Innovation causes	Market field	*N*	Mean rank	Sum of ranks	Z	Mann-Whitney U	P
Due to competing enterprises	Domestic	42	101.55	4265.0	-2.672	2098	0.008*
	Domestic + Foreign	130	81.64	10613.0			
Due to changing customer demands and requirements	Domestic	42	82.12	3449.0	-0.806	2546	0.420
	Domestic + Foreign	130	87.92	11429.0			
Due to the development of current technology	Domestic	42	87.18	3661.5	-0.117	2701	0.907
	Domestic + Foreign	130	86.28	11216.5			
Due to the change in the structure or the price of inputs	Domestic	42	82.30	3456.5	-0.705	2553	0.481
	Domestic + Foreign	130	87.86	11421.5			
Due to the decline in demand of older products in markets	Domestic	42	97.68	4102.5	-1.855	2260	0.044*
	Domestic + Foreign	130	82.89	10775.50			
In order to enter new markets	Domestic	42	96.81	4066.0	-1.753	2297	0.040*
	Domestic + Foreign	130	83.17	10812.0			
In order to use existing resources efficiently	Domestic	42	83.98	3527.0	-0.423	2624	0.672
	Domestic + Foreign	130	87.32	11351.0			
In order to obtain image and prestige	Domestic	42	106.89	4489.5	-3.343	1873	0.001*
	Domestic + Foreign	130	79.91	10388.5			
In order to develop production capabilities (quality, cost, time, flexibility and service)	Domestic	42	85.24	3580.0	-0.214	2677	0.830
	Domestic + Foreign	130	86.91	11298.0			

*The mean difference is significant at the 0.05 level.

[F(3,168)=0.789; p>0.05], [F(3,168)=0.596; p>0.05], [F(3,168)=1.214; p>0.05], [F(3,168)=0.195; p>0.05].

In reference to LSD test results, enterprises operating in the range of 6 - 8 years ($\overline{X}$=3.29) give more importance to the factor of "developing current technology" than the ones in the range of 12 years and over ($\overline{X}$=3.02). The enterprises operating in the range of 6 - 8 and 9 - 11 years ($\overline{X}$=3.29, $\overline{X}$=3.38) give more importance to the reason of "decline in demand of older products in the markets" than the ones operating for 12 years and over ($\overline{X}$=2.88). The factor of "obtaining image and prestige", which is the one of innovation causes, is more preferred by enterprises operating in the range of 6 - 8 and 9 - 11 years ($\overline{X}$=3.11, $\overline{X}$=3.03) when compared with the ones in the range of 12 years and over ($\overline{X}$=2.70). Considering the findings in Table 12 as a whole, much difference is not seen in the assessments that are related to innovation causes according to operating periods of enterprises. It can be stated that the means of assessments, relating to innovation causes in only enterprises operating for 12 years and over, are slightly lower than the ones in other periods.

Conclusions

About 75% of the enterprises that have joined in the study are the enterprises that export and compete in international markets. It can be stated that this situation has made the usage of AMTs inevitable. It is seen that AMTs usage rates in enterprises have significantly increased when compared to the past three years. In their studies, Ömürbek and Yılmaz (2009) state that there is a significant increase in the usage of AMTs compared to its usage in the past three years. Due to the fact that the enterprises that have joined in the research are SMEs, even if they encounter difficulties relating to finance of AMTs used, they use AMTs at the medium level. It is seen that the use of robot technology that can be installed with high costs has occurred at the minimum level. The use of CAD, CAM and CNC at the significant levels in enterprises shows that the adaptation of enterprises to computer technology has made significant progress. In the study done by Pınar (2008), he states that the usage of AMT leads to a significant increase in production flexibility, quality and production. In their research result, Altuğ and Nalbant (2008) have added

Table 12. ANOVA results relating to the difference in operating periods of enterprises, in views on innovation causes of enterprises using AMT.

Innovation causes	Variance source	KT	SD	KO	F	LSD P < 0.05
Due to competing enterprises	Between groups	1.625	3	0.542	1.567	
	Within groups	58.067	168	0.346		
	Total	59.692	171			
Due to changing customer demands and requirements	Between groups	0.860	3	0.287	1.049	
	Within groups	45.901	168	0.273		
	Total	46.762	171			
Due to the development of current technology	Between groups	1.501	3	0.500	1.331	2 - 4
	Within groups	63.168	168	0.376		
	Total	64.669	171			
Due to the change in the structure or the price of inputs	Between groups	1.269	3	0.423	0.789	
	Within groups	90.097	168	0.536		
	Total	91.366	171			
Due to the decline in demand of older products in markets	Between groups	5.617	3	1.872	3.453	2 - 4, 3 - 4
	Within groups	91.081	168	0.542		
	Total	96.698	171			
In order to enter new markets	Between groups	0.766	3	0.255	0.596	
	Within groups	72.001	168	0.429		
	Total	72.767	171			
In order to use existing resources efficiently	Between groups	1.635	3	0.545	1.214	
	Within groups	75.406	168	0.449		
	Total	77.041	171			
In order to obtain image and prestige	Between groups	4.023	3	1.341	2.304	2 - 4, 3 - 4
	Within groups	97.768	168	0.582		
	Total	101.791	171			
In order to develop production capabilities (quality, cost, time, flexibility and service)	Between groups	0.193	3	0.064	0.195	
	Within groups	55.499	168	0.330		
	Total	55.692	171			

*The mean difference is significant at the 0.05 level. (1) 3 - 5 years, (2) 6 - 8 years, (3) 9 - 11 years and (4) 12 - + years.

that productivity increases, while costs decrease to these advancements. Spanos and Voudouris (2009) have concluded that there was an increase in production flexibility and quality, and a decrease in production costs in the study done in 87 SMEs using AMTs in Greece.

It is seen that the enterprises using AMTs are more focused on marketing, service and organizational innovations. It is thought that the costs of these innovation types for enterprises were at the lower level compared to the others. This could be a preferred reason why the cost of developing a new product for enterprises is high; and in addition to this, due to the fact that the risk ratio is high, it is seen that enterprises make more innovations towards the development and improvement of existing products. These findings are parallel with the research results done by Bülbül (2007) in the food sector in Turkey. For the fact that the enterprises in which the research was done are mostly the enterprises that are contract manufacturers can lead to determination of these strategies. However, this situation is an obstacle to create its own brands for enterprises. Making radical innovations becomes important for an enterprise that is growing in sector and increasing in competitive power. In the results of the research done on enterprises in Turkey, by Uzun (2001),

he stated that 50% of total sales in manufacturing sector were obtained with new products and new technology.

According to variable of employee number, significant difference has not been seen in innovation activities done in small and medium scale enterprises. It can be stated that small and medium scale enterprises using AMTs have applied strategies which are close to each other in innovation activities done. According to the variable of market areas of innovation activities done on the enterprises which have joined the research, significant differences have come out in developing a new product and making marketing innovation. It is seen that the enterprises, producing towards both markets, have been given important innovation activities which were focused on developing a new product. It is seen that the enterprises operating for 12 years and over have focused more on innovations of developing a new product and production process than the others. It can be stated that these enterprises which have more knowledge, experience and technological knowledge have focused on developing a new product. It can be defined that there is a significant relationship between the increasing activities towards developing a new product with the increasing operating periods. However, it is seen that works towards the renewal and development of the old production process are done. It can be stated that the enterprises operating for 9 years and over perform more activities towards developing and improving their products than the ones in which their existing products are new and operating periods are short (2 - 5 years). An increase is seen in activities that are directed towards developing and improving existing products to be parallel with the increasing operating periods.

Changing customer demands and requirements lead the innovation causes of enterprises. It can be stated that an innovation strategy focused on activities of competing enterprises has been applied. In addition to this, an ability to adapt to changes in markets and reduce business costs by increasing operational efficiency, are the causes of innovation activities. In the research done by Bülbül (2007), it is stated that the most important factor of the innovation reasons is to enter into new markets. In the research on SMEs done by Şahin (2009), it is emphasized that the enterprises make innovation activities in order to reduce material consumption, decrease labour costs and provide energy savings. In evaluations relating to innovation causes of SMEs using AMT, it is seen that the small scale enterprises have higher participation rate in factors. In reference to this, it can be expressed that the small scale enterprises are more willing to innovate. It can be stated that the scale difference is a variable which will create a significant difference in assessments relating to innovation causes in enterprises. It is seen that the enterprises producing for only domestic market have a higher rate of participation in innovation causes than the ones accessing domestic and foreign markets. It is thought that these enterprises can target an entrance into the foreign market through self-development. In general, there is not much difference in evaluations of innovation causes according to operating periods in enterprises using AMT. However, it can be expressed that enterprises operating for 12 years and over have the lower rates of innovation causes than the ones in other ranges.

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