UNITED NATIONS **E**

Economic and Social Council

Distr.
GENERAL

ECE/CECI/2006/3/Add.1
11 July 2006

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

COMMITTEE ON ECONOMIC COOPERATION AND INTEGRATION

First session
Geneva, 27-28 September 2006
Item 5 of the provisional agenda

SUBSTANTIVE DISCUSSION SEGMENT: "COMPETITIVENESS IN THE MODERN ECONOMY: CHALLENGES FOR THE UNECE REGION"

Competitiveness and Innovation

Note by the Secretariat

Addendum

I. SELECTED TOPICS

A. Development and quality ladders

1. Higher-income countries (e.g. those with developed industrial economies) generally specialize in products with higher value added or higher technological content. This is due to their human capital or skills endowment and to the technological knowledge they have accumulated. Products with low value added content cease to be competitive due to high labour costs in these countries. Lower-income countries, on the other hand, tend to specialize in products with low value added and low technological content.

2. This type of international division of labour is, however, not static; on the contrary, it changes continuously. In the case of homogeneous products with low barriers to access to production technology, lower-income countries can imitate the technology that higher-income countries use and thereby become competitive in these markets. Thanks to their lower labour costs, the lower-income countries gradually succeed in displacing producers in higher-income countries. If industries in the developed industrial countries wish to survive, they must increase their innovation efforts and develop new or differentiated products. If they successfully do so, their technological lead more than compensates for their wage disadvantage, at least temporarily. In this process of changes in the international division of labour, both higher and lower-income countries are climbing up the quality ladder, as they are both shifting production towards products of higher quality.[1]

3. In lower-income countries, strong and sustained economic growth is usually accompanied by rapid changes in the structure of their output and exports towards products with higher technological content and value added. If growth persists over a long period, these economies will catch up with higher-income countries in terms of standards of living. The convergence of incomes is accompanied by convergence of economic structures. Hence, the patterns of specialization of output, employment and exports tend to become more similar to those of higher-income countries as the catching-up process evolves.

B. The determinants of productivity

4. Researchers linked to the Harvard Institute for Strategy and Competitiveness [2] have used an explicit interpretation of competitiveness as the set of factors that explain productivity. This covers a wide range of determinants. An overall indicator is constructed on the basis of seven components: openness, finance, good government, infrastructure, technology, labour markets (including quality of the labour force) and institutions. All are strongly interrelated - for example, a developed financial system that is able to manage innovation-related risks will have ultimately a positive impact on technological progress. In a broad sense, productivity growth

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[1] K. Aiginger, "The use of unit values to discriminate between prices and quality competition", *Cambridge Journal of Economics*, Volume 12, No. 5, 1997.

[2] J. Sachs, C. Zinnes and Y. Eilat, "Benchmarking Competitiveness in transition economies", *Economics of Transition*, Volume 9, No. 2, 2001.

depends on the quality of institutions, understood as the set of rules, norms and organizations that coordinate human behaviour.

C. Competitiveness councils

5. Competitiveness councils provide a forum for industry, academic and labour representatives, and sometimes also government officials, to exchange views. Such councils may also be formed at the subnational level, in view of the importance of the territorial dimension of competitiveness. They can contribute to creating a shared vision of a long-term strategy to foster competitiveness, while identifying the problems that need to be addressed. Critically, the broad focus of these councils acknowledges that enhancing competitiveness is a cross-cutting issue that requires interventions in many different fields. Exchange of experiences between different competitiveness councils (across regions and countries) may serve to draw useful lessons, to identify common problems and to outline areas where common action could be beneficial.

D. Clusters and competitiveness

6. The formation of clusters, a critical mass of companies over a certain territory, interlinked by a web of supply and demand interrelations, provides a solid foundation for the emergence of competitive advantages. The ability of companies to compete depends not only on their own capacities but also on the quality of the business environment in which they operate and on the linkages (upstream and downstream) with other companies.[3] The concept of cluster emphasizes the importance of interaction between companies and their customers, suppliers and even competitors. Clustering is now seen as a source of increasing productivity, capacity for innovation and productivity growth, and as facilitating new business formation.

7. Geographical clusters foster the formation of "relational assets". Even though external to individual companies, they nevertheless support the competitiveness of the whole cluster. Qualitative factors, such as for example, informal networks of exchange or trust among participants, facilitate the formation of "relational assets". The attractiveness of clusters largely depends on the existence of so-called external economies of scale, i.e. the reduction of costs to individual firms as the size of the cluster increases, e.g. through knowledge spillovers.

8. Cluster policies focus on the establishment of close relations between the public and private sectors. Public intervention aims to support the efforts of the private sector to improve performance, in an integrated strategy to build a competitive advantage. Industrial or science and technology parks constitute particular types of clusters that make common facilities available to the participants while encouraging relations between them. More generally, these types of policies to improve competitiveness can be seen as a collaborative process, involving different government levels, private-sector participants and education institutions. These cooperative agreements may also have a cross-border dimension.

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[3] OECD, *Innovative Clusters* (Paris), 2001.

E. General-purpose technologies

9. General-purpose technologies (GPT) are considered as "enabling" technologies, which provide new opportunities for innovation and productivity increases in other sectors. This characteristic promotes their adoption throughout the economy. Their contribution to economic growth lies mainly not in changes taking place within the sector where they originate but through their propagation. Some of the defining features of GPT are: significant scope for improvement, applicability and relevance for many uses and strong complementarities with new or existing technologies. Information and communication technologies (ICT) are the main GPT of our time, as electricity or the railways have been in the past. The concept of GPT is also applicable to organisational changes.

F. National innovation systems

10. Innovation results from complex interactions between different actors, being influenced by the system of incentives and the general framework conditions for economic activity.

11. The main generators of innovation are knowledge institutions and the enterprise sector. The former include universities, research institutes and technology-providing firms. Their main objective is to generate, process and transmit knowledge in a range of forms spanning from basic science to applied technology. Innovation in the enterprise sector results mainly from the application of new knowledge to firms' production and marketing processes. This new knowledge is generated in-house by firms (e.g. by corporate research laboratories) or externally, through interactions between firms and other economic agents, such as knowledge institutions, but also market agents such as suppliers, clients and consumers. The increasing complexity of knowledge and of the innovation process has deepened the division of labour, leading to increasing collaboration between firms. This type of collaboration has therefore become a major channel of knowledge flow in the economy.

12. Interaction between the enterprise sector and knowledge institutions is particularly important and has turned out to be even more so over the last 20 years, for several reasons. Given the very high costs of in-house research and development (R&D), many firms have outsourced these activities to knowledge institutions. These seek business tie-ups as a way to partly compensate for resource scarcity due to budgetary restrictions (particularly in the case of publicly funded R&D). Some industries (especially high-tech sectors such as ICTs and pharmaceuticals) rely heavily on knowledge generated by such institutions for their innovations and business development. The spread of ICTs has favoured collaboration between the enterprise sector and knowledge institutions, as it greatly facilitates the codification and transmission of knowledge.

13. Governments (national, regional or local) are an essential component of National Innovation Systems (NIS). They finance directly a certain part of R&D (particularly in basic research), mainly in universities and research institutes. Besides, some policy measures encourage the collaboration between public and private institutions, in order to foster innovation.

14. Governments are responsible for the framework conditions in which the NIS operates. These include both macroeconomic aspects and the regulatory environment in labour, capital and product markets. Government policies greatly affect firms' incentives to innovate. The

enforcement of strong competition institutions resulting in a competitive environment represents a major innovation driver. Industrial, innovation and fiscal policies, if coherent and properly implemented, can also reinforce the incentives to firms to engage in innovative activity.

15. The concept of NIS does not imply isolation or a denial of the importance of international networks for the transmission of knowledge and technology. The NIS provides a useful analytical tool to assess a complex set of interrelations, including those related to the ability to participate in those international networks, while generally taking into account the international context both regarding institutions and policies.

G. Financing of innovation

16. Innovative activities are particularly difficult to finance, as cash flows are unproven and unpredictable. The level of risk and the financing needs vary through the cycle of invention to mass commercialisation. The scope for commercial financing changes with the specific position within this cycle. The overall degree of financial development is a major determinant of cross-country differences in innovation activities.[4]

17. Equity and grants are better suited than loans to finance innovative activities, since the fixed schedule of repayment of a loan may be difficult to reconcile with uncertain cash flows. The generation of ideas depends on the perception that financing would be forthcoming, so support programmes should identify any bottlenecks along the whole life of the project, leading up to mass commercialisation..

18. The initial stages of technological development present the most serious financing challenges. Existing companies may rely on internal resources but for start-ups this is much more difficult. In mature markets, "angel investors", i.e. entrepreneurs in the same line of business, with specialized knowledge, provide a supplementary source of finance. In less mature markets, exposure to international networks can compensate for the lack of domestic expertise.

19. Venture capital (VC) financing becomes usually available at a relatively late stage of the innovation process, where a commercial application and possible markets have already been identified. VC is a form of commercial financing that depends on a steady flow of possible opportunities; only a few of which will be considered "investment worthy". Out of these, many will fail, a few will provide only adequate returns and a very few will generate extraordinarily large returns that would allow an overall rate of return commensurate with the risks. A strong "deal flow" of opportunities needs to be complemented by "exit possibilities", allowing venture capitalists to sell their investments. Bankruptcy legislation and taxation, especially of capital gains, influence the development of the VC industry.[5] Pension funds can be a source of financing for VC investments, but this may be hampered by existing restrictions on portfolio allocation.

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[4] F. Jaumotte and N. Pain, "From Ideas to Development: The Determinants of R&D and Patenting", *OECD Economics Department Working Paper*, No. 457, 2005.

[5] OECD, *Going for Growth* (Paris), 2006.

20. Public-private partnerships can also provide supportive financing arrangements for innovative activities. They make possible the use of the private knowledge of target industries and management expertise while reducing the risk to private operators as a result of public participation. Public funding is sometimes used to encourage VC activities, either through direct co-financing, guarantees or unequal sharing of returns.

H. Intellectual property rights

21. Intellectual property rights (IPRs) comprise patents, copyrights, trademarks, trade secrets, industrial designs, integrated circuit layout designs (i.e. microchip designs) and geographical indications of origin (mostly for agricultural products). The case for (limited) IPRs rests on the notion that research, development, and commercialization of new products or processes often requires considerable upfront investments. It is typically a high-risk venture where a few successes have to cover the costs of many failed attempts. For this reason, the upfront investment costs often dwarf the subsequent unit costs of producing a new product (or using the new process), once it has been invented. Recovering these investment costs and compensating for the risk incurred therefore is possible only if innovators are able, at least for a limited period of time, to sell their products at mark-ups substantially exceeding marginal production costs. Alternatively, they need to be able to sell their innovations to others at a price covering their costs.

22. Patents and other IPRs allow innovators to control access to the innovation once it is being made public, and thereby to prevent would-be imitators from competing away their mark-ups. They support innovative activity by providing financial incentives for innovation, while encouraging successful innovators to put their new knowledge into the public domain so that others can build on it for future innovation.

23. The allocation of IPRs among the participants in collaborative research, sometimes with public funding, becomes an integral part of the creation of a suitable incentive structure that underpins the success of these joint efforts.

24. Patents and other intellectual property rights are assets for their holders. As such, they can be used as a way to raise external financing, to yield revenue through licensing or to offer them as contribution in the collaboration with other companies or research institutes. They may be a core component of business strategies, being particularly important for SMEs. The use of IPRs as business assets depends on the methods of their valuation and the public support to this use. Examples of public support to enhance the use of IPRs as business assets include legal initiatives to include IPR among the asset classes that can legally be pledged as collateral and to develop accounting and disclosure standards for IPRs.

25. At the same time, IPRs impose costs on the economy and society precisely because they limit access to the use of new knowledge and exclude some potential beneficiaries and other innovators from using it. These barriers potentially reduce the rate of innovation and limit competition in product markets. Concerns about recovering the costs of investment in innovation prevail in countries at the leading edge of technological development. In countries trying to catch

up with the technological leaders, not unduly restricting access to innovations is high on the policy agenda. [6]

26. A balance must be ensured between the need to provide adequate financial incentives for would-be innovators by giving them some exclusive rights over the commercial exploitation of their innovations and the desire to allow widespread diffusion and use of existing knowledge as an input for future knowledge creation. As a result, IPRs are typically limited both in duration and scope. Where exactly to strike that balance, however, is a complex and contentious issue.

II. COMPETITIVENESS INDICATORS

27. The concept of competitiveness has been amply debated and remains problematic when applied at the national level. Competitiveness is sometimes examined in terms of a single dimension such as changes in exchange rates, labour productivity or unit labour costs. Composite indices, which include a number of variables, have become popular means to benchmark competitiveness across countries. This section provides an overview of some of these exercises.

28. The World Economic Forum (WEF), which prepares a well-known annual assessment of countries' competitiveness, defines competitiveness as "the collection of factors, policies and institutions which determine the level of productivity of a country"[7], thus having an impact on its prosperity. Hence, the emphasis is not on the outcomes but on a number of influencing elements that may have a potential impact on competitive performance.

29. These are grouped in three "pillars": the quality of the macroeconomic environment, the state of the country's public institutions and the level of its technological readiness. Indicators under these headings are compiled on the basis of quantitative data and opinion surveys. They are aggregated into a competitiveness score, the "Growth Competitiveness Index" (GCI). A certain degree of differentiation across countries is introduced. This concerns the distinction between core and non-core innovators, as for the latter adoption and technology transfers represent realistically more relevant issues than innovation. Competitiveness factors differ between these two groups of countries. However, mere imitation by the non-core countries is not sufficient, as they are trying to get closer to a moving target with technologies being constantly modernized. Some degree of innovation, adapted to national circumstances, becomes necessary.

30. Another index, the "Business Competitiveness Index" (BCI), emphasizes the microeconomic factors that explain the current levels of productivity and competitiveness. This differs from the macro, forward-looking approach of the GCI. The BCI attempts to measure two

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[6] K. Blind, Standards, *Technical Change and IPRs: Lessons from Industrial Countries for Developing Countries. Industrial Development Report 2005 background paper*, UNIDO Office of the Director General (Geneva), 2005.

[7] A. López-Claros, M.E. Porter and K. Schwab, *Global Competitiveness Report 2005-2006* (London), Palgrave Macmillan, 2005.

main aspects: the sophistication of company operations and strategy and, second, the quality of the business environment in which they are operating.

31. WEF has recently launched a third index, the Global Competitiveness Index, which includes a wider range of factors that influence growth. It is based on new "pillars", including institutions, infrastructure, macroeconomy, health, education and training, market efficiency, technological readiness, business sophistication and innovation. The new index continues with the idea that not all the factors are equally important for all the countries, given the different stages of economic development. A distinction between phases in the development of national competitiveness is made. These different stages are factor driven (competitive advantage based on endowments), investment driven (efficiency in producing standard products) and innovation driven (ability to produce innovative products using the most advanced methods).[8]

32. The International Institute for Management Development, Lausanne, Switzerland, also compiles annual rankings of countries according to their competitiveness. Similar to WEF, it emphasizes influencing factors. It defines the scope of the assessment as " the analysis of how nations and enterprises manage the totality of their competences to achieve prosperity and profit" [9]. The assessment focuses on the interaction of four competitiveness elements (economic performance, government efficiency, business efficiency and infrastructure), specified by around 300 factors. The interaction of these factors then creates a national environment that supports competitiveness.

33. More modest in scope but more focused is the assessment of competitiveness prepared by UNIDO, which compiles an Industrial Development Scoreboard to benchmark national industrial performance. This includes a Competitive Industrial Performance index, constructed on the basis of four simple indicators: manufacturing value added per capita, manufacturing exports per capita, share of medium and high-tech activities in manufacturing value added and share of medium and high-tech products in manufactured exports. Unlike the WEF and IMD indexes, the UNIDO assessment emphasizes actual performance, with a particular interest in the situation in developing countries.[10] The Scoreboard also provides information on a number of structural factors that affect the countries' industrial capabilities. These include skills, technological effort, inward FDI, royalty and licence payments abroad and modern infrastructure. The index is simple and includes relevant variables, but, as in the case of other composite indexes, aggregation methods make the validity of the rankings somewhat questionable.

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[8] This follows the work of Michael Porter, a business economist who has made important contributions in this area.

[9] S. Garelli, *Competitiveness of Nations: the Fundamentals*, accessible at www01.imd.ch/wcc/fundamentals.

[10] A simple index, inspired by UNIDO's work, which also focuses on actual performance in developing countries, has been developed on the basis of four variables: manufacturing exports per capita, average manufactured export growth per annum and technology-intensive exports as percent of total merchandise exports. G. Wignaraja and A. Taylor, "Benchmarking Competitiveness: A First Look at the MECI" in G. Wignaraja, *Competitiveness Strategy in Developing Countries* (London), Routledge, 2003.

34. While the European Bank for Reconstruction and Development (EBRD) does not have a specific programme on competitiveness, its work touches upon significant aspects for competitiveness in transition economies. The extensive Business Environment and Enterprise Performance Survey, the third round of which was undertaken in Spring 2005, provides a picture of the various factors shaping the business environment, which are grouped in seven categories: business regulation, labour, taxation, institutions and property rights, infrastructure, finance and macroeconomic environment. The EBRD transition indicator facilitates the assessment of the quality of policies in areas that have an impact on competitiveness. Other elements that are also relevant for competitiveness, such as the quality of corporate governance, are also surveyed regularly and appraised against benchmark principles issued by the Organisation for Economic Co-operation and Development (OECD).

III. INDICATORS OF INNOVATIVE ACTIVITY AND PERFORMANCE

35. OECD has developed a multi-dimensional system to assess the science, technology and innovation (STI) performance of countries based on a list of composite indicators. These indicators include five broad categories: innovation in the company system, knowledge generation through the education and research systems, industry-science linkages, absorption capacity, and overall performance. Many of the indicators measure inputs devoted to innovative activities. These include business R&D expenditures, employment in medium and high-tech manufacturing and services, government funding of R&D, stock of inward FDI, venture capital investments, spending on higher education. More output-oriented measures comprise number of patents, number of scientific publications, new science and engineering graduates, PhDs, population with tertiary education, share of innovative firms, labour productivity and value added growth in medium and high-tech sectors.

36. The World Bank has developed a Knowledge Assessment Methodology (KAM), which produces indicators based on 80 variables grouped into four areas: economic incentive and institutional regime, education and human resources, innovation system, and information and telecommunication technology. In addition, measures of overall economic development and performance are taken into account. The broadest of the World Bank's aggregate indicators is the Knowledge Economy Index (KEI), which aims to assess whether countries have succeeded in creating an environment conducive to using knowledge effectively for economic development.

37. A similar methodology has been developed by the European Commission. Like the World Bank, it produces an Innovation Scorecard with a broad set of detailed indicators, as well as more aggregate indices, the broadest of which is the Summary Innovation Index (SII). The country rankings produced by the EU and World Bank indicators are fairly similar. The World Economic Forum (WEF) is compiling National Innovative Capacity indices and Network Readiness Indices, which include qualitative, survey-based measures in addition to quantitative variables.

38. Within the United Nations system, several organizations have also produced indicators assessing innovative capacity or performance. These include UNDP's Technology Achievement Index, UNIDO's Competitive Industrial Performance Index, and UNCTAD's Innovation Capability Index. UNDP's and UNIDO's indices focus more on output indicators (such as

patents, income from royalties and license fees, internet hosts, high and medium technology exports, years of schooling, tertiary science enrolment). UNCTAD's index comprises a technology activity index (R&D personnel, U.S. patents granted, scientific publications) and a human capital index (literacy, secondary and tertiary school enrolment).