New Technologies and Changes in Work Organization: A Survey

Ulaş Arslan
Department of Electrical and Electronics Engineering
Bilkent University
06800 Bilkent Ankara
TURKEY
uarslan@ug.bilkent.edu.tr

Erkan Erdil
STP Research Center
Middle East Technical University
06531 Ankara
TURKEY
erdil@metu.edu.tr

STPS – WP – 0303

ABSTRACT

Recently, relative demand for multi-skilled labor has increased sharply. Information and education became the most important factor when determining the role of labor at work. Especially, the intense rise of microelectronic technologies changed the structure of production after 1970s. By the effect of changing structure of production and growing competition brought a new organization of work. The main aim of this study is summarize the literature on the transformation of production systems and the impact of flexible production systems and automation technologies on employment and labor. This paper also analyzes the impact of new technologies on composition of employment, unemployment and labor organizations. Technological changes will not be considered as an external force, the human aspect of technology in work organization will also be analyzed. Besides the theoretical expansion of new technologies in production process, the changes in the role of state and economic policies will be discussed.

Keywords : New technologies, Work organization, Fordism, Post-fordism, Flexible production systems

JEL codes : 033 , M54

1. INTRODUCTION

At the end of 1960s, capitalist economy came face to face with a crisis starting with a decrease in the rate of profit and efficiency. This crisis which is also called as the crisis of Fordism led to the world wide collapse of the mode of accumulation and regulation which were its characteristics. The reasons of this crisis were the unemployment, growing inflation and decreasing economic growth. Actually, this was the crisis of industrial relations and work organization of capitalism. The crisis of Fordism was therefore also a structural crisis of capitalist economy. In order to overcome this crisis, from Fordist phase to a new phase was inevitable. In this new phase, the technological paradigm was taken into consideration, and as a result, some modifications in production systems, work organization and technology were started to be applied.

This new phase was called as post-Fordist period, and flexible automation technologies were widely used. The microelectronic based information and communication technologies also accompanied with these technologies. As a result of wide spread use of high technologies after 1970s, technology has always been a central variable in work organization. These technologies adapted to the production process in order to fit to changing market conditions, and in this manner, flexibility became the core element of work organization.

Besides all of these changes occurred in the structure of production, Keynesian welfare state whose expansion was strongly shaped by the development of the Fordist mode of the growth removed. Since the welfare policies pursued by the state up to 1970s abandoned; naturally, the role of unions and state policies with respect to industrial relations changed.

Thus, in brief, new technologies affected all relations in the society and economy, and they created a new work organization and systems of production relations. Therefore, new technologies led to significant changes in most areas such as labor, work organization, employment composition and unions.

In this paper, we will try to reexamine the nature and role of technology in work organization. The purpose of this study is to present the literature on the analysis of the transformation of production systems and the impact of flexible production systems and flexible automation technologies on labor and employment in detail.

2. INFORMATION SOCIETY AND LABOR

In the famous 11.thesis of Marx and Engels' Feurbach Critics, it is said that " Philosophers were satisfied with only defining the world in different ways, but the important one is to change it"(Marx, 1976:27). There have been made lots of definitions to express change; "information economics"(Machlup), "post-capitalism"(Dahrendorf), "disorganised capitalism"(Lash and Urry, 1987), "information society"(Giddens), "third wave society"(Toffler, 1991). The first group of definitions represents two sided world system, whereas the second part represents changes that require technological and economical facts in the capitalist structure. There are two different concepts; (a) chaotic political atmosphere, (b) a new chaos that is seen in the economical relations as a result of technological developments (Belek, 1997:9-11).

Although, chaotic political atmosphere still exists and focused on the fights for economic profits in the Middle East, a new paradigm exists that implies society is based on information workers. This removes the social dimension of old paradigm. The information is the base force and it diminishes the effect of labor and capital. A new labor and information intensive world started to be restructured by the effect of this new information paradigm.

Drucker notes that " information became the only source rather than becoming one of the source, and this made our society post-capitalist"(1993:69). In this post-capitalist society represented by Drucker, information society includes individuals who have equal profits and they are defined by their flexibility and activity (1994:95-97). Capital and labor became less important and post-capitalist society was described as information society. However, there was no discussion about whether the information is a kind of labor or not. On the other hand, people with this qualification were treated as staff.

In his "Third Wave", Toffler examined the history in three parts. The first wave is characterized by agriculture between 8000 BC and 1650-1750. The second wave, which lasted up to Second World War, is industrialization stage. The third wave was raised after 1960s (1981:32). The main industry of the third wave is electronics and computers. In this period, technology is controlled by the society instead of determining the aims. The information is not a part of capital and labor anymore, but it became the core of them.

In this new system, everything was modulated; from domestic production to customer special production, new firm structures, production process and new products. Lash and Urry characterize this as passing to disorganized period. The most important element of disorganized capitalism comes from the fact that the weight of productive labor based on

information is increased in the economy (1987:2-6). In this disorganized period, the productive labor based on information is accompanied by technological developments, and according to Piorre and Sabel, technological developments will also solve each problem in this production process (1984:32).

In all of these approaches in which change is highlighted, there occurs some political and ideological results in addition to technological developments. The most important of them is that capitalism causes a new social formation in the obligation of technological changes. In this new social formation, class struggle is not as sharp as in the past, and class-consciousness is tried to be diminished by new state policies and adaptations to the structure of new production systems.

In all views mentioned above, change is focused on some points like production instruments, labor, production structure, social formation, the control mechanism of capitalism over labor, and the structure of economic sector. Since the technology is based on the change determined by necessities, there is an exact relationship between technological developments and the changes in production systems. Therefore, it is necessary to explain technological developments in conjunction with the changes in production systems.

2.1 Technological Development and Change in Production

The change in production systems is a result of technological change. According to Marx, production instruments are the composition of the things, that are used by workers, and labor in production process (Marx, 1978:195). Then, the labor is affected by technological changes directly. Dickson sees the technology as the machines and all tools used by society and the relations stem from these machines (Dickson, 1992:36). Therefore, "technological change can be defined as the process by which economies change over time with regards to products they produce and the process used to produce them" (Stoneman, 1983:our emphasis)

According to Halal, technology is divided into two groups in its historical developments:

1) Low level technology which describes agricultural and physical machines

2) High level technology which intends to improve the function of social systems and to serve people (Halal, 1986:54)

Low level technologies consist of machine and machine systems. Since a machine is an arranged combination of resistant bodies, it can be compelled to do work accompanied by certain determinate motions. Marx states that therefore the machine is a mechanism that

makes the same operation which was done by a workman before with similar tools. In this respect, it does not make any difference that the source of the motive power comes from the workman or from another machine (Marx, 1975:353-54).

Braverman (1974) claims that the most important improvement in the evolution of machine is related to the environment in which its operation is controlled, not to its bigness, complexity and operation rate. The second stage in mechanization is provided by adding a mechanism from outside to machine so as to control itself. In order to reduce the need for human intervention by putting the actuation of the machine under remote control, many machines may be set in motion and away from single human control. However, such refinements did not change the internally fixed character of the machine cycle (Bright, 1966:201-220). Such mechanization occurred in industrialization period advanced to a new level accompanied with developments in computers and information systems. As a result, there have been lots of changes in the relation between labor and production tools.

After application of new technologies in production systems, the role of labor and structure of work changed sharply. Although at first the role of technology was minor, its effects increased gradually. Therefore, in order to understand the structure of work organization formed by technological developments, the phases of the labor organization after industrial revolution should be examined. These three phases are Taylorism, Fordism and post-Fordism.

2.2 Scientific Period in the Labor Organization: Taylorism

The classical economists were the first who approached to the problems of labor organization within capitalist relations of production theoretically. Therefore, they can be seen as the first management experts, and some people like Andrew Ure and Charles Babbage continued such works in the latter part of the Industrial Revolution. The next step which can be described as the comprehensive formulation of management theory occurred at the late nineteenth and twentieth centuries. Between these two steps, there was a big gap which there was a huge growth in the systematic and purposive application of science and technology to production and labor, the beginnings of the monopolistic organization of industry, and the size of enterprises that lasted more than half a century. Frederick Winslow Taylor initiated a new movement called scientific management in the last decades of the nineteenth century. This movement appeared as a result of new developments of management methods and the organization of labor, not the development of technology. The role of technology was minor.

Scientific management was an attempt to profit by the methods of technology to growing complex problems of labor control in capitalist enterprises. (Braverman, 1974:85-86)

Taylor examined the adaptation of labor to the needs of capital. His aim was the control of labor with using fundamentals of labor process. (Braverman, 1974:86-87) Taylorism, which insists on the control of management over labor process, mainly based on three principles: firstly, the classification of the objectives of the whole firm; secondly, consistency of the subgoals of each part with the goals of the whole; and finally, unification and rationalism of the work of each part (Drucker, 1954:280).

All things mentioned above were the result of technological evolution and in fact had just one aim which is to make a good adaptation for the adjustments in the market forces. However, there appeared some problems that come from the result of specializing and mechanizing that put the limits of the abilities and rights of control managers in decision making what is the most suitable to be done. The control from the top was restricted, since trained and skilled workers at each part directed operations (Waring, 1991:7-12). Although, some of his techniques like skill and control transfer from workers to managers and time and motion study were not applied practically up to late 1920s, Taylor popularized the time study of control over the labor. By time study it was aimed to measure the time elapsed for each operation in the work process. Taylor sees the work as an instrument in the production process; in other words, it made a reduction in the function of workers by giving a task making the machines' routine procedures. Workers treated themselves as a part of machines. In this Taylorist work organization, by controlling of each worker according to predetermined work time, it is aimed to reduce the waste of energy and labor which could be occurred by coincidence. For the next step, a new principle called as "investigation and classification of base emotions of the body" was added to "time study the concept of motion study" by the Taylor's followers (Braverman, 1974:170-178). As a result, in the first step of this modern mechanization, it was objected to control of labor in a high degree, and these became the messenger of new labor and work organizations which would be called as Fordism in future.

2.3 Fordism

Fordism which is also called as mass production based on moving assembly-line techniques, firstly applied in the beginnings of 1900s by Henry Ford in his own automobile factory. It is a kind of production system which is made on a moving continuously assembly-line by using special machines and dominantly non-skilled labor. Like Taylorism, Fordism

was also a form of work organization that results to the further integration of production. Taylor put the bureaucratization into consideration so as to solve the problems of reintegration and coordination because of the complex division of labor. Ford proposed an innovation which based on technical solutions that constructed a rationalization pattern for mass production industries. The institution of a flow line in order to gate high rates of benefits of fixed capital was the most important principle of both Taylorism and Fordism (Amin, 1994:177).

Fordist production system was raised during the 1929 crisis and post war conditions, and the main features of Fordist production were shaped by the economical, social and political conditions of this period. In Fordist production system, Taylor's Scientific Management principles were used. By using these principles, the organization of machines and labor at work was realized. In this respect, new organization of labor and labor instruments was the main purpose of Fordism. In other words, Ford rationalized the old technologies and the division of labor, and obtained high gain in the productivity by stationary workers. Since the mass production brings a standardization in production, it is seen that production on assembly-line can be applied after getting a standardization (Bilgin, 2000:5-7).

The essential in this system based on the standardization of products and production systems, mass production of these products, production on assembly-line and using of one aimed machine and non-skilled labor. Jessop, B.(1991:136-137) examines the dynamics of Fordism at four levels:

> Fordism can be analyzed on four levels. As a distinctive type of labor process, it involves mass production based on moving assembly-line techniques operated with the semi-skilled labor of the mass worker. Not all branches nor workers will be directly involved in mass production in a Fordist economy, of course: the important point is that mass production is the main source of its dynamism. As a stable mode of macroeconomic growth, Fordism involves a virtuous circle of growth based on mass production, rising productivity based on economies of scale, rising incomes linked to productivity, increased mass demand due to rising wages, increased profits based on full utilization of capacity, and increased investment in improved mass production equipment and techniques. As a mode of social and economic regulation, Fordism involves a separation of ownership and control in large corporations with a distinctive multi-divisional decentralized organization subject to central controls; monopoly pricing; union recognition and collective bargaining; wages indexed to

> productivity growth and retail price inflation; and monetary emission and credit policies orientated to securing effective aggregate demand.

Fordism has two uniqueness as regards labor organization:

1-) Decomposition of purposes: separation of skilled purposes from non-skilled ones definitely. By this way, the labor class is divided into two parts: less number of skilled workers and many number of non-skilled.

2-) Bringing labor force in an organic structure, it means creation of a collective labor. This makes the productivity of each person depended to others. This point is the main difference between Fordism and Taylorism. Although Taylorism simplifies and makes unqualified the purposes, it leaves the purpose to individual worker. However, Fordism puts together worker with the machine, and by this way, it realizes "collective labor" which was stated by Marx before, in the Capital (Belek, 1997:50-51).

Increase in productivity and time saving popularized Fordism during 1950s and 1960s and Fordism gained a wide application area (Alcorta, 1998:24). Standardization element was applied especially in the banking and finance sectors. It was quite difficult to change the product type in Fordism, since production was designed for standard products. Thus, there was no flexibility in the Fordist work organization. It was necessary to create institutional forms which guarantee the consumption of products produced in huge quantities by wide range of people for the continuity of Fordism. It was very important to have a society that has enough revenue and free time for the big firms, and Keynesian state was assigned this duty (The expansion of the Keynesian welfare state which was shaped by the development of the Fordist mode of growth, was the result). Government with Keynesian policies developed fine tuning policies which take the conjectural movements in economy during post war under control, and provide flexible capital policies. To increase the level of consumption, infrastructure, such as transportation, communication, education, health services and the other public services were given great importance. All of these were for consumption of products produced by mass production. Policies which were constructed by demand in international markets were added. By this way, developed countries could export their extra products to developing and underdeveloped countries (Bilgin, 2000: 8).

As it is seen, Fordism gave an ideological and social dimension to Taylorism (Belek, 1997:51). Modernism having an ideology exposed a new social life and organizational style, and yielded to a new political regime (Ongen, 1996).

The importance of this period as regards labor can be summarized as follows: specialization at work, alienation of labor to production process, decrease in labor productivity due to quality of work and its strict control in production process.

Although Fordism gained a wide application area, some reasons led to the crisis of Fordism.

2.3.1 The Crisis of Fordism

After the second world war, fast and stable growth rate of economies, low unemployment and expansion of economies did not last long. The problems that Fordism encountered in the 1960s were giving the signals of a new crisis. According to Piore and Sabel, the limits of economic growth were reached. In other words, this was crisis of Fordism, and the technology of mass production and institutional structure reached their limits (Piore, Sabel, 1984:165-167). Boyer identifies four factors in his analysis of the structural crisis of Fordism (Nielsen, 1991:23-25); firstly because of reaching the social and technical limits of Fordism, productivity gains decreased. Secondly, the expansion at mass production caused to an increased global economic flows. It made the management of national economic too difficult. Thirdly, Fordism resulted in growing social expenditure. Inflationary pressures and distributional conflicts appeared since there is no applicability of mass production methods in this area. Finally, the consumption pattern has changed. New demands could not be satisfied with mass production methods. Annual rate of labor force transfer, defective production, increasing of wastage, avoiding doing work and strikes reached a high level. In other words, workers' resistance to capitalist production relations caused rising of a new crisis. This can be called as the crisis of Fordism, that is to say, the crisis of organization style of labor (Bonefeld, Holloway,1991:1-2). With this crisis, the demand for the standardized products sharply decreased, while the demand for the variety of customized goods increased. Piore and Sabel (1984) make a simple conceptual distinction between mass production and flexible specialization. In the mass production, standardized goods are produced by the help of semi-skilled workers and product specific machines. However, skilled workers produce a variety of customized goods in flexible specialization (Nielsen, 1991:12-13). To overcome this crisis, the intensive part of labor at production in industrialized countries started to use in South American countries in which labor is much cheaper. A tendency towards flexible specialization appeared with the help of new high technologies like microelectronic and the role of state in economy decreased. In these crisis conditions, firms made some adaptations to

survive, such as technological changes, automation, representing new products, making flexible labor market, firm combinations and using of new geographies in which labor is controlled easily. It was entered to a new period which there has been occurred technological changes intensively and new organization of production systems (Bilgin, 2000:12). This new economic model can be accounted for the wide acceptance of post-Fordist organization of production process.

2.4 Post-Fordism

Post-Fordism is a process in which firms make adaptation for flexible automation technologies and flexible production systems. In addition to using new flexible production systems, new high technologies called as flexible automation technologies started to become a part of production process in this period. In post-fordism, instead of specially designed machines which dispose labor, general-aimed machines which can be programmed, equipped with new automation technologies, can observe different kinds of products, save time and make motions one by one started to be used widely (Yenturk, 1993:48-49).

Thanks to flexible production systems and automation technologies, the design of products, control of stock, marketing, finance, subcontractor relations and management and control functions are included in the automation practices. Flexible production system depends on the work organization model in which there are combination of computer aided production, design, finance activities and research, and employment of skilled labor (Taymaz, 1995:709).

In this period,

(a) small business firms became widespread. Decreasing scales of firms stemmed from the increasing demand for the flexible firms that can be easily adapted to unregulated demand waving in markets (Price, 1994:83-84).

(b) Social security system was broken

(c) Unions became less effective; unemployment rate increased; employment style became disordered and labor class became more heterogeneous.

(d) Decentralized corporatism was broken and new capital and labor relations developed (Esser, Hirsch, 1989:419-425).

Polarization which is just seen in international area before, started to be seen in national markets, as well. However, this post-fordist period was started to be called as south-africanization as regards organization of labor by some authors. Due to demand for flexibility,

subcontracting relations increased sharply. As a result, post-fordism is a kind of separation as regards consumption style, work organization, firm relations, the role of state and class structure. The main reason for this separation mainly stems from flexible production systems which determined the direction of post-Fordist process.

2.5 Flexible Production Systems

Mainly, two kinds of post-Fordist flexible production systems were started to be used so as to adapt to changes in markets quickly and effectively. First one is the lean production that is the big firm version of flexible production. Lean production is similar to Taylor's approach with regards elimination of waste of any kind. In this kind of production, reintegration of skill, control of responsibilities and dispersal of managerial authority were developed in the direction of coordination rather than control (Grinth, Wooldar, 1997:125). In the lean production, firm requires less work force and engineering time. Because of this, there are no unwanted components, such as, cost, stock, wastage, labor training time and customer complaints. It developed on a structure, which has an adaptation to heterogeneous good demand and produces high quality products, due to limited market and socio-economic conditions of Japan after Second World War. Elimination of all waste and producing with zero defect realized by using of workers' capacities and experiences, and mental potentials in the upper limits (Ansal, 1996:48).

In lean production, mass production did not given up entirely and a more developed work organization that is lacked of efficiency and time wastage was applied. This is a kind of flexibility that removes the negative effects of economies of scale and causes to new production relations such as subcontractor relations and creation of new industrial spaces. In order to improve production and quality, new techniques started to be used, such as quality circles, suggestions system, total quality management, just-in-time production, time based competition, customer driven and interactive planning.

In lean production, there are mainly three elements that provide a system to work coherently:

(a) Total Quality Control: It is a kind of technique which enables to have a zero defect manufacturing. Each worker is responsible for quality of his work; and the following worker checks the quality of previous work done.

(b) Just-In-Time Production: It bases on demand. It is aimed to make savings from stock expenditures production time and the other production factors by transfer of suitable raw material to suitable machines at proper time.

(c) Quality Control Circles: It is a meeting of workers voluntarily in order to remove defections, increasing of efficiency (Bilgin, 2000:19).

Positive features of lean production can be summarized as job security, egalitarian character, shop-floor focus, pride in work, and a carefully selected work force. The down sides of lean production are unlimited demands for performance, unbounded work time, little tolerance of work injuries, and the unbounded factory regime (Berggren, 1992:50-55).

Another flexible manufacturing model is flexible specialization model which based on small scaled production. This model is described as production, that depends on customer demand, by using of general aided machines and skilled work force. Opposite to mass production, flexible specialization model based on small-scale manufacturing in conjunction with changing demand by using new designers and trained workers. Manual labor which is the old working class replaced by mental labor. Toffler calls the social group shaped by this new work force as "cogniterya" (Toffler, 1992:215-229) Production could be divided into smaller elements with the help of new technologies by transferring some parts of production process to subcontractors. In this new production system, the production is made by main firms and other satellite firms which produce input to these main firms.

In conclusion, new work force obtained a plenty of new features like multi-functionality, no immobility, no hierarchical and bureaucratic order, creativity and unionization of manual and mental labor. As a result of these technological developments at manufacturing sector, the use of technological innovations became inevitable in order to get an adaptation for changing market conditions and to survive.

The flexible production systems necessitated the application of flexible automation technologies which yielded to many kind of microelectronic technologies adapted to production process.

3. NEW TECHNOLOGIES

3.1 Flexible Automation Technologies

Production period which evolved starting from 1970s achieved its last level called as computer integrated manufacturing with its new techniques such as CAM and CAD at 1990s. The automation periods, in which numerically controlled machines and industrial robots were employed, was realized. The most important feature of flexible automation systems which were used firstly in USA at 1970 is the replacing of mental force of human being whose physical force replaced by machines before, by machines. First industrial revolution based on division of physical labor, on the other hand microelectronic revolution lead to division of mental labor. In microelectronic technologies, mental labor divided into small pieces by giving routine and repeated works to machines. This is the dual of Taylorist approach: scientific division of physical labor. In this period, unskilled labor was replaced by programmable automation technologies (Bilgin, 2000:28).

Flexible Automation Technologies do not only contain the production techniques and services produced by machines and tools but also social organization of labor and production. It is aimed a new organization of labor by decreasing the labor force in the origin of flexible relations with technological developments. In this new organization, the aim is to remove Taylorist labor force, to increase the use of capacity, to create collective organization atmosphere (Hirsch, 1991:25). However, since all of these are realized on the basis of increasing profit rate and productivity, it was needed to make some changes in the technology besides production systems and organizations. In this period, technological problems experienced in the past are solved by the help of microelectronic transformation. In this respect, the flexible automation enabled the firms to give flexible response needed to adjust to rapid changes in marketing or production requirements. It contains new skill combinations. New technologies generated new forms which have the following effects on work tasks and skills; firstly, the number of complex tasks including manual skills and capabilities is diminished. Secondly, new complex tasks requiring mental problem solving, understanding of system interdependencies and skills are generated. Thirdly, tacit skills associated with the old technology are still required in order to get effective performance of many tasks. Lastly, the relation between the user and technology is changed fundamentally (McLoughlin, Clark, 1994:150-151).

On the other hand, it is known that each society is under dominancy of a production system, and each production system has two main elements. The first one is the "production forces" including producers and material production tools. The second one is "production relations" which determine the production activities and show specific social relations. As it is seen, technological change differs both the physical conditions of production and social force relations. Since these technologies affect all relations in society and economy, it is a kind of revolution. This revolution is in the area of microelectronics, and it is firstly observed by arising of especially the numerically controlled machines, industrial robots and flexible production systems (Ongen, 1996:176). The industrial revolution increases the human physical capability by using technology: the computer or information revolution extends mental capability of labor. The result of these extensions makes technology a potent economic force.

Microelectronic technologies which use computers or microprocessors in its circuits or components make a great development especially in the area of electronics, mechanics and optics and so economical structure of sectors based on electronic undergoes big changes. Especially, in the 1980s, the extension of microelectronic technologies provided to firms important opportunities in the area of flexibility of production period, planning and management techniques, and the variety of products. In the production process, flexible automation technologies, which brought new production relations such as subcontracting firm relations, caused to decreasing scales of production and new organization of labor. The most important advantage of flexible automation technologies with respect to capital was flexibility. Capital could decrease the cost of stock thanks to flexibility and could make savings in production space by using less work bench. The flexible automation techniques made a great reduction in the labor cost per unit output and increase in the labor productivity. The use of these technologies reduced the need for stocks by increasing the flexibility of the production apparatus. (Edquist, Jacobsson, 1988:33). These new automation technologies, especially computer aided information and communication techniques made the application of them easier. Increasing competition in the international markets made the high technologies inevitable to adapt to their production process (McLoughlin, Clark, 1994:208).

In the new construction period of post-Fordism, microelectronic technologies at firm level were put in industrial production process and new flexible automation techniques were started to be used in order to overcome the crisis at 1970s. New microelectronic technologies adapted to production process can be listed as follows: (Bilgin, 2000: 24-26)

-Flexible Manufacturing Systems- FMS

-Advanced manufacturing technology-AMT
-Computer numerically controlled-CNC
-Numerically controlled machine tools-NCMT
-Flexible manufacturing systems-FMS
-Computer aided design-CAD
-Computer aided manufacturing-CAM
-Computer integrated manufacturing-CIM
-Process control technology-PCT
-Programmable logic controllers-PLC
-Distributed control systems-DCS
-Industrial robots

These technologies lead to different effects on the employment, productivity, cost of production and production process. Therefore, it is necessary to mention about the effects of the ones which are widely used:

3.1.1 Flexible Manufacturing Systems-FMS

The characteristics of FMS can be summarized as follows: an automatic flow system interlinks flexible manufacturing cells. This system enables the simultaneous machining of different work pieces passing through the system along the different routes. It makes the utilization of labor very low. Different kinds of products can be quickly produced as a result of this system in which there is a high flexibility. The economics of FMS introduce to us four general objectives:

1-) High machine utilization
2-) Reduced cost for work in progress and stocks
3-) Improved labor productivity, labor-intensive activity
4-) Greater flexibility of equipment. It means an ability to react faster to changing market conditions. This enables the reduction in the amount and cost of stocks (Edquist, Jacobsson, 1988:62-67).

3.1.2. Numerically Controlled Machine Tools-NCMT

In the 1950s, the first numerically controlled machine tool was developed. The combination of flexibility and automation was made. However, because of the high cost of it

and unreliability of the numerical control unit, this new technology was not used widely until the early 1970s when the adaptation of numerical control unit to microcomputers was started. The important economics of NCMTs based on the increasing degree of saving on the cost of production and savings in space (cost of building). It enables the firms to increase labor productivity (labor cost per unit of output increased). It reduces the need for stocks by increasing the flexibility of production. Apart from these, a significant reduction has been occurred in the skills per worker, which is needed to operate the new machine tools, and in the number of people who are required to learn skills (Edquist, Jacobsson, 1988:23-35).

3.1.3. Computer Aided Design-CAD

CAD systems are computerized drafting tables. This technology considerably increased the productivity of users. It developed and spread out by the using of personal computers. It improved the productivity of designers and shortened the lead time from conception to production. The introduction of this system makes savings in the skilled labor. It means that a smaller number of engineers are enough to undertake a given amount of design work.

3.1.4. Computer Aided Manufacturing-CAM

Computer Aided Manufacturing implies computer based preparation for manufacturing. The machine is programmed for the desired product. Moreover, the management and control of work organizations are provided by this technology which improves the quality of product and can reduce the cost of operation per unit (Bilgin, 2000:26).

3.1.5. Industrial Robots

The most important reason for investment in industrial robots is to decrease labor cost. The labor saved by industrial robots consists of unskilled and semi-skilled labor. Generally it is assumed that each robot replaces two manual workers on average. The industrial robots which started to be used from 1970s was spread out quickly, and in the following 20 years there has been occurred 60% increasing of its usage. In the long run, many companies invested in robots in order to advance the firms technologically. This long run investment is

expected to bring increased capital productivity. Reduced cost for unskilled and semi-skilled labor is the most important reason for the investments in robots in the short run (Edquist, Jacobsson, 1988:46-61).

As a result of programmable automation technologies (PAC), the work which is done by a plenty of workers can be done by a robot or a computer. Numerically controlled machines, computerized control tools and industrial robots made the production and control period automatic by introducing these new high technologies. These high technologies affected production process deeply and caused to new work organizations. Since the new products were technically very complex, the determinants of international competitiveness were not only production costs any further. Comprehensive organizational changes were inevitable as a result of the introduction of flexible automation techniques. The new labor organizations have a feature of innovation for the changes so as to adapt to demand. Apart from these, these technologies also affected labor force, structure of employment, and unionism. As a result, it directed the organizational structure of labor in production process deeply by affecting the social structure of a country besides production relations.

3.2 The Characteristics of Change of Labor In Production Systems

The crisis of 1973-75 indicated a tremendous change in the development of capitalism. The following 20 years period after Second World War generated a significant growth rate (greater than 4.4% annually), less unemployment, controlled inflation, stabilized rate of exchange, and standard goods costs in most capitalist countries. The technological and organizational change in this period followed a graded extension and the spread of old technological systems which were developed before and during Second World War. After the crisis of 1973-75, capitalist economies entered a reconstruction period in which there are slow downs in the growth rate (between 1973-1988, annually 2.2%), high unemployment rate and inflation. As a reaction formation to the pressures on the profits, firms entered an adaptation period including intensive technological developments (computerization and telecommunication), the new organization of production techniques (just-in-time control), financial reconstruction, and production associated with postmodern culture. These firms considered flexibility and demand based marketing important in new production systems (Harvey,1993:83-92)

Post-Fordism is a kind of system which can cure the crisis period, on the other hand it can be said that it is a kind of system which overcomes the conditions restricting the real

value of capital in Fordist production system. When the Fordism is examined in the objectives of its conditions with respect to deregulation and counter productive effects, post-Fordist production could be considered as the adaptation to new technologies. It can be mentioned about two main changes of Fordist system. First one is to go towards a kind of production system which can enable an increase in the productivity by technical division of labor in the factory and can meet to low and unstable demand. The second one is the appearing of a production system aiming to meet differentiated demands and to overcome unproductivity by the systematic unity of conception and production with a coordinated automation. The most important innovation of technological changes on labor process and characteristic of labor is the appearing of a necessity to a labor force having an idea about all production process, quality and renewal of products. The multi-skilled feature of labor is necessary for the efficient usage of new technologies. There is a transformation from unskilled labor force doing routine works to multi-skilled labor force doing computerized planning, design and operation. This development does not only increase the control on the workers, but also makes the work more intensive. Microelectronic technologies reduced the labor per unit of output and caused to unemployment. However, passing of labor from many unskilled workers to few skilled workers exposed a divided and changed structure of labor force. In the new conditions in which there are unstable markets, adapted production system is provided with recession in scales of firm and changing of optimum scales in many sectors. Developments do not only consist of the separate automation of design, management, coordination and the production units. Moreover, this is the new reconstruction of an organization aiming the systematic integration and mutual influence of each system. These technologies which are provided with information technologies between conception and production enabled to contact with changing structure of demand. This is realized by the construction of a continuous feedback mechanism among these units.

This direction increases the productivity by saving blue-collar workers and time and preventing increased transaction cost which is caused by bureaucratic structures. Therefore, it can be seen that post-Fordist developments or flexible production systems is a kind of productivity and profit searching aiming the adaptation to small and unstable markets and changing demands of consumers. This is not a different thing from a reconstruction of post-Fordism in the direction of capitalist profits. In this period, which requires flexibility inevitably to exist, subcontractor contracts, make production and paternalist working styles became important (Harvey, 1997:176). By the effect of changing structure of industrial

relations and work organization, the role of labor at work and labor-union relations also changed. Therefore, the state acquired a new identity in industrial relations.

3.3 The New Identity of State and Relation Between Economy Politics and Production Systems

Because Fordist mass production requires big stable capital investment, and profits are depended on mainly stable demand conditions, important duties were assigned to the state. In other words, government had to take new roles and develop new institutional capacities. In this period, government tried to take under control the industrial transformations by the help of capital and fiscal policies. By this, it is aimed to provide the continuity and stability of capital's productivity and profits. In other words, government tried to guarantee the revaluation of capital by arranging and intervening the working conditions, wages, job security systems, and even technology (Burawoy, 1985:252-254)

Government creates demand by its growth-oriented policies (cost of public services at high scales) and at the same time it also assists in social agreement by redistributing income (Eser, 1993:54-55). Thus, government is a social security and welfare state. After 1980s, it was seen that government was changing the core of its policies about the working relations. At this period, it attempted to diminish the effects of the rules regulating the labor market and defending the workers. Moreover, because of the growing pressure of international competitiveness, employers showed a tendency to act unwillingly about regulation of working relations by collective agreement, and they considered only themselves by using human resources management techniques (Treu, 1994:13).

The change in the economical policies was provided with savings in public services, reduction in real wages and restriction in capital and fiscal policies. In this period, since conservative parties were in power, the foundations of neo-liberalism were established. Until this period, although government had an important role in the system by making legal regulations for the existence of the system, at this period, it attempted to diminish the effects of protective rules regulating the labor market and industrial relations (Senkal, 1998:75).

The technical staff, called as white-collar workers or information labor arising as a result of technological developments, and decreasing number of white-collar workers are proofs of non-unionization policies which reinforcing the domination of employers and reducing the role of state.

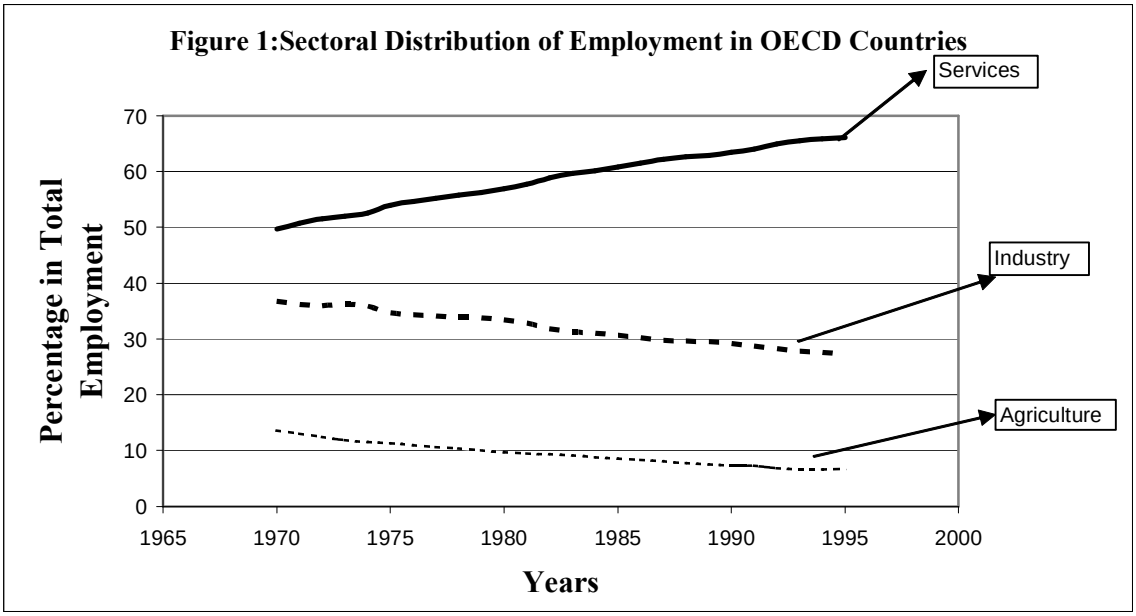
However, in this period, the government made some changes while becoming less effective in production part. For example; the US federal government helps to change the educational systems by studying the changes in jobs and providing information on new skill requirements (Helfgott, 1988:132). "Monetary, fiscal and foreign trade policies of governments must accommodate to the policies of technology, education and health that are only fruitful in the 'very long run'. This argument of an economists may be not new but it is an often overlooked truth because both of the myopia of politicians and unconsciousness of voters particularly in developing countries. International diffusion of advanced technologies due to the imitation of important goods, the licensing agreements or the foreign direct investments imposes to the governments the necessity to design their trade and technology policies as a whole. Because, both trade and growth are mainly influenced by the level of technology, and then, foreign trade stimulate economic growth worldwide." (Akat, 1999:96)

While technological innovations were bringing significant number of changes in the area of production and work organization, it also forced to change radically the traditional activities of government on labor, employer-employee relations, and worker-union relations. These changes in production and the role of state indicate new organization of work and new role of state. By the effect of these changes, there occurred significant changes in the employment composition, labor force and unionism in order to get adaptations for the changing market conditions.

4. THE IMPACTS OF NEW AUTOMATION TECHNOLOGIES ON LABOR AND WORKING STYLES

4.1 Employment Composition

Technological development stimulated by profit motive, brought new work organizations which make technology practical in work, new working styles, new labor structure and new judicial arrangements which are indispensable elements for these developments. In this new work organization, there occurred significant changes in the employment composition and structure of labor especially in the period after 1970s. The most important one of these changes is the shift in the sectoral employment and growing of services sector. In Figure 1, presenting the sectoral distribution of employment for OECD countries, the fall in the share of industrial sector and increase of services sector can be seen. This may show us that there may be a positive relation between technological innovations and the rise of services sector.



Source: OECD, Labor Force Statistics

In the developed western countries, the percentage of services sector is increasing rapidly. When we look at the data, manufacturing sector of Turkey is similar to the countries which have high capital investment per capita, whereas the sectoral distribution of employment is similar to the countries which have low capital investment per capita (Bulutay, 1995). As mentioned above, manufacturing firms started to give marketing and advertising to subcontractor firms. Increase in this consultancy and subcontracting relations caused to an increase of employment in the services sector and it became a rapidly-growing sector. Development in the services sector occurred mostly in the area of social and work services (Andersen, 1993:37-43). Besides the authors claiming services sector is expanding at the cost of manufacturing sector, most authors (Dordick and Wang) evaluate it as the expansion of information sector.

The distribution of employment according to size of workplace is very significant due to importance of technological developments in the economy. In the manufacturing industry, the percentage of large size firms which employ ten or more workers in total is increasing gradually (Ansal, 2000: 40). The most important diagnosis as a result of examination of the employment structure and job creation of Turkish economy is the great increase in the percentage of employment of self-employed/unpaid family workers. The flexibility of small and big firms, production with high technologies and employment of unskilled labor increased the profit more. The addition of small firms, using labor-intensive production techniques with classical technologies, to value added taxes became low.

There also occurred significant changes in terms of gender. The spreading of new technology and flexibility brought feminization of labor. The increase in women employment appeared mostly in the services sector. In this way, it was observed that there is an important shift in the percentage of women from traditional home workings to the salaried postindustrial workings. In developed countries, while 56 % of men are employed traditional sector of industrial economy, 66% of women are in postindustrial sector (Clement, 1994:32-40). For a large part growth of part time workers which are dominated by women clearly reflects the expansion of the services sector as well (Walby, 1986). The increase in female labor force is provided with getting rid of patriarchal employment relations coming from Fordist industrial organization. Besides, social services which are the most important subgroup of postindustrial sector is fulfilled by women. Thus, it can be claimed that female labor force having a rising rate in total labor force ionized in services sector with in a nonstandard employment manner. The percentage of female labor force in total labor force continued to increase in 1980s but not as rapid as in the 1970s. The percentage of working women in total adult women was 36% in 1960s, and it increased to 48% in 1980s (Bilgin, 2000:39). In this point, this postindustrial sector is feminized, besides its flexibility (Walby, 1986: Ch.6).

New technologies and flexible production systems also affect labor force with respect to age. The most distinctive change is the decrease in the employment portion of the population below 20. This comes from the necessity for the skilled labor having graduate and undergraduate degree, on the other hand, while employment rate was 70.9% in 1989, it increased to 74.6% in 1998 (Ansal, 2000:48). With the changes in the sectoral shares of employment, the increasing of women and young people in the employment and labor have deep impacts on the characteristic of industrial relations and institutions. As a result, changes in technology and production systems caused to growing prime-age employees in total employment and the expanding structure of services sector leaded to increase in the employment of female work force. Thus, these led to arising of new working styles in conjunction with changing structure of labor force and work organization. In order to understand the impact of new technologies on labor, it is necessary to determine new working styles spreading out as a result of these technologies.

4.2 Flexibility and New Working Styles

The economic stagnation and crisis at either global and national level or some changes such as increasing or decreasing of production due to conjectural fluctuations are the most

important reasons of the appearing of flexibility in work life. In the traditional economical structure, when the information factor is added to the other factors such as capital, raw material and labor creating national wealth, new changeable concepts appeared within classical industrial relations. First of all these concepts are time, place, standardized products and flexibility concept which balances the production according to the needs of society, especially individuals and industrial and services sector (TISK, 1994: 10-11). The firms got an opportunity to balance their employment levels rapidly according to floats on production level by the help of flexibility which is the capability of meeting needed number of labor force in the existing work organization. At this point, they prefer to use nonstandard employment instead of full time employment in order to meet necessary employment in short time (Bronstein, 1991:292-294). In brief, it can be stated that there has been a sharp trend towards the substitution of part time employment for full time employment.

Atkinson examines flexibility under the following sub-points: (Belek, 1997:69)

-Functional Flexibility
-Numerical Flexibility
-Working Time Flexibility
-Flexibility of Payment

4.2.1 Numerical Flexibility:

It can also be called as external flexibility. It is concerned with enhancing the firms' ability to adjust the labor inputs to fluctuations in output according to demands in the markets and new production techniques (Wood, 1989:1). This is the most argumentative type flexibility of labor market and labor flexibility; and this appears as a threatening element.

In OECD declaration, it is claimed that numerical flexibility causes a kind of labor structure consisting of less number of core workers under guarantee and lots of workers having no social guarantee; and some relaxations have been made at the existing legal rules. Contractual and part time working styles spread out, and the criteria of employment security is started not to be a necessity. Governments tried to make flexible employment styles widespread by making employment securities of both part time and full time workers equal. By this way, numerical flexibility is started to be supported as a government policy.

4.2.2 Working Time Flexibility:

It is an arrangement of quality and timing of labor by changing the working time but not the number of workers to increase the competitiveness of firms. It is claimed that working time flexibility, which is caused by the change in technology and production systems, is necessary to decrease the firm costs, to adapt new necessities, services and production demands, and changing life styles. Besides, the restrictions for some employment styles such as part time work and night work are removed. The restrictions which arrange the obligatory relaxation time of women workers and which bring payment obligation for extra working are changed.

4.2.3 Functional Flexibility:

The opposite of division of labor and work organization is group organization. It is the spreading out of skills, aims and the usage of labor in different conditions. It is a kind of creation of multi-skilled labor. At this point, education level is very important, and it is a result of necessity for multi-skilled labor. In order to obtain an adaptation of labor to technology and production process according to changing demand conditions, horizontal work actions, horizontal flexibility among groups, vertical group compositions, vertical functional compositions, quality control and team working appeared as the type of functional flexibility (TISK, 1999:15). All of these provide an opportunity to capital and managers to contact with workers directly and they removed unions (Treu, 1992:502-508). The advantages of functional flexibility are the lessening of time to realize the aim, less dependency to work, coordination with each step, more responsibility at management, control, planning, ergonomic work conditions, getting more power of lower levels towards management.

4.2.4 Flexibility of Payment:

It is the firm’s ability to adjust labor costs, particularly pay, to changing market conditions (both labor and product) (Wood, 1989:1-2). Especially this is encouraged by capitalist economy in order adapt to capitalist competition and it is the most important competitive advantage for capitalist countries using unskilled labor force. Briefly, it is a kind of system awarding just high-skilled workers.

Apart form these, many mechanisms are developed for the economical floats such as carrying out of some production process by other subcontractor firms and distancing policies. The overall conclusion about all of these flexibility styles emerging after mid-1980s is that "Flexibility has become an important theme in emerging corporate thinking" (Atkinson, 1985: 26). All of these flexibility styles led to a new kind of labor force. This labor force also prepared the infrastructure of new working styles.

4.3 More on New Working Styles:

During last years, there has been a sharp trend towards the substitution of nonstandard working styles for standard working rapidly in order to set employment levels to meet fluctuations in the demand from day to day and not oriented to the peak periods and to desire to decrease the cost of labor. These new working styles provide a very important economic advantage to firms to get an adaptation to the technology so as to be able to survive and compete. They are seen as a kind of innovation based on the social structure of society within the new economic form. Therefore, technology has not a uniform impact on the new organization of labor. There are various side factors. According to Wilkinson "the technical and social organization of work can best be seen as an outcome which has been chosen and… In this view, the design and choice of technology may be seen as the result of socially-derived decisions, and the way in which technology is used can be explained in terms of the political process-formal and informal- of negotiation, persuasion, bargaining, and so on" (Wilkinson, 1983: 20). Thus, the growing international competition, globalization, economic crisis, weakened national economies, rapidly changing technology and unemployment problems made the transition from classical employment styles to flexible working styles called as nonstandard ones inevitable. Up to the beginning of 1970s, the employment style of Europe was standard or in other words, classical job relations exist. In this work form, workers accept full time work based on legal forms including generally eight hours in a day. By arising of new working styles, life-long full time employment is replaced by nonstandard employment. In other words, by lessening of standard work style, nonstandard work styles appeared (Cordova, 1986:642-643).

The clearest example of decreasing rate of standard work styles happened in European countries. In Europe, there occurred 4% decrease of standard work hours in average in industry and services sector between 1983 and 1991. In this period, there is a little increase in the working hours in England. In Holland, there was 13% decrease; in other words, there was

1% decrease in average annually. This decrease was more than 5% in Belgium, Denmark and Germany. When the relation of change in working hours with employment is examined, 3% of 12% increase in employment happened full time working styles between 1983 and 1991 in Belgium and Denmark. In the same period, 1% of 4% increase in employment happened in full time working styles in France (TISK, 1999:28).

New working styles brought not only difficulties at human resource planning, organization, management and control but also objection with respect to workers and labor. These advantages can be listed as decrease of overtime work, removal of short time salaried vacation and social insurance, and difficulties about the definition of working times and planning and when there are interdependencies between work tasks created by advanced technologies. Apart from these, since workers have no employment security within these working styles, they could not have any chance to bargain on their wages and benefit from social security systems. This also changes from country to country. Flexibility in labor market and new working styles did not provide any flexibility for labor. It is the flexibility only for capital (Bilgin, 2000:47). Although flexible forms of work organization create upskilled workforce and give workers more direct control over their work, unions lose their decision-making influence on workers. This yields to a creation of work class without any consciousness to seek to bargain. In this manner, these systems discourage union-based worker participation at both firm level and national level. It is created a working class having no job security, low paid wages and working times increased. Although in forms of nonstandard working such as home working and the numbers of temporary workers are small, there is an evidence of increase in the 1980s in most industrialized countries (Dale, 1988: 210-218).

Some flexible working styles can be summarized as follows:

4.3.1 Part Time Work:

This kind of working has a less working time according to standard one, and the amount of working time and its statues are determined before. This is different from the working style which contains less time than the normal working time due to economical reasons. The definition of part time working can change from country to country, for example in Germany, Ireland, Luxemburg and Holland the working time less than 38 hours in a week is part time working, whilst working time less than 66% of normal working time in Spain, less than 80% in France and less than normal weekly working time in Denmark are accepted as

part time working (Blomeyer, 1994:201-202). The most important feature of part time working time is being more disposable, temporary employment, and having shortened working time. The most important advantages are having ability to adapt to changing market conditions with respect to both product and labor, getting rid of extra social aid of part time workers. As a result, in the period after 1980, the percentage of part-time work increased in most European countries and for both employers and workers it became a more desirable working style.

4.3.2 Job Sharing:

In this model, each side shares not only work and working time but also wages, bonuses, vacations, responsibilities and social aids. Since it was seemed as a way of decreasing of unemployment, it causes the spreading out of this model in most European and industrialized countries during 1980s. This model, encouraged by some governments, firstly used in the public sector, later spread many professional branches and private sector. Since this model improve the efficiency, decrease the transfer of labor force, provide great activities and creativity, and make possible utilization of large labor force potential, it gives significant advantages to capital in many area (Bilgin, M.H., 2000:51).

4.3.3 Tele-working:

In tele-working model, the work is carried out outside the workplace by the help of a network based on electronic telecommunication and programmable tools. Since there is an uncertainty about work done, the workers have no social security. There are different kinds of styles such as electronic homework, satellite centers, neighborhood centers and mobile work (TISK, 1999:40-41).

4.3.4 Home-working:

As opposed to the traditional working models, workers make their job in accordance with a contract, not in the workplace, but in some other place such as their own homes without having any control mechanism by their employers. Especially, in Europe it is determined that most housewives work in this way, since it enables them to carry out their responsibilities at home. When it is looked at from the points of employers, home-working

decreases the total cost of work. This working style especially used in textile sector causes the decrease of cost of labor and the workers could not benefit from the social security system besides having no job security.

4.3.5. On-call work:

On-call work called as changeable working time dependent on capacity is used for the decrease of working time when the demand is low and making possible the on –call work during the periods when the demand is high. In this model, an employee is obliged to be available and present at the work place rather than being merely contactable. In other words, this working style which simplifies to adapt demand fluctuations and provide flexibility for capital is also defined as the working in existing workplace when the worker is called by his employer in accordance with a contract. Since this model is not possible with collective agreement and so considered with services agreements since 1970s, it is spread out the workplaces whose contents are uncertain such as hospitals, hotels, restaurants, and so on (Bilgin, 2000:52-53).

4.3.6 Compressed work:

Another working style is compressed work weeks described as the compression of weekly total classical working time consisting of five or six working days to less number of working days such as three or four days.

Developments in the structure of working brought more intensity for the labor force, although it decreased the job security of labor. Thus all kinds of these working styles necessitated the new construction of labor force so as to get more efficiency.

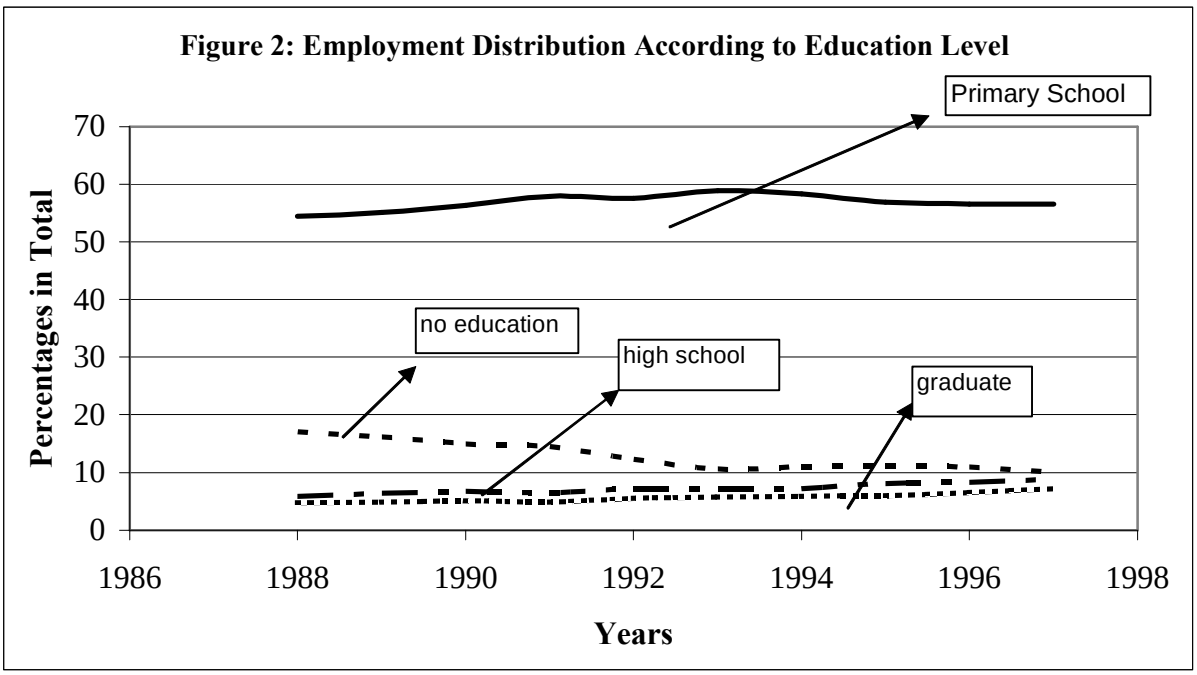
4.4 Changing Characteristics of Labor Force:

With the crisis of capitalism during 1970s, the assembly line system of Fordist production based on unskilled labor became insufficiently qualified at the targeting of efficiency and profit. During this period, with the changes in production systems and technology, the need of labor force having an idea about all production process, production renewal, quality increase and active contribution to the creation process revealed. Qualified labor force which is described as the ability of involvement to the labor process designed by

himself at a required speed by the help of machine formed an important structure. Worker group at the production is replaced by the worker type having adoption to innovations and making contribution to the production process. Because of this, the leave from the Fordist production process providing efficiency and aiming removal of the control of labor on work via the use of unqualified labor and division of work appeared especially in the labor process and the characteristic of labor force. In the lean production which is one of the flexible production styles, it is needed to have a continuous production process with zero defection and multi-skilled labor force. In another model, flexible specialization, workers who can design and carry out both production process and products exist due to the great intensity of core workers (Bilgin, 2000:53-56).

The changes in production systems and technology caused to increase in the qualification of labor force. If we look at the developments in Turkey between 1988 and 1998, while there is a decrease in the percentage of the ones having no education, there is a big increase in the percentage of workers having a degree. The only increase occurred in the percentage of people having high school and graduate degree as it is seen from the Figure-2. (Ansal, 2000:52).

Figure 2: Employment Distribution According to Education Level



Source: State Institute of Statistics

Apart from these, as a result of developing technology, growing international competition and globalization movements, dynamism in economic and social life brought

rationalization in firms and a kind of polarization in profile of staff. In this period, workforce segmented into two groups: core and peripheral labor force. The core workforce is multi-skilled and functionally flexible. It is composed of ones who work full time in central firms, have employment security, and are well paid. Peripheral workforce is a worker group in a subcontractor and employed on a peripheral basis, such as in an office cleaning firm. This group has a big numerical flexibility and is more disposable with fewer employment rights. Peripheral workforce is facilitated as temporary employment, part time working and short term contracts (Atkinson, 1985:26-29).

The main reason for the need of these models stems from economic stagnation with unemployment at 1970s and 1980s and creation of a peripheral workforce which is more disposable, having short term contracts and fewer employment rights. This makes labor organization more resistive for the market fluctuations. This is also preferred by employers, since it is a very easy way for the continuous working of firms and increase of efficiency. Apart from these, workers approach this working style positively, because it enables workers to have dominancy on work.

Technological change and its effects on the characteristic of labor force are observed in the OECD Jobs Strategy's Second Analytical Report (Technology, Productivity and Job Creation, 1996, 96-98) as follows:

> Using industry-level data, Berndt et al. (1992), examined the relationship between worker styles and high-technology capital intensity for US manufacturing industries; they found a positive correlation between high-technology capital intensity and white-collar workers. They also noted a significant increase in education level among blue-collar workers. Berman et al. (1994) examined the evolution of skills for US manufacturing industries and the wage share of white-collar and blue-collar workers. They found that skill upgrading (increase in the wage share of white-collar workers) is positively related to two measures of technology: computer expenditures and research and development. Using two-digit manufacturing data, Bartel and Lichtenberg (1987) found that the age of the capital stock (a proxy for technology) is inversely related to the percentage of labor costs for highly educated workers; this indicates that industries with high-skilled workers may be more adept at adopting new technologies…….. Overall the increase in the share of white-collar high-skilled workers within sectors seems to be positively correlated to variables related to technological change, such as R&D investment and growth in the number of patents; this is especially true in the high-technology sectors. The results show in effect a strong positive correlation between the increasing share in white-collar high-skilled workers and initial R&D intensity (See Graph 4.8). Changes in relative R&D intensities or growth rates in the number of patents are significant also but have very little impact. The relative initial capital-labor ratio is less robust if one controls for outliers or if the sample is changed……. In conclusion the sectors that invest ed more in research and performed more innovative activity are those that employed a larger share of higher-skilled people at the beginning of

> the 1980s and that continued to the so at an increasing rate. Thus, the annual change in the share of white-collar high-skilled workers is positively correlated to the initial level across sectors in the sample.

Developments in the structure of profession bring more information intensity and the necessity for making this information contemporary. This new construction at the level of professions called as knowledge based products and processes by Bengtsson, services by French economists, softening by Japanese economists. The micro changes happening in this period can be summarized as follows: (1) Providing new technologies for the development of human resources and work organization. (2) Being an improving parameter of human resources with respect to developments of performance of firms and competitiveness. (3) Being smooth of hierarchical structure of organization. (4) Improvements in production according to demands.

The things stimulating all of these are new technologies. These developments towards the increasing of labor force have a tendency to the level that special abilities are important. Bengsston divides new labor force into the three groups with respect to necessities: (1) Employment of a worker group having high education level and application of an intensive rotation program in work. (2) Having a small labor force ready and when it is needed supplication of temporary workers. (3) Employment of a labor force having graduate degree. By this way, the structure of labor force mainly consists of professionals, associate professionals, skilled workers and low-skilled workers (Belek, 1997:85-86).

As a result, we cannot claim that there is an increase in the level of qualification for all labor force. Actually, this is just valid for the core labor force. For the other worker groups, there is a case of unemployment and low qualification. This made the two segmented work organization structure, and resulted in a division of rights of workers between these two segments. Since the work started to be focused on the core labor force, the number of peripheral labor force decreased and this yielded the differentiation of classical structure of labor force. Thus, this situation changed the classical unemployment rates, work organization and the role of unions.

4.5 Effects on Unemployment

The worldwide economic seriously affected developed countries after 1970s, brought a big unemployment problem together with itself. After the Second World War, a phase of rapid economical growth and rise in investments, which has not ever seen, occurred. Besides,

this golden age which also known as political and economical polarization lasted until 1970. An important feature of this period is that USA became the superior power of the world with respect to technology and economy. By this way, Keynesian period started after Second World War, also ended. After this period, some negative developments arising at economic arena directed the attention of peripheral governments to the inflation. In this period, politics considered by these governments affected rate of unemployment and economical growth negatively. The most important target of them was to decrease the inflation, because it was believed that if the necessary decrease for inflation is obtained in a short period of time, economic growth and decrease of unemployment is achieved. Governments believed that giving priority to the economic growth and unemployment will accelerate the inflation. As a result, big unemployment rates occurred after 1970 were preferred against the much bigger unemployment problems which will arise in the future. No doubt, as a result of application of this economic strategy, unemployment rate rose and investment and profits of industry remained at low levels. In this period which was aimed to decrease the inflation, more strict precautions were taken about monetary and fiscal policies. The increase in the rate of wages started to slow down, and investments were supported in order to increase the work capacity (Senkal, 1999:48-49).

While these developments were happening, the technological development and the rationalism of production process was realized with the economical, social and political developments in capitalist societies. Technological developments accelerated after 1980s shook up the industrial relations deeply. This mutual influence brought some changes not only in the structure and role of factors establishing the industrial relations, but also in the structure of all system. The most important impact of new technologies on the relations of employee and employers was the change of the power and position of workers in management and agreement. Workers started to react to technological innovations in different ways. These were reactions to participation, negotiated trade-offs and definite opposition. Besides, these innovations mean that the replacement of white-collar professions for blue-collar professions, increasing of the number of non-unionized workers and the decreasing of job security. Firing and using less number of multi-skilled workers started to be spread out. The new industrial relations based on information society, increasing use of computers and robots in production process were shaped with the developments in information technologies. In this manner, a different kind of labor structure which is unbounded with microelectronic technologies arose. These microelectronic technologies or new high-tech led to constriction of employment

besides labor savings. Thanks to technology, more efficiency could be obtained by using of less labor force. In other words, this reduced the cost of labor per unit of product.

Labor force decreased in most of the sectors by using new technologies. For example, in Germany, the production increased 48.9% while employment decreased 27.5% in the office and information process sectors between 1970-1977. Again, TV production increased 25% in Japan, although overall employment decreased from 480.000 to 250.000. In Japan, total employment in electronics sector decreased 31.2% between 1976-1979. The number of workers in telecommunication sector which use high technologies decreased sharply in the developed countries such as USA, England and Sweden (Koray, 1994:47).

While new technologies yields to employment constriction, it also provide the creation of new job opportunities, however, this is not enough to decrease the unemployment problem caused by employment constriction at high rates. The decrease in employment mainly results from the technological changes which save labor and the need for low-skilled labor. Because developing countries cannot produce new technologies, they have to import them from the technologically developed first world countries. This removes the opportunity that restores the unemployment by creating new employment sector arising by using of new technologies. As opposed to this, the demand for new technologies of developing countries creates employment for developed countries. In this situation, due to the decrease in self-produced conventional technology demand of developing countries, these countries have a more employment decrease than developed countries. By this way, as the use of technology increases, efficiency also increases and employment decreases (Senkal, 1999:58-61). This is a reason for increase in unemployment rate for developing countries such as Turkey. In brief, the modification of new technologies to production systems is the most important reason for unemployment increase in especially developing countries after 1970s.

Besides, according to the direction and nature of technological developments it is necessary to supply technological capacity, and to increase the portion of infrastructure investment expenditures and public R&D facilities in national income, in addition to the private sector R&D activities which are about development of new technologies. Moreover it is clear that these expenditures should transfer to the most dynamic and strategic sectors. In this manner, it is clear that these new technologies provide new opportunities creating new employment areas. However, since creation of these new sectors oriented for the aim of creation of multi-skilled less number labor force potential and more efficient use of existent employment by organization associated with new technologies, there naturally occurs an

employment constriction. This also proves that new technologies affect the growing unemployment negatively.

The most important point establishing technological politics with respect to struggle with unemployment is that while the new technologies provide big productivity increase in traditional sectors, it reconstructs labor and so it leads to a probability of technological unemployment. On contrary to this, it is claimed that this negative effect of technological developments can be restored by the creation of new job opportunities and new sectors. According to this idea, new job opportunities arise both in the industrial branches producing new technologies and the other industrial branches producing new products by new technologies. However, since new technologies and even products could not be produced and generally are imported by most countries such as Turkey, the employment created by these new technologies are very restricted; even, it can affect employment rate negatively (Ansal, 2000:140).

The other important reason of the high rate of unemployment is the growing international competitiveness and the accelerated globalization during last years. The flow of capital and investment in industrial countries to the areas having low-priced labor due to accelerated international competitiveness is an important cause of unemployment. During this period, the increase of import of developed countries from low-priced countries causes to disappear of many labor intensive professions in developed countries. In the developing countries, the sectors, which could not adapt this process and compete, constrict and even many work places go bankrupt, some jobs disappear (Lee, 1996:489).

However, in the long run, it is believed that new technologies broaden the employment by creating new works and new jobs. This is generally valid for the countries producing the technology. For the countries importing technology, the most important aim of technological developments besides the reducing the dependency of firms to the qualified labor force, is to provide labor force saving. By this way, computerized production systems separate the production from human interventions. It is seen that new technologies reducing the labor force per unit of product make labor savings, and develop by increasing the unemployment (Edquist, Jacobsson, 1988:113-114).

Another most important change carried out in production systems by new technologies is about changing characteristic of labor force. Since the new technologies have a characteristic labor saving, it causes to division of labor force. Less number of multi-skilled core labor force having always employment opportunity and low-skilled labor force called as “McDonald’s workers” reveal. The first group has high wages and providing more efficiency

increase, while second unskilled group has low wages and no job guarantee (Yenturk, 1993:48-49). From this point of view, this new organization of employment makes constrictive impact. Apart from this, replacement of human labor by robots, and removal of routine and simple works by new technologies are seen, and as a result it makes unskilled labor out of work. It is claimed that the industrial robots making savings from unskilled or semi-skilled labor take place of three or four workers on average.

While there is a decrease in employment, there are huge increases in production. This shows us how tremendous changes in the structure of sectors and the quality of labor occurred, and the relation between economic growth and employment is broken, since the technological developments caused to spreading out of the concept of jobless growth in production.

Despite all of these changes, according to the neoclassical approach, unemployment which is caused by the technological developments, technological unemployment is not possible. In this approach, since the labor market is flexible enough and market forces can move easily, wages make a balance between the demand and supply of labor in the long run. In this theory, technological change is perceived as an external factor and it is stated that unemployment is determined by only internal factors. Consequently, technological change is not seen as a characteristic factor determining unemployment. Although, in analyses, the technological developments establishing labor is included, technological unemployment is considered as temporary and unconstitutional problem. Because, according to this approach, unemployed workers as a result of new technologies providing labor saving, could be employed in the new working areas created by technological developments. Thus, according to neoclassical theory, negative effect of technological changes on employment is not possible in the long run (Bilgin, 2000:60).

Despite all of these approaches, the fear of growing unemployment caused by changes in production systems and especially technology is gradually increasing. When we look at the foresights, Rifkin's one attracts attention. He states that in future less than 20% of adults will continue to work; remaining part has a social income in return for socially aimed activities (Insel, 1997). Apart from these, in the flexible production systems becoming gradually technologically intensive, human being get a role based on control mechanism. In future, it seems possible the mental side of labor will proceed in the direction of control mechanism which will contain less number of workers. In addition to all of these, if the jobless growth theory becomes true, the reveal of a kind of unemployed community or the case of working poor will be possible (Bilgin, 2000:66). Despite all of these possibilities, the most probable

case is that the world proceeds towards to an information society and all constitutions will change and be formed in this direction. This also shows us that the structural changes centered on technological developments will happen, and these structural changes occurring in work organization will determine the level of unemployment. Thus, the rate of unemployment as a result of technological changes is directly related to the structure of work organization.

4.6 Effects on Work Organization

The changes in technological and the other socio-economic conditions brought new concepts in the management and organization areas. As it is known, the technological developments after 1970s not only increased the variety of products but also revealed significant changes in the production process. The technological developments affecting production period happened especially in the area of microelectronic technologies which are called as key technologies, and as a result a transition from old Fordist production style to new post-Fordist production occurred. Therefore, the role of labor in work organization changed. In order to understand the main features of new post-Fordist work organization, it is necessary to compare it with Fordist work organization.

When we compare the Fordist and post-Fordist process, we see that hierarchy, strict control mechanisms, and time standardization were the most important features of Fordist organization. In this type of organization, specialization level determined the necessity for coordination and control, and the role of each person in organization was determined in this way. In the Fordist work organization, in which analysis of work was made with respect to time and work place in detail, standardization of all motion of employees was made. However, the post-Fordist organization included the technological changes seen in Fordist organization, and in this organization, abilities of workers increased, while division of labor lost its importance. On the other hand, the hierarchic structure of firms diminished, or at least it became smooth and the social relations among hierarchies developed. Such relationships were taken into consideration in order to get more efficiency. By this way, the necessity for strict control in the firm disappeared. As a result, it was tried to develop some concepts such as total quality management which makes person responsible for each level of production and this brought an auto control mechanism. All of these developments prepared the conditions of constriction in management mechanism. Such responsibility mechanisms were also tried to improve by new labor organizations and managements models, such as group workings (Belek, 1997:95). Toffler (1992) claims that classical division of labor diminished and

workers must assist on the production by having new work techniques and creating new ideas in learning circles. In this manner, he agrees with that workers should have an idea about all process of production and claims that changes with respect to organization will remove bureaucracy and division of labor (Toffler, 1992:195-220).

In the organization of work in post-industrial period, firms made some adoptions to developments in the direction of various targets. Firstly, in order to reduce the cost, simple arrangements and low labor force were used. Secondly, operation and planning were separated from control and application respectively. Vertical and horizontal communication were increased and the importance of consumer services increased. In this manner, it can be said that it was tried to create a quality-based firm.

In the new work organization, a big importance was given to flexibility in order to improve the competitiveness of the firm and to increase the efficiency of production with new technologies and flexible production systems. In this manner, the changes in work organization were made mostly so as to create a work organization having a flexibility adapted to market fluctuations (Ozaki, 1996:54-56). In this organization, arrangements based on the creation of feedback circles making possible to response sudden changes in inputs. Here, hierarchy was compressed and firm became oriented to products. Job enlargement and job rotation were started to be used widely in order to make these possible. Apart from these, in this new organization, the previous organization structure including hierarchy from top to bottom, vertical communication and information flow, and central and bureaucratic control mechanism were replaced by a model having a complex telecommunication network, vertical and horizontal information flow, regional autonomy, auto control and team workings (Yenturk, 1995:806-808)

In the new organization, the importance of information and technical specialization gradually increased, and hierarchic structure became smooth. Professionals got autonomy about their responsibilities and some facilities, such as collective decision making and production search became important. Although the control of labor on work started to increase, the control on labor also increased due to intensification and mobility of work.

As a result, while characteristic of work and labor force changed with new technologies, the work organization also changed with the application of these in production process resulted in automation in most areas. Since the production system is not a kind of organization including technical work process, the change in production systems influenced not only the form of technical division of labor but also social organization of production and work organization.

4.7 Effects on Unionism

After 1970s, world market met new competitors by various changes in the structure of international economy politics resulted from developments in economic arena. These new competitors called as Asian Tigers caused to rise of international competition. Besides, growing competitiveness constrained western countries and forced to search for new models due to having high cost of labor. Another development happened in technological area. Due to the rapid developments in the technological area, and becoming a determining factor of new techniques for production and management, both organizational structure and production systems changed. The changes in production and management systems brought important results with respect to industrial relations. While these developments were happening in economic and technologic area, some changes in conjunction with these in organizational area became inevitable. These changes in organizational area appeared in different ways. In traditional organizations, while Fordist production style is dominant, Taylorist approach was used for the management. The use of flexible production and management techniques caused to appearance of flexible firm perception different from the traditional firm structure. The most important feature of this new firm is that it had no adaptations for the arrangements of unions, and developed in non-unionized conditions. Therefore, the economic crisis and unemployment during 1970s made the first stage of non-unionism. Then, technological developments and new developments resulted from these technological developments, such as the increase in the level of labor force, changes the sectoral distribution of labor force, and appearance of new production and management techniques formed the following stage.

We should examine these two stages to express the reasons for non-unionism. The first stage causing non-unionism, crisis and unemployment, can be explained as the following: In the 1970s, Keynesian period starting after Second World War ended. After this period, some negative developments arising in economical area directed the interest of peripheral states to the inflation. In this period, generally it was believed that if the inflation was decreased, economic growth can be increased and unemployment rate can be decreased. The most common idea was that giving priority to economic growth and unemployment would accelerate the inflation. Thus, the high rate of unemployment in 1970s was preferred for the higher unemployment rates in future. This growing characteristic of unemployment and changing structure of labor force caused to organization and representation problem and both throat the collective bargaining and diminished the role of unions at international area. As a result of unemployment, unions lost lots of their members and increasing international

competitiveness made inevitable new constructions in most countries and the use of flexible labor force. Thus, collective bargaining lost its importance and fell at the work place level (Senkal, 1999:48-50). Therefore, unions experienced many difficulties with respect to organizational activities and bargaining power.

The most important drop in the power of unions can be expressed by the second stage. To explain this second stage, we should look at the rates of unionism in world. Especially, after 1970s, firstly USA and the other countries such as Japan and England involved in non-unionized developments. In USA, the highest point of the participation rate of union organizing was 35%, and it occurred in 1950s. After this period, unions always lost members. This decrease was slow in 1960s, however, it was very sharp in 1970s and 1980s (Senkal, 1999:45). The most important reason for this decrease was the spreading out of flexible working styles during post-Fordist period. As a result of changes in the production process and developments in new technologies, traditional working styles changed and atypical working styles became widespread. All of these diminished the union organizations, since new working styles became gradually independent and developed outside the firm. This made unions unable to organize workers properly, and created a big gap among unions and labor class (Insel, 1997). In other words, the most important reason for the reduction in the power of unions comes from these structural changes happening in labor force and economy.

Another fact arising in the power of labor unionism and accelerating the change was the sectoral distribution of labor force as a result of new technological developments. The employment in the industrial sector, in which there was a high percentage of blue-collar labor force having a great tendency towards the traditional unionism, constrained, and employment mostly increased in the services sector. This reduced the participation for unions and created new organization problems (Bilgin, 2000:74). Apart from these, increasing rate of female participation in employment and increase in the percentage of white-collar workers changed the homogeneous structure of labor. With this changing structure, management prevented the white-collars, professionals and the other high skilled labor force from unionism, and it diminished the unionism seriously.

The politics of management on skilled labor force about non-unionization is aimed to form a new alternative structure for the current non-unionized structure. In this manner, new management strategies are started to be carried out. When we examine the developments of non-unionized industrial relations, technological developments caused to new human resources management politics in the presence of values and politics of firm. As a result, it realized the institutionalization of non-unionized system.

This new perception developed as a result of non-unionized system intend to give the work individuals in the production and management process, instead of perceiving human as a part of machine like in the Fordist management strategy. In accordance with this, the human resources management entered in a phase of rapid change was a new development from this point of view. This also organized a new alternative for the unionized system. Thus, firms could greatly benefit from management and human resources techniques developed by themselves in order to increase their profits and they caused the non-unionized industrial relations to get strong.

Apart from these, another strategy of management was to create a kind of firm culture and to make the firm center of the system (Koray, 1994:90-91). In this period, in which class and union corporation for labor was replaced by loyalty to the firm and micro-solidarity, it was aimed to combine the workers and firm's targets and it was tried to create a micro-corporation by improving the relations (Bilgin, 2000:70). Besides the concept of micro-corporation, the creation of some other concepts, such as Corporate Culture in which professional management, group working, quality circles and participatory working were all together evaluated, increased the importance of individuals and reduced the unions' importance in industrial relations system.

Another fact underlying the non-unionized system is the increasing rate of subcontracting industrial relations. Flexible firms give the non-strategic activities and sectors to the other firms with a contract, while they adapt the technology for their production process. Therefore, it is a kind of network consisting of middle and small scale firms surrounding the main firm. These satellite firms and developing subcontractor relations cause the scale of firms to become small. For developing countries, although small scale firms seem to be advantageous, the movement of unions from work department to the work place is very difficult. In these small scale firms, lots of rights such as collective bargaining traditions and social aid were given up with the effect of change in the characteristic of professional groups. This also means the development of non-unionized circumstances.

Besides all of these, the policies of states are in the direction of diminishing unions' power by making some restrictions especially about collective bargaining. These arrangements especially revealed the new style unionism now. After 1980s, there has been a regression in the power of unions with the application of government policies. The collective agreements at industrial level gradually lost their importance, and collective agreements mostly started to be made at firm level. This kind of unionism carried out at firm level went away from center and started to focus on individual relations, instead of collective relations.

This unionism at the firm level is also called as market unionism. As a result, although traditional unionism diminished, new alternatives at the firm level, such as market unionism are also tried to be made widespread by new management techniques, since these are mostly under the control of capital.

When we look at all of these developments, it is difficult to determine the role of unions exactly. Therefore, it became impossible to make a foresight for the role of unions in future. However, it is seen that labor gained a new structure with technological developments and unions weakened. Most pessimistic authors claim that the unions will not exist in 21st century (Bilgin, 2000:79). Despite these authors, there has appeared no evidence about that there will be a non-unionized society in future. Besides all of these possibilities, some problems such as sectoral constrictions, unemployment and human resources management, seem permanent for labor unions (Bilgin, 2000:79). In the light of these facts, it is seen that there is a similar change in unions and employment in most countries. However, with the growing globalization movements and international characteristics of firms, the labor also gained an international statue, and international organization of labor seems possible. In this manner, the global organizations of unions will be inevitable for the existence of unions in the future. The acceleration of globalization shows us that the unions should be formed in this direction.

5. CONCLUDING REMARKS

In this study, we tried to illustrate the structural model of technology so as to get an idea about the investigations of how technologies interact with work organization and labor. As a result of this study, it can be said that there has been occurred significant changes in the production systems and the characteristic of labor in the last 20 years. In this period, capitalism caused a new social formation called as post-Fordism in the light of even increasing technological developments. In the new post-Fordist social formation, the role of labor in production process significantly changed. Naturally the policies of state and the relation between labor and unions turned out to be to labor class' disadvantage in conjunction with the changes in technology.

In this new period, due to decreasing less effectiveness of unions, increasing rate of unemployment and heterogeneous structure of labor class, workers lost most of their rights. However, by the effect of globalisation factor, it seems that they can gain natural rights by the help of union organizations at global level. To sum up, the specific mechanisms of skill-

biased technological changes are mostly directed by the profits of capital, and the nature all of these technological changes can be better understood by detailed examination on the effect of it on labor and work organization.

REFERENCES

Akat, A. S., The Political Economy of Globalization: The New Identity of State in the 21st Century, Friedrich Naumann Foundation, Ankara, 1999.

Alcorta, L., Flexible Automation in Developing Countries, Routledge, USA, 1998.

Amin, A., Post-Fordism, Blackwell Publishers Inc., Cambridge, 1994

Andersen, G.E., Assimakopoulou, Z., Kersbergen, K.V., Trends in Contemporary Class Structure, a Six Nation Comparison.(Changing Classes, Stratification and Mobility in Post Industrial Societies, Ed. by Andersen G.E., Sage Pub., London) p.32-57,1993.

Ansal, H., Esnek Üretimde İşçiler ve Sendikalar, Birleşik Metal-İş Sendikası Yayını, Istanbul, 1996

Ansal, H., Kucukciftci, S., Onaran, O., Orbay, B.Z., Türkiye Emek Piyasasının Yapısı ve İşsizlik, Türkiye Ekonomik ve Toplumsal Tarih Vakfi Yayını, Istanbul, Kasım 2000.

Atkinson, J., 'Flexibility: Planing for an Uncertain Future', Manpower Policy and Practise, Vol:1, Summer 1985, p.26-29.

Belek, I., "Postkapitalist" Paradigmalar, Sorun Yayınları, Istanbul, 1997.

Berggren, C., Alternatives to lean production : work organization in the Swedish auto industry, ILR Press Ithaca, N.Y., 1992.

Bilgin, M,H., Yeni Teknolojiler ve Üretim Sistemlerindeki Değişimin Emek ve İstihdam Üzerindeki Etkileri , Türk Tarih Kurumu Basımevi, Ankara, 2000.

Blomeyer, W., "Almanya'da İstihdam İlişkilerinin Esnekleştirilmesi Yönünde Denemeler", Çalışma Hayatında Esneklik, Yaşar Eğitim ve Kültür Vakfı Yayını, Izmir, 1994.

Bonefeld W., Holloway, J., "Introduction: Post-Fordism and Social Form", Post-Fordism and Social Form, The Macmillan Press Ltd., London, 1991.

Braverman, H., Labor and Monopoly Capital, The Degredation of Work In the Twentieth Century, Monthly Review Press, Fifth Printing, New York, 1974.

Bright, J., Technology and the American Economy, Washington, D.C., 1966.

Bronstein, A.S., "Temporary Work in Western Europe: Threat or Complement to Permanent Employment?", International Labor Review, Volume 130, No:3, 1991.

Bulutay, T., Employment, Unemployment and Wages in Turkey, Devlet Istatistik Enstitusu International Labor Office, Ankara, 1995.

Burawoy, M., The Politics of Production, Verso, 1985.

Clement, W., Myles, J., Relations of Rulling Class and Gender in Postindustrial Societies, McGill Queens University Press, Canada, 1994.

Cordova, E., 'From Full-Time Wage Employment to Atypical Employment: A major Shift in the Evolution of Labor Relations', International Labor Review, Vol:125, No:6, November-December 1986.

Dale, A., Bamford, C., 'Temporary Workers: Cause for Concern or Complacency', Work, Employment and Society, Vol.2, No:2, 1988: p.210-228.

Dickson, D., Alternatif Teknoloji, Ayrinti Yayinlari, Cev: Erdogan N., 1.basim, Istanbul,1992.

Drucker, P. F., The Practice of Management, New York, 1954

Drucker, P. F., Yeni Gerçekler, İş Bankası Yayınları, Çev:Karanakic, B., 3. Baskı, Ankara, 1993

Drucker, P. F., Kapitalist Otesi Toplum, Inkilap Yayinlari, Cev: Corakic, B., Istanbul,1994.

Edquist, C., Jacobsson, S., Flexible Automation: The Global Diffusion of New Engineering Technoogy, Basil Blackwell Ltd., Oxford, 1988.

Ekin, N., Küreselleşme ve Gümrük Birliği, İstanbul Ticaret Odası Yayını, Yayın no:1996-32, İstanbul, 1996.

Eser, U., Türkiye'de Sanayileşme, İmge Kitabevi, Ankara, 1993.

Esser, J., Hirsch, J., The Crisis of Fordism and The Dimensions of a "Post-Fordist"., Regional and Urban Structure, IJURR, 13(3):417-435, 1989.

Grinth,K. Woolgar,S., The machine at work : technology, work and organization, Polity Press, Cambridge, 1997.

Halal, W.E., The New Capitalism, John Willey and Sons Inc., Canada, 1986.

Harvey, D., "Esneklik: Tehdit mi yoksa Fırsat mı?", Çev: Ayca Kurdoglu, Toplum ve Bilim, Sayı:56-61, Bahar, 1993.

Harvey, D., Postmodernliğin Durumu, Çev: S. Savran, Metis Yayınları, İstanbul, 1997.

Helfgott, R.B., Computerized Manufacturing and Human Resources, Industrial Relations Counselors Inc., Toronto, 1988.

Hirsch, J., Fordism and Post-Fordism: The Present Social Crisis and its Consequences, (Post-Fordism and Social Form a Marxist Debate On The Post-Fordist State, Ed. by Bonefeld, W., Holloway, J., MacMillan Press Ltd., London) : 8-34, 1991.

Insel, A., "Fabrikasız İşçiler ve Sendikaların Kabusu", Yeni Yuzyıl Gazetesi, 18.05.1997.

Jessop, B., Thatcherism and Flexibility: The White Heat of a Post-Fordist Revolution, In B.Jessop, H. Kastendick, K. Neilsen and O. Pedersen (eds), The Politics of Flexibility. Aldershot: Edward Elgar, 1991.

Koray, M., Değişen Koşullarda Sendikacılık, TÜSES Yayınları, İstanbul, 1994.

Lash, S., Urry, J., The End of Organized Capitalism, The University of Winconsin Press, Great Britain, 1987.

Lee, E., "Globalization and Employment: Is Anxiety Justified?", International Labor Review, Vol.135, No.5, 1996.

Marx, K., Capital, Volume 1, 2nd Edition, Moscow, 1975.

Marx, K., Fransa'da Sınıf Mücadeleleri, Sol Yayınları, 1.baskı, Ankara, 1976.

Marx, K., Kapital-1, 3.ciltler, Sol Yayinlari, Cev: Bilgi, A., Ankara, 1978.

McLoughlin, I., Clark, J., Technological Change at Work, Second Edition, Open University Press, London, 1988

Nielsen, K., Towards a Flexible Future-theories and politics., In B.Jessop, H. Kastendick, K. Neilsen and O. Pedersen (eds), The Politics of Flexibility. Aldershot: Edward Elgar, 1991.

OECD, Employment Outlook, July 1996.

OECD, 'Technology, Productivity and Job Creation', The OECD Job Strategy, Vol.2 Analytical Report, Head of Publication Service, OECD. France, 1996.

Öngen, T. Esneklik: Kapitalizmin Yeni Fetişi, İktisat Dergisi, Sayı:357, Mayis-Haziran 1996.

Öngen, T., "Teknolojik Gelişme Döneminde Işgücünün Niteliği", '95 Sanayi Kongresi Bildiriler Kitabı 1-2, TMMOB Makine Muhendisleri Odası Yayın No:186, Ankara, 1996, p.176.

Ozaki, M., "Labor Relations and Work Organization in Industrialized Countries", International Labor Review, Vol.135, No.1, 1996.

Piore, M. J., Sabel, C. F., The Second Industrial Divide, Basic Books New York, 1984.

Price, J., "Lean Production at Suzuki and Toyota: A Historical Perspective", Studies in Political Economy, Vol.45, Fall-1994.

Şenkal, A., Sendikasiz Endustri Iliskileri (Doktora Tezi), Istanbul Universitesi Sosyal Bilimler Enstitusu, Istanbul, 1998.

Stoneman, P., The Economic Analysis of Technological Change, Oxford University Press, Oxford., 1983.

Taymaz, E., "Esnek üretime Dayalı Bir Rekabet Stratejisi Geliştirilebilir mi? Türkiye'de Fason Üretim", Petrol-İş 95-96 Yilligi, Petrol-İş Sendikası Yayını, Yayın No:44, Istanbul.

TİSK, Calışma Hayatında Esneklik, TISK yayini, Yayin no:136, Ankara, 1994.

TİSK, Calışma Hayatında Esneklik, TISK yayini, Yayin no:190, Ankara, 1999.

Toffler, A., Üçüncü Dalga, Altin Kitaplar, Çev: Seden, A., Istanbul, 1981.

Toffler, A., Yeni Güçler Yeni Şoklar, Altin Kitaplar, Çev: Corakic, B., 1.Basim, Istanbul, 1992.

Treu, T., "Avrupa Topluluğu Endüstri İlişkilerinde Yeni Eğilimler", Çev: T. Dereli, Çağdaş Gelişmeler Işıgında Türkiye'de Toplu Pazarlığın Otuz Yılı, II. Ulusal Endustri İlişkileri Kongresi, Kamu-İş Yayınları, Ankara, 1994.

Treu, T., Labor Flexibility in Europe, Int., Labor Review, 131(4-5), 1992, 497-512.

Walby, S., Patriarchy at Work: Patriarchal and Capitalist Realtions in Employment, Cambridge: Polity, 1986.

Waring, S. P., Taylorism transformed : scientific management theory since 1945, University of North Carolina P Chapel Hill, 1991.

Wilkinson, B., The Shop Floor Politics of New Technology, London, Heinemann, 1983.

Wood, S., Transformation of Work, Academic Division of Unwin Hyman Ltd., London, 1989.

Yavuz, A., Esnek Çalışma ve Endüstri İlişkilerine Etkisi, Filiz Kitabevi, İstanbul, 1995.

Yentürk, N., "Post-Fordist Gelişmeler ve Dünya İktisadi İş Bölümünün Geleceği", Toplum ve Bilim, Bahar 1993, Sayi:346, Subat 1994.

Yentürk, N., "Üretim ve Organizasyon Sisteminde Değişmeler ve Türkiye Uygulamları", Petrol-İş 93-94 Yıllığı, Petrol-İş Sendikası Yayını, Yayın no.36, Istanbul, 1995.