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ASPECTS REGARDING THE COMPETITIVENESS OF MANUFACTURING SECTOR IN EUROPE

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Abstract
The work paper aims to outline that for European industries to remain competitive in the increasingly complex global economic environment, it is crucial to modernize the manufacturing base and strengthen the links between research and innovation. The establishment of appropriate research infrastructures, adoption of new approaches to education and training, life-long learning to re-skill or up-skill the workforce, and encouragement of the mobility of researchers will be further key aspects of the drive to achieve the Lisbon objective.

THE SITUATION OF THE MANUFACTURING SECTOR IN THE WORLD

Asia and China in particular, is becoming an increasingly potent force in the global marketplace. But, although the exodus of less-skilled production jobs to lower-wage countries is inevitable, many experts foresee positive benefits for the world economy as a whole. The latest manufacturing statistics in China show that the sector has become a magnet for foreign investment. China's manufacturing sector now ranks the 4th in the world after the United States, Japan and Germany. Experts attribute the fast growth of the industry to China's huge market potential, low labor costs and sound investment environment. But they also say low efficiency is still a problem for Chinese enterprises. Experts call for more investment in key industries with high technology, so that more breakthroughs can be achieved. They also stress that efficiency is as important as size, and that technology is vital for the overall development of the manufacturing sector.

According to Henry S Rowen – a senior fellow at the Hoover Institution in the USA – writing in The International Economy, *"(China's) manufactured goods exports rose during the 1990s at a 15% annual rate to about $220 billion in 2000. On one estimate, China now makes 50% of the world's telephones, 17% of refrigerators, 41% of video monitors, 23% of washing machines, 30% of air conditioners and 30% of color TVs. Many companies in the USA, Japan, Taiwan and elsewhere are moving operations there. Jobs are shrinking in Mexico's factories as work shifts to China. The building space of foreign contract manufacturers grew from 1.6 million square feet (0.16 million m2) in June 1999 to 5 million square feet (0.5 million m2) two years later*."

However, as Rowen goes on to observe, "…*those who argue that Chinese manufacturing is going to dominate the world soon, if ever, are missing some basic facts. Perhaps their most important oversight is neglect of its manufactured imports, which are almost as big as its exports, about $180 billion in 2000*." Machinery imports are particularly important to produce the goods exported. The result for China in 2000 was a positive balance of manufacturing trade of about $40 billion: an amount that is less than one percent of total world industrial production. Factors that will keep China from sustaining a large manufacturing trade surplus include a growing domestic market, which will continue to generate demand for imports, and lagging technical competence that will take some time to redress.

India also envisages the prospect of seizing a substantial share of global contract manufacturing business, which is currently estimated to be close to $149 billion and is expected to grow to $500 billion by the end of the decade.

The U.S. manufacturing sector also leads in innovation, accounting for more than 90% of all U.S. patents registered annually (*figure 1*). Investments in technology create new industries and careers in manufacturing as U.S. firms introduce products and cutting-edge manufacturing techniques.

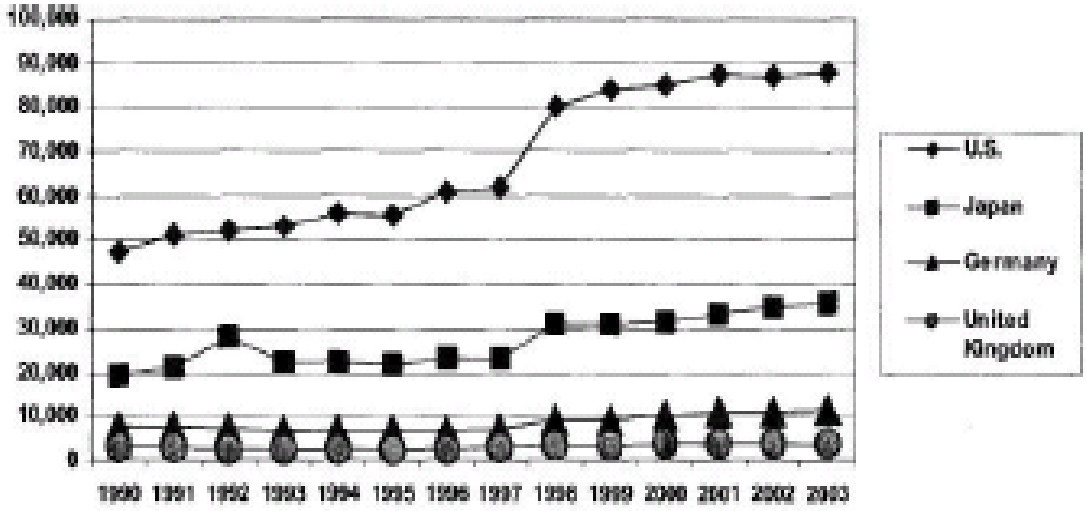

Figure no.1: *Number of Patents granted by year and country*
Source: *US Patent and trademark Office*

The U.S. manufacturing companies offered higher compensation than most of the countries in the world (*figure no.2*). Standing alone, the U.S. manufacturing sector would represent the fifth-largest economy in the world.

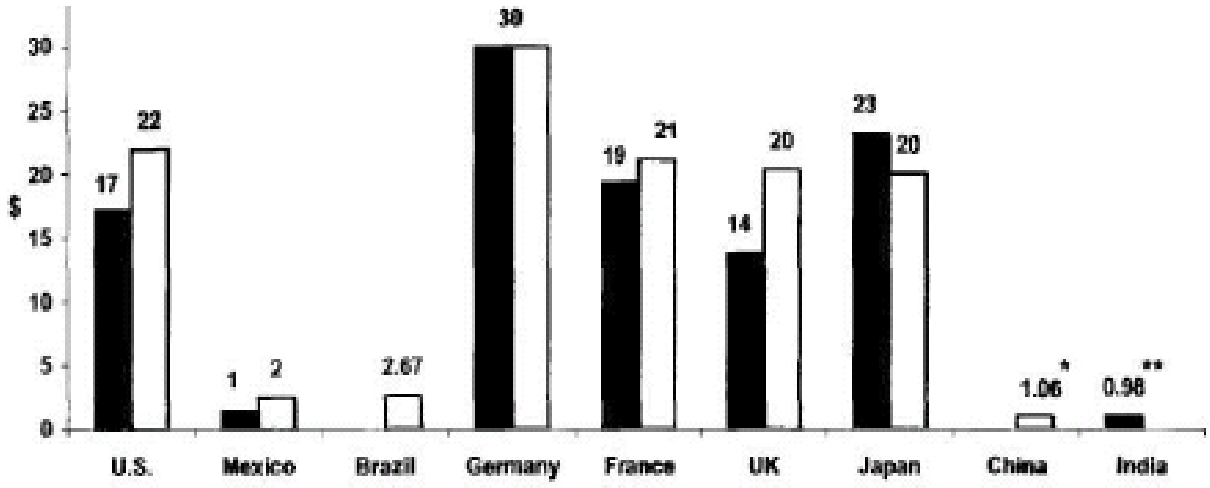

Figure no.2: *Average hourly Compensation Manufacturing Workers*
Source: *Bourse de labour Statistics*

March 2003, the US federal government launched its own Manufacturing Initiative, expressing the belief that manufacturing is the key to competing and winning in a global economy. In a report entitled *Manufacturing in America*, it states: "Manufacturing is an integral part of a web of inter-industry relationships that create a stronger economy. Manufacturing sells goods to other sectors in the economy and, in turn, buys products and services from them. "*Manufacturing spurs demand for everything from raw materials to intermediate components to software to financial, legal, health, accounting, transportation, and other services in the course of doing business. According to the Bureau of Economic Analysis, every $1 of final demand spent for a manufactured good generates $0.55 of GDP in the manufacturing sector and $0.45 of GDP in non-manufacturing sectors. "A healthy manufacturing sector is critical… for other reasons as well – innovation and productivity. Innovation holds the key to rising productivity, and productivity gains are the key to both economic growth and a rising standard of living*."

As a result of increasing productivity, the USA has seen a decline in manufacturing employment over a number of years. A recent study by the US National Institute of Standards and Technology nevertheless underlines the benefits of improved manufacturing productivity to other sectors in the economy. It emphasizes "*the substantial dependency of services on manufacturing firms for technology*" and the "*critical role*" manufacturing plays in stimulating growth in the services sector, which now makes up more than 70% of the US economy.

THE STREIGHTS AND WEEKNESSES FOR EUROPEAN MANUFACTURING

The March 2000 Lisbon European Council set the objective of making the EU '"he most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion". This ambitious target cannot be met without the continuing presence of a strong and competitive manufacturing sector.

Creation of a European Research Area (ERA) for industrial technologies is seen as the way to involve all Member States in creating a strategy for supporting the manufacturing industry. In the last part of the article are pointing out the main directions where the changes will occur.

Analyzing the situation of European manufacturing, a number of European strengths and weaknesses can be identified:

A) Strengths

- European industry is modern and competitive in many areas. A long-lasting industrial culture exists, with large networks linking suppliers, manufacturers, services and user companies;
- Leading-edge research capabilities are available across Member States, leading to high levels of knowledge generation and a reputation for scientific excellence;
- Some 99% of European businesses are SMEs, which typically exhibit greater flexibility, agility, innovative spirit and entrepreneurship than more monolithic organizations. In addition, SMEs tend to interact in a manner that lies between strong competition and fruitful co-operation, which helps to foster the process of what has been called 'co-opetition';
- Europe has taken on board sustainable development. Significant investments in environmental protection, clean technologies and environment-friendly production processes have led to new manufacturing and consumption paradigms;

- Historic and cultural differences between individual Member States and regions bring a diversity of viewpoints and skills that can be coordinated to produce novel solutions.

B) Weaknesses

- Productivity growth in European manufacturing industry as a whole has been below US levels in recent years. Investment in ICT and new technologies is still too low, and has not so far led to the desired productivity gains;
- Innovation activity is too weak. The EU does not suffer from a lack of new ideas, but is not so good at transforming these into new products and processes. Industry's analysis is that this is due to the framework conditions for manufacturers operating in Europe.

PROPOSES FOR IMPROVING THE COMPETITIVENESS OF EUROPEAN MANUFACTURE SECTOR

As a response to the dramatic changes expected in both the scope and scale of manufacturing, the strategy proposed by European union will promote a research oriented strategy that will advocate science & technology based growth for the European manufacturing industry supporting the development of global competitiveness, sustainable development and high value added employment. Europe cannot afford to fall behind in science and technology.

The dimensions within which manufacturing enterprises operate are also subject to major change. Manufacturing is evolving from local satisfaction of local needs to production patterns able to respond flexibly to global demand. In parallel with this trend, the timescale of product conception and development is shifting from the long to the shorter term – and ultimately to a near real-time response.

In addition, manufacturing is likely to become increasingly service-intensive. This service orientation and the increasing customer expectations will have consequences for the competitive organization of production, value-chain management and customer relationships, as well as the service elements themselves.

The options for adapting to the new conditions are illustrated in *figure no. 3*.

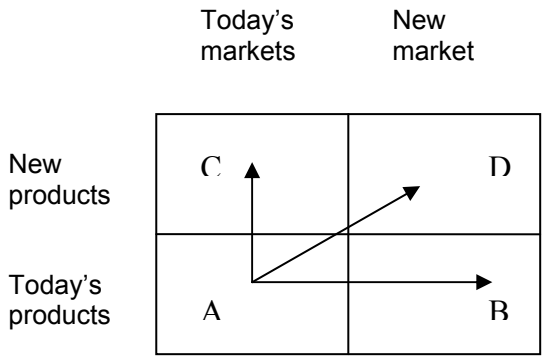

Figure no.3: Scenarios for improving the comparative advantage of the manufacturing sector

A – Centralised, local production
B – Distributed production, global market
C – Leadership in technologies
D – New business models and technologies for strategic innovations

The *situation A)* represents the status quo, where the companies are trying to gain competitive advantage through mass customization, high quality and short time-to-market. However, concentration solely on short term advantages will put into danger the competitiveness in the long term.

Even for less research-intensive enterprises, there will be clearly a need to move towards *situation B)*, in which production is matched to the demands of customers enjoying a wealth of choice in a globalize marketplace. This will apply equally to enterprises supplying niche markets and to those serving large customer bases.

Research-intensive organizations may already be working towards technological leadership as a way to innovate new products (*situation C)*), but they must combine the technological approach with the adaptation to new market conditions in order to reap maximum benefit from their innovations (*situation D)*).

Naturally, *situation D)* requires long term, high-risk investments and is therefore a challenge especially for the smaller enterprises. However, the risks of "short-term" and "business as usual" are even higher.

The traditional structure of manufacturing industries is constructed upon the three pillars of land, labour and capital. The challenge is to move towards a new structure, which can be described as 'innovating production', founded on knowledge and capital. The transition will depend on adoption of new attitudes towards the continuous acquisition, deployment, protection and funding of new knowledge. Change will occur in six main areas:

- *From resource-based to knowledge-based* **-** Increasing the knowledge content of manufacturing will lead to more economical use of materials and energy.
- *From linearity to complexity* **-** To accommodate the changes foreseen in manufacturing processes, industrial enterprises must also re-examine their organizational structures. Former linear approaches to product and process renewal must be replaced by a 'manufacturing engineering' strategy that simultaneously addresses all inter-related aspects.
- *From individual to system competition* **-** Single companies working in isolation will not be able to respond to challenges of the magnitude that will arise in effecting such fundamental transformation – and even whole countries will find problems in mustering the necessary human and financial resources
- *From mono-disciplinarity to transdisciplinarity* - Innovation processes centered on single competences will give way to multicompetence and multidisciplinary innovation. In the mid-term, added value will come primarily from an increasing convergence of the three most revolutionary industries: microelectronics, nanotechnology and biotechnology.
- *From macro- to micro- to nanoscale* **-** The electronics and biotechnology industries are already well advanced in merging materials design and manipulation with product processing. The progressive reduction of device dimensions, together with the added functions provided by knowledge-based materials, is permitting substantial savings to be made in resource use across the whole swathe of user sectors. But as this shrinkage approaches the nanoscale, established technologies are reaching their physical limits. To take the next steps, breakthrough research will be needed
- *From top-down to bottom-up production* **-**Over a longer timescale of, perhaps, 20 to 50 years, it is to be hoped that scientists will solve the problems of mimicking nature, making it possible to move from today's top-down methods to bottom-up manipulation of individual atoms and molecules.

Because of diversity of manufacturing activities, the number of actors involved and widely different national and regional needs across the EU, these challenges obviously cannot be met by a single universal solution.

The Strategic Research Agenda for Manufactory European Sector that will accompany this document envisions a multiperspective approach based on:

- Creating an integrated knowledge-sharing community, with strong links between academia and industry;
- Building a world-class R&D infrastructure;
- Adopting new business models, organizational concepts and working methods;
- Establishing a favorable economic and regulatory climate to encourage research investment and entrepreneurialism;
- Restructuring education and training to reflect the lifelong learning needs of tomorrow's 'knowledge workers'; and
- Increasing public awareness of the value of science, the rewarding career opportunities that will arise in knowledge-based manufacturing and the importance of sustainable production/consumption patterns.

A number of implementation plans will therefore be formulated, consistent with the step-wise development of the Strategic Research Agenda and aiming at mobilizing stakeholders and resources at the most appropriate levels.

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