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***TOWARDS THE DEFINITION OF AN  
INNOVATION AND EMPLOYMENT  
STRATEGY***

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## **1. INTRODUCTION**

The paper addresses the topic of technology and employment. The impact of technological change in the economy and particularly, on employment, is nowadays a very controversial subject.

Europe is very concerned about the negative impact of technology on employment. Although it is true that technology may save labour through higher productivity, on the other hand, innovation and the development of new ways of organising production and labour may bring new opportunities of business and self employment.

First, we will analysis the impact of technology on employment in Europe, providing different figures that makes it clear that the situation will depend in any case, on industrial or sectoral specialization and the capacity of adaptation of each sector.

Secondly, the paper will try to focus on the main changes that technological change is causing in production systems and employment organisation. Some dimensions are analysed like automation, work reorganization, the new division of labour and the new demand of qualifications.

Then, the paper considers the role of innovation for creating employment. Innovation may offer a solution to unemployment, in terms of creation of new business and exploitation of emerging niches of market.

New businesses can be the result of self employment through “spin-offs” or other initiatives to start new projects taking advantage of previous learning

and experience. This will be true under certain circumstances. This leads us to the next aim of the paper.

Therefore, the paper finally, pretends to offer some guidelines for the definition of an strategy of innovation and employment.

## **2. TECHNOLOGY AND EMPLOYMENT IN EUROPE**

Nowadays, Europe is very concerned about unemployment. Facing unemployment is not only a technological problem as it could be widely understood, but it also concerns economic, cultural, social, training and legal aspects.

In the one hand, it seems that technology can destroy employment through automation and new production technologies saving labour, but in the other hand, there is a strong link among innovation, growth and employment. Reality has made it clear that employment creation is higher in those countries investing in education, training, research, innovation and technology.

For this reason, Europe has decided to stimulate research and innovation to face unemployment. Before we analyse the relationships between innovation and employment, it is important to consider that the impact of technology on employment is quite different depending on the sectors and on the countries. Besides, within technological change we should take into account changes in the organisation of production, in the distribution of products and in the requirement of human qualifications.

In this sense, labour market should be enough flexible (in terms of determination of wages, adaptation of staff and training policies) to admit these changes in organisation and technology in order to permit to exploit the synergies deriving from the introduction of new technologies in economy. In addition, labour market should consider an accurate policy for promoting employment. At the same time, this policy must be coherent with the aims of the innovation and technology policy. It must have an integrated approach.

In Europe, there has been different situations regarding labour markets. First, the anglosaxons countries have tended to have a very flexible market. On the other side, there are countries with very strong rigidities to protect workers. Even if we consider the case of Japan, here, there is a very strong link between the worker and the firm leading to a long life relationship.

In general, Europe has been involved recently, in the eighties, in a liberalization process of labour markets in order to facilitate industrial restructuring. However, this has not been an homogeneous process within the countries. This fact could be one of the reasons explaining the different impact of technology on employment in Europe.

In the following chart, we can see the general evolution of employment in Europe considering industry and services. The other sectors have not been considered. Industry is divided into three groups: technology intensive subsectors, medium technology intensive subsectors and low intensive subsectors.

Chart 2.1.

**EMPLOYMENT EVOLUTION BY SECTORS IN EUROPEAN  
UNION**

	1980-1988	1988-1995
<b>INDUSTRY</b>		
HIGH TECHNOLOGY	2,6	-4,7
MEDIUM TECHNOLOGY	-5,4	-2,8
LOW TECHNOLOGY	-7,6	-7,6
<b>SERVICES</b>	16	9

Source: Author's preparation from data taken out from Alonso Borrego, C. (1999), p. 133.

From this chart, an important decrease in industry employment is appreciated. The negative impact is higher in low technology sectors. In the second period, 1988-1995, the decrease is higher in high technology intensive sectors while in the first period, 1980-1988, the trend was just the opposite, the low technology intensive sector was the main responsible for employment lost. This could be explained by the higher development of high technology. In any case, service sector appears as an employment creation sector.

In the next chart, we will be able to see the different employment evolution in european countries.

Chart 2.2.

## EMPLOYMENT EVOLUTION IN EUROPEAN COUNTRIES

	EMPLOYMENT EVOLUTION BY SECTORS			
	INDUSTRY			SERVICES
	HIGH TECHNOLOGY	MEDIUM TECHNOLOGY	LOW TECHNOLOGY	
<b>1980-1988</b>				
ALEMANIA	4,8	2,1	-12,3	12,9
AUSTRIA	-6,2	-7,8	-17,4	11,2
BELGICA	-7,8	-6,3	-14,4	13,3
DINAMARCA	18,6	11,5	6,9	9,7
ESPAÑA	4,1	3,7	-2,5	23
FINLANDIA	6,5	-20,2	-14,1	18,1
FRANCIA	-4,3	-18	-13,9	16,5
REINO UNIDO	-10,6	-12,3	-14,8	20,3
GRECIA	3,5	-11	7	9,7
HOLANDA	5,8	-4,1	-6,6	13
IRLANDA	15,1	-12	-29,8	8,5
ITALIA	-7,8	-14	-12,8	22,9
PORTUGAL	29,5	10,8	19,6	33,1
SUECIA	-14,4	2,4	-1,7	11,2
<b>1988-1995</b>				
ALEMANIA	-13,6	-5,3	-7,7	15,5
AUSTRIA	-5,7	2	-17,6	14,7
BELGICA	2,2	-0,9	-4,8	4,2
DINAMARCA	-8,4	-4,9	-9,5	3,5
ESPAÑA	-2,9	-0,6	-6,1	20,3
FINLANDIA	-23,2	-13	-25,1	-3,2
FRANCIA	-8,3	-9,7	-13,1	14
REINO UNIDO	-12,5	-14,3	-12,6	0,7
GRECIA	15,1	15,9	11,8	14,9
HOLANDA	-8,2	7,7	3,3	12
IRLANDA	34,4	36,2	3,2	14,5
ITALIA	-11,9	-12	-10,5	5,2
PORTUGAL	-3,6	-17,3	3,4	10,9
SUECIA	-19,4	-22,9	-21,7	-1,2

Source: Author's preparation from data taken out from Alonso Borrego, C. (1999), p. 133.

In the eighties, the lost of industrial employment is higher in those countries like Sweden, the United Kingdom, Finland, Italy and Austria. The employment decline seems to be lower in those countries like Portugal,

Greece or Ireland which a lower degree of industrial development. In fact, in high technology sectors these countries are creating employment.

In the second period 1988-1995, the lost in industrial employment is higher for the high technology sectors.

Taking into account that high technology sectors are the promoters of innovation for its higher effort in terms of R&D, the link between innovation and employment is not always so clear and in any case, it is different by countries. However, it seems the relationship between employment and technological development is more important in high technology intensive sectors.

These facts are the ones that are causing the debate in Europe about the impact of technology on employment: is it positive, is it negative?

In some cases, evidence can suggest that a higher R&D budget implies more employment. In any case, this is not something homogeneous and it can change in the time. On the other side, sometimes technological change associated to R&D leads to a substantial labour saving.

As a result, it is necessary to go further in the analysis of the employment policy associated to the technological policy in order to promote the exploitation of technology possibilities for employment and what is more important, for creating good jobs and avoid negative impacts.

But first, it is important to note the main effects that technological change has caused in the organisation of production and in terms of employment.



### **3. IMPACT OF TECHNOLOGICAL CHANGE ON PRODUCTION SYSTEMS AND ON EMPLOYMENT**

One of the main impacts of technological change on production and on employment is the requirement of higher flexibility. This fact has adopted different ways that have implied necessary changes in organisation of production, in firms structure and in the demand of employment.

Flexibility has acquired namely the following dimensions:

#### ***1. AUTOMATION***

The crisis of the seventies implied important structural changes that led to a new structure of production. Since then, investment looked for the substitution of labour to improve efficiency and productivity through automation associated to the development of new technologies such as microelectronics, information and telecommunication technologies.

Firms have implemented new manufacturing tools that permit to obtain products faster, to improve their quality and their design. In fact, this is part of the innovation strategy that has led firms to find new sources of competitive advantages.

Computers, new flexible systems of production, numerically controlled machines and digital systems have improved productivity and the result of production. However, the automation of production processes may destroy jobs or at least reduces rates of employment increase.

Besides, these new tools have altered the qualifications and skills requirement of the work force. In general, some skills have become obsolete, and higher levels of expertise are required. This will imply a new policy of education and training.

This policy should be focused on the continuous training of work force at their jobs, and education on management of new techniques of production.

## **2. WORK REORGANIZATION**

Firms have reorganised themselves. Flexibility is the main reference. At this point, it is important the ability to create networks, externally with suppliers and internally, to establish working teams to collaborate reinforcing synergies.

In a knowledge society, it is important to improve information in order to generate added value and new competitive advantages in terms of technology, quality, design or new products.

New advantages take shape around innovation and this means that innovation is pluridisciplinary. If we define innovation as *the first application of science and technology to a new commercial idea successfully*, this implies that it is necessary to consider a wide field of subjects, such as research, development, production or distribution. For this reason, it is important to be an expert and at the same time, to be able to cooperate with those experts on other subjects where the firm is not specialized in.

As a result, new ways of organising production like decentralization or subcontracting have appeared. Besides, the creation and promotion of

networks has become the main focus on any policy for innovation, technology or employment.

Internally, at firms, support is necessary to assist the complex decisions that the firms have to make out. This means that the consultancy and advisory services help to make out better decisions and to concentrate in those tasks where firms have really an advantage.

Another result of the need of flexibility is the fact that new ways of employment start to appear as part time work or self employment. This is specially relevant in a context where long term employment is disappearing and where youth unemployment rates are constantly increasing.

The requirement of higher flexibility is understood as a combination of technologies, design of products, quality, better manufacturing processes and a rapid respond to the market needs. This flexibility cannot be possible without internal flexibility in the firms and within its relationships with other firms. For this reason, subcontracting and specialization have made it possible that small and medium sized enterprises (SMEs) and start up initiatives or spin-offs appear as an important element of flexibility for the whole system.

### ***3. NEW DIVISION OF LABOUR***

In a context of increasing globalization of economies, advanced countries have concentrated on quality, design and added value competition. For this purpose, they have adopted an strategy of diversification and innovation.

As a result, firms have transferred manufacturing operations of low added value to low-wage developing countries and have specialized in high technology activities and in those products with a significant content in terms of knowledge.

For this reason, in advanced countries like Europe, cheap labour has become less important in manufacturing industries and in services. As long as technology development implies productivity growth, this reduces the direct labour content of production in almost all sectors.

This is also a result of liberalization of capital markets and flexibility of firms to decide where they will locate their investments. Capital flexibility and mobility have advanced faster than labour mobility.

Therefore, Europe and the developed countries are competing in knowledge, technology and innovation, but no longer in prices or costs. Consequently, taking into account their workforce, this must be compete in terms of qualifications, skills and know-how.

This has obvious implications in the structure of qualifications. New qualifications are demanded.

#### ***4. NEW DEMAND OF QUALIFICATIONS***

If Europe is competing in qualified manpower, the less qualified workers will be the worst affected group by the technological change. If there is not an accurate policy of training, there will also appear permanent differences in terms of wages.

The wages will reflect the increasing demand of qualified workers and the decline of low qualifications demand. Differences in wages are becoming

higher depending on qualifications. Technological change has led firms to increase the level of expertise of their workers, and as a result to pay higher wages. The demand of low qualified workers has declined as the ways of production have changed.

Even though unemployment does not rise, in fact, job quality is going to be affected, provided that there is an increasing group of workers poorly paid.

Therefore, the capacity of economies to adapt to technological change and to provide work force according to the new demand of qualifications is going to be the determinant fact in order to check if finally, the result will be a better qualified work force, better paid and more flexible, or on the contrary, the economy will face increasing unemployment rates or a damage of working conditions.

In fact, the main cause of technological unemployment is the lack of adequacy between education and professional training and the new opportunities of employment.

New technologies have obliged to develop human capital and to the workers to continuously training themselves in their work. Workers must specialize strongly in their work and develop their expertise but at the same time, they must be aware of the need to interact with other actors taking part in the production activities.

Mobility and the development of skills for creating working teams, for organisational learning, for the exchange of information, for participation, communication and cooperation are the key elements in the new training and education policies.

Besides, it is very important considering the possibilities of new information and telecommunication technologies, to accelerate their diffusion in society and their introduction in production as they may enrich work and increase productivity. This implies an accurate training strategy aimed at workers in management of these technologies

Another point to take into account is that human resources qualifications must be more and more higher to make use of new technologies but not only as working tools, but also as original knowledge that can permit new business opportunities. In this sense, training is necessary not only to avoid unemployment and to adapt skills to technological change, but also to transfer innovative potential into new possibilities of employment.

#### **4. INNOVATION AS A TOOL FOR CREATING EMPLOYMENT**

Technological changes open new possibilities of investment, of benefit and improvement of competitiveness. If investment is carried out, then technological change through innovation, this is, commercial exploitation of technological potential, can provide new opportunities of employment.

The problem is that investment must be understood in a wider sense. Investment is more than financial capital. Investment must be focused not only in tangible actions but also in more intangible actions. This implies technology transfer, development of know-how, training and education that permit assimilation of new knowledge and utilization of research results.

Obviously, these aspects ask for necessary changes in current institutions. They imply to make more innovative industrial organisations and to make

more entrepreneurial research institutions. Therefore, coordination, cooperation and integration of objectives is imperative.

Firms will not survive in the market without useful ideas, but this makes it necessary to promote innovation and endogenous potential of firms, like human resources, as new sources of growth and employment.

At the same time, research and education institutions must assume a new role in providing knowledge to industry for future innovation, in supporting new firms implementing innovation and in developing human potential.

Nowadays, in the current context of economic and production relationships, firms have become the promoters of change and the main vehicle of innovation diffusion in the market. Firms are the meeting point between scientific knowledge, production and the market. Their significance in the innovation process is clear in their role as instruments of training, learning and exploitation of research results.

Technological change has made it possible in some cases production of goods and services at a small scale. This fact opens new possibilities for SMEs in a context of cooperation and interaction with other actors of the science, technology and industry system.

In this way, enterprises find out new possibilities of business in the application of technology through innovation. Innovation may be an organizational change as a result of learning and experience, the adoption of new processes or the design of new products. However, a very well-known vehicle of innovation is the spin-off.

*Spin-offs are a new entrepreneurial initiative started by a researcher, an student, a worker or a manager taking advantage of their previous experience and learning to develop a new business.*

Spin off are vehicles for exploring new sources of competitiveness, for emergence of new firms capable of creating employment, and for transferring and disseminating knowledge. But above all, spin offs are ways of experimenting new projects.

As experimenting and innovation ways they imply a high risk, a capacity of anticipating change and new trends, an ability for organisation and for leadership, and control of management and costs.

Of course, these are new disciplines for traditional organisations. Therefore, if we assume that innovation is necessary for employment, we also must assume their implications in terms of organisational changes, and of new policies.

First of all, spin offs must be promoted and supported as ways of self employment. In practice, innovation environment and entrepreneurial culture is what determines the emergence of new business or spin offs.

The first obstacle entrepreneur is facing is risk and this concerns necessary support in financial terms. Long term should be the point of reference for investors. In exploring new markets, cooperation, joint venture or strategic alliances can be useful for these initiatives. In any case, this means to develop an ability for communication and cooperation.

Besides, these new initiatives tend to be small. In this case, for small firms, infrastructure, equipment and technology transfer support are very



important. This, again, can be obtained through cooperation with universities, research centres or specialized laboratories.

At the same time, spin offs need expertise in order to differentiate from the others and in order to incorporate high added value into their products. Cooperation is useful but it is important to develop accurate training policies according to innovative abilities required and to the increasing complexity of technologies.

Originality and success of spin offs depend on a wide range of disciplines: knowledge, expertise, capacity of management, of learning, of communication, leadership, financial support, and technology. These are therefore, the aspects to take into account in developing an integral action for innovation and employment.

## **5. POLICY FOR INNOVATION AND EMPLOYMENT**

Europe is interested in promoting its competitiveness and at the same time, a sustainable growth based on the creation of employment. This has to be not only with the creation of new jobs, but also with enhancing the quality of jobs.

As a result, measures must be carried out for encouraging entrepreneurial culture, innovation and development of human potential.

This means that it is necessary to coordinate the objectives of research policy, of innovation policy and of training and education policies in order to make it possible that science and technology contribute to industrial and commercial success.

To transfer innovation into employment concerns an articulated policy around the basic following aspects:

### **1. Integration of science, technology and industry systems**

Innovation policy must be adapted to the specific possibilities and needs of regional industry so that synergies can be emerged. In this way, innovation can be introduced in production structures.

This has implications in terms of research policy. Research must be oriented and planned in order to match industrial needs. In this way, and with the accurate support, spin offs may be possible. Although basic research is needed in the long run to feed knowledge, more attention to development and applied research must be paid, above all, for SMEs.

Research must be useful for economy in order to make it possible the creation of new jobs or the success of spin-offs. But research must be integrated in production. In this sense, mobility schemes between research laboratories, R&D departments, universities and firms may help scientists to understand the behaviour of market.

Besides, it is important to promote the acceptance of technological change in the firms so they can modernize themselves. Here, it must be noted that technology and knowledge are not always developed in the firms so they must have access to specialists. Other possibilities to acquire knowledge are R&D cooperation projects with technology centres or universities and exchange programmes, even international ones.

## **2. Technology transfer support**

Knowledge is more and more complex. Besides, it is not always transferable. Actually, it is acquired through practice, experience and learning.

At the beginning, innovative firms and start ups do not have these abilities. They need expertise to acquire knowledge and technology. Technology transfer programmes contribute to achieve it. This concerns advisory services, technical experts support, support for commercialization in terms of information and also, infrastructure and physical equipment availability that firms cannot afford by themselves.

Here it is very important to enhance learning processes for using new information and telecommunication tools in order to have a permanent dialogue internally at firms, and externally in order to detect needs, possibilities of cooperation.

Technology transfer organisations and this kind of interface institutions must be alert of industrial needs and they contribute to the dissemination of research results. In this way, through interaction new possibilities of business can emerge.

Networks are very important in this sense, so that they permit cooperation and communication among firms, universities and public institutions and without cooperation, innovation is not possible. These networks give support also in terms of research projects, personnel exchange or training concerning regional innovation and local industry, although they coverage must be international.

### **3. Fostering entrepreneurship**

One of the biggest difficulties in transferring innovation is the commercialization. It is also at this stage, when added value is really generated is the and exploitation of research results.

In this sense, it is important the anticipation of changes and new trends and the knowledge of the industrial needs and the market. Prospective activity and assesment to start ups must be provided in order to detect new market niches.

Besides, start ups must have help to identify who and where new firms can get support from in order to find services adapted to their needs. Lack of relevant information on markets, technologies and financial instruments is often an obstacle in establishing a new firm.

Generally, the culture of innovation, entrepreneurship and the environment is important in developing in innovation. Universities, science parks, spatial clusters and this kind of agglomerations tend to provide expertise and facilities for innovation, for research and for entrepreneurship. In this context, it will be easier that new ideas can come up and that learning by networking may happen.

In this sense, it is important to promote research centres, science and technology parks and business innovation centres. However, more important is the dinamization of the networks that appear around these centres.

The financial aspect represents also a weaknesses for new firms. It is necessary to look for new financial mechanisms, to improve the access and

the availability of risk capital to support the creation of new firms. Financing is generally provided in a purely commercial basis, is expensive and poor. An intense activity in order to develop schemes with public support at first stages and to orientate private capital towards emergent firms must be carried out. Exchange of best practices in this aspect and demonstration activities may contribute to increase the amount of risk capital.

Intellectual property must be also encouraged. In the one hand, it is necessary that research results are known. The diffusion of available knowledge alerts possible entrepreneurs on opportunities of business. Sensibilization of the need to establish intellectual property is necessary to avoid research results remain secret.

This means that accurate strategies to protect innovation need to be established. The improvement of the access to patents information will foster the utilization and dissemination of knowledge.

Furthermore, the human element greatly determines the success of entrepreneurial projects. The access to skills and competences is a key element for firms. Firms need human and technological resources. However, it is possible and probable that human competences have not been developed yet by new firms. This concerns entrepreneurial, managerial, marketing, financial and technological competences

Training and education policies are responsible for developing this kind of competences.

#### **4. Training and education**

First of all, firms must have support in adapting to new forms of work organisation. Technological change has brought new changes that lead firms to look for flexibility, specialization, creativity and networking. This kind of competences can only be achieved through training and learning.

Therefore, education policies must provide basic skills for learning that help to develop these abilities. Traditional programmes have tended to provide specific knowledge, but sometimes, difficult to apply in practice. However, today, managers, researchers and students must be able to look for knowledge and technology applications.

Applications, however, can be planned and fostered in a proactive way. Education systems must encourage creativity and risk to foster entrepreneurship rather than to stay in actual jobs, big companies or research laboratories. At the same time, education institutions have to play a role in entrepreneurship involving spin offs and interacting with technological departments and with local institutions.

Business schools, universities and training centres have to offer accurate education programmes adapted to new trends. They have to anticipate future demand of knowledge and changes in employment to encourage adaptation of students and employed workers to technological and industrial change.

It is important to combine theory and practice along the education period, to give collaboration scholarships, to make it possible practices of students

at firms. This provides a better knowledge of industrial and technological reality.

In the case of research laboratories or R&D departments, exchange and mobility schemes help researchers to understand firms behaviour and needs and to know managerial problems that affect to innovation.

In any case, continuous training to develop expertise is necessary at all stages of innovation and even for unemployed people. Technology becomes obsolete very soon and firms must look for new competitive advantages based on new knowledge.

Information technologies can play a valuable role in learning process to encourage distance training and bring it nearer training to SMEs, and to long term unemployed. Communication skills are necessary in a globalized economy to develop interaction and the only possible way to achieve this is through information and telecommunication technologies.

For unemployed people, and for students, information must be provided on labour demands for job matching with employers recruiting workers. Local action could improve information of job availability. Advice and guidance are necessary to adapt labour supply to labour demand and provide accurate skills and qualifications required.

## **6. CONCLUSIONS**

Innovation is necessary to compete in an increasing globalized market. Besides, innovation provides new sources of employment. As a result, an

strategy should consider, the significance of technology, and what is more important, the commercial exploitation of technology and the need to develop the human potential as a differentiation factor and as a key element, in managing innovation and acquiring knowledge.

The unemployment associated to technological change may be due to the fact that technology have change the demand of qualifications. It requires higher specialization and it destroys low qualification jobs.

As a result, human potential is a key element not only at starting new initiatives but also at adapting to technological change. In general, current human skills do not match labour availability. Technology requires specialization and very qualified manpower.

For this reason, it is important to provide the necessary tools to the society in order to acquire new qualifications adapted to the new requirements of technology. This means involving not only employees or enterprises in innovation but also research centres, universities, training centres and information centres in innovation from an interactive approach trying to bring them together all these actors.

Interaction takes place through networking and networks make it possible specialization and flexibility but it takes time to learn to work in this way. The learning process must be reinforced and continuously promoted encouraging the utilization of new information and communication tools, and the development of new skills such as team working, creativity, participation and leadership.

The aim is not only maintaining actual jobs through adaptation but creation of new jobs by self employment and enhancing the quality of jobs.



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