

Elements for integration the country position papers

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This paper is based on an assessment of most position papers according to their status in February 2006 (Habana).

As general impression, the papers provide, already in the present status, a good overview of the role of universities in different countries linked to their specific state of development. In particular, the comparison shows that third missions are defined in a different way at different stages of development. This means that, if the papers are written in a more unified way, it would be possible to edit a referring book.

An d important issue is to provide data characterising the innovation systems and the situation of universities in a comparable way. So absolute numbers are interesting but should be supplemented by relative data for making the countries comparable. Relevant items are:

- Percentage of total (public and private) R&D with reference to the GDP (Gross domestic expenditure on R&D, GERD)
- Public share within the total GERD
- There should be a clear definition of business R&D, here the R&D should be performed by and in the enterprises, not externally by other institutions.
- The relative share of university research within public research should be indicated. So the volume of research of non-university public institutions should be indicated. This nis an important characteristic of a country.
- The number of students (enrolment) should be given, if possible also the number of annual graduates. Both figures should be referred to the population of a country. For instance, there are 1.305 mio students in Germany and a population of 82,495 mio leading to 15.8 students per 1000 inhabitants.
- The number of universities is interesting, but must be supplemented by the student number, as universities may have quite different sizes.
- The universities should be differentiated by private and public, but again the number of students is important.
- For the number of students, the development in time for about the last 20 years is characteristic.

- There should be a clear distinction between different types of higher education institutions. The basis for this can be the International Standard Classification of Education (ISCED). Universities should be linked to the classification levels 5A and 6, 5A is tertiary education with a distinct theoretical focus with a minimum theoretical education of three years providing qualification for research. Polytechnical schools or similar institutions are on the level 5B. Level 6 aims at the submission of a thesis.
- A characteristic feature is the share of students in social sciences and humanities.
- A further important point is the sources of university funding. (Public base funding, additional private sources, student fees, external funding of research by industry/contract research or foundations etc.)
- Polytechnical schools and their enrolment should be addressed as well, as this activity is important for the provision of skilled staff for industry, administration etc. (ISCED 5B).
- A further important aspect is the structure of industry. In addition to the overall industry share of R&D the structure (relative shares) of sectors by production or foreign trade is illustrative, as it characterises the engagement in R&D-intensive sectors.
- As to the characterisation, different definitions of high-tech, medium-tech and lowtech are used. We use in our reports the following concept:

It is useful to focus the analysis of technological performance of an economy on those sectors in which science, knowledge, research and technology play a decisive role in entrepreneurial activities. Therefore the branches of economic activity are classified according to their 'technology intensity'.

In manufacturing industry the R&D intensity (**share of R&D expenditure in turnover or value added**) is the most critical indicator in this respect. The cutting rule is: Any sector or product group with an above average R&D intensity (what means at least 3.5% in 1995-1997) is called '**R&D intensive**'. The enumeration of R&D intensive products alone, however, would still conceal considerable intensity differences among this group. Therefore a further differentiation is made between '**high-level technology**' (3.5 to 8.5%) and '**leading-edge technology**' (more than 8.5% in 1995-1997). 'Leading-edge technologies' on the one hand are cross-section technologies (e. g. biotechnology, electronics) and the key factors for related product groups such as pharmaceuticals, computers, telecommunication equipment, scientific instruments but also for users

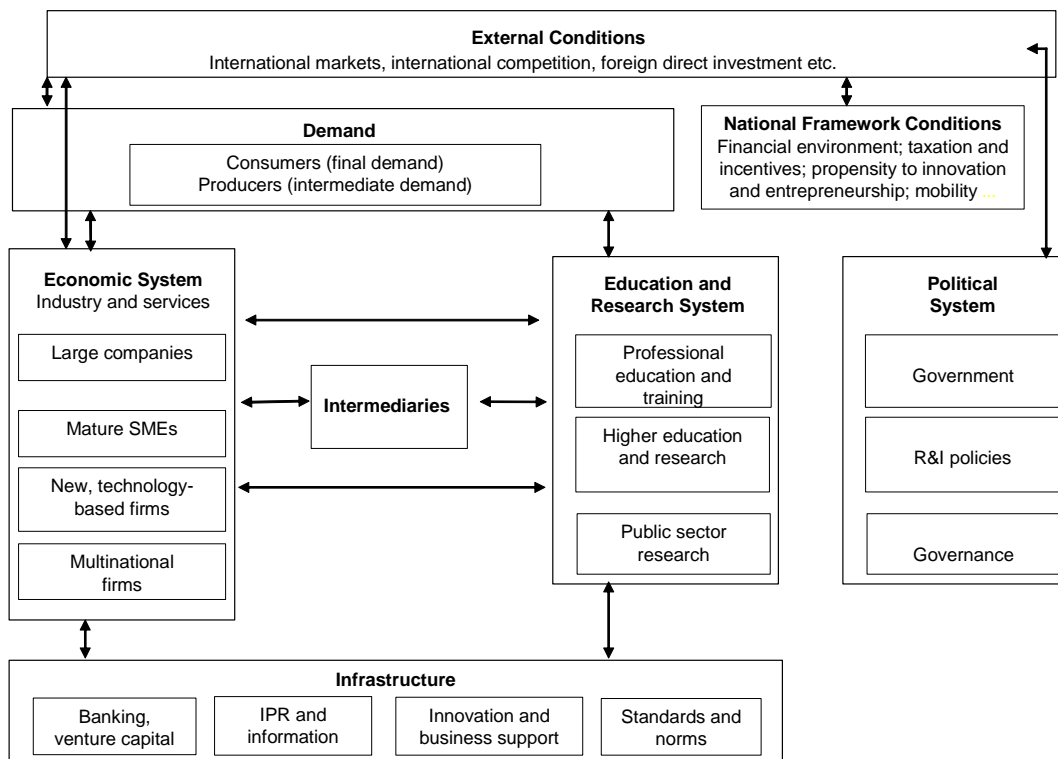
in other branches. On the other hand, they often are subject to protectionism, such as in aircraft and aerospace or weapons technology. In 'high-level technology' industries, there is still a need for above average R&D activities, too. But they are concentrating less on research, but more on experimental development.

This concept is conceived for the situation in advanced countries beginning at a level of 3.5 percent. We could add medium-level technology (1 to 3.5 %) and low-level technology (below 1 %).

- In the service sector however technological R&D is not an adequate indicator for the generation and use of new knowledge, as investment in R&D is not that important. Rather we can assume that the innovative potential is embodied in the skills of workers. 'Knowledge-intensive services' are defined by an intensive employment of academically trained workers, natural scientists and engineers in particular, or by selected occupational characteristics (such as high shares of workers in planning, construction, development, research, consulting). Therefore, in this sector we mainly find knowledge-intensive business services (e. g. telecommunication services, software development, economic and technical consulting), but also some other services with a high affinity to technology (health, media, transport).

All papers draw, directly or indirectly, on the concept of national systems of innovation (NSI). Therefore a joint definition should be used: "NSI is that system constituted by elements and relationships in which the production, diffusion, use and transformation of new and economically useful knowledge take place. The concept of elements here basically refers to two major components of the system, organisations and institutions. Institutions include things like policies, rules, regulations and norms. On the other hand organizations are formal structures where things happen ..."

Starting from this definition, NSIs can be illustrated by the enclosed graph which can be used as a kind of check list. In this illustration, the economic system encompasses manufacturing as well as services. In addition to firms of different size multinational firms are explicitly included. Furthermore the external conditions comprise the item foreign direct investment. On this basis, it should be possible to still speak of NSIs, as each country is characterized by a specific structure of multinationals in the country and FDI abroad. This cannot be depicted in a rational way by a global system of innovation, in any case, the depiction would be too complex.



In a potential book, the country papers should be complemented by an integrative paper where the international averages for students, GERD etc. are documented as reference.

An assumption in several papers of developing countries is that there are close linkages between universities and industry in advanced industrial countries. A look at the papers of Denmark, Sweden and Germany shows that in these countries, the university-industry interaction is difficult too. A further assumption is that start-ups from universities considerably contribute to the economic dynamic. In this context, the US example is taken as implicit benchmark. But the strong impact of start-ups in ICT and biotech in the US cannot be generalised with regard to other sectors and countries without modification.

In the paper, the concept of the third mission is used in different ways. Most papers link it to the knowledge and technology transfer of universities to firms, others highlight activities with regard to social needs (support of public authorities, health services, law assistance, organisation of social events etc.). In the discussion, there was an agreement that both dimensions should be covered. I would suggest in addition that we label

the activities for social needs as forth mission, as in the literature, third mission is generally associated to technology transfer.

The scan of all papers reveals a first rough structure which should be discussed in more detail: There is a group of industrialised countries (Germany, Sweden, Denmark). A second group is socialist or former socialist countries (Latvia, Russia, Cuba, China). Their joint characteristic is the separation of R&D from the firms leading to specific structures. Of course, these countries can also be associated to other groups. A third group are the catch-up countries (Brazil, South Africa, China, Latvia?) which presently are in an active growth stage. The next group refers to developing countries with a low economic dynamic. This refers, despite considerable difference, to Tansania and Uruguay. The structures will get clearer, when the indicators are transferred into a comparable format.

My attention was attracted by some items in some papers which may be taken up by other papers.

- Although our focus is on the third (and fourth) mission, we have to be aware of the important role of universities in education. Universities are responsible for the provision of highly qualified staff for industry and services. Therefore a stronger orientation on professional needs is important. Furthermore the share of students in engineering, natural and life sciences is crucial.
- In this context, the improved orientation of the teaching staff on requirements of the economic sector is important.
- In many countries, the need for external funding is relevant or increasing. Therefore this question should be addressed in more detail.
- The Uruguay paper addresses the crucial role of high-tech firms for the low-tech sector. This argument takes up an idea of Keith Pavitt (Pavitt, K. (1984): Sectoral Patterns of Technological Change. Towards a Taxonomy and a Theory, in: Research Policy, Vol. 13, S. 343-373) and was developed by the example of the UK. We should look whether it is useful for other countries as well.
- It is obvious that the role of universities is different in different stages of development. At a lower level the fourth mission and an active initiation of firm activities by universities are quite relevant. In contrast in more advanced countries, the activation of research by medium-sized firms by various incentives (subsidies to research staff, tax exemption, subsidies to collaborative research with universities etc). seems to be more important for a further increase of university-industry collaboration. There it is more important to develop a better ab-

sorptive capacity on the side of the firms for improving the situation (Cohen, Levinthal).

- With regard to technology transfer, the role of universities has to be considered in a more critical way. Various papers report of an overload of work and linked to that time pressure and worry about the marketisation and commodification of knowledge. In any case, we have to look whether universities are always the appropriate partners of industry. In many cases, more applied institutions seem to be more effective (polytechnical schools, specialised non-university units e.g. for agricultural extension)

In any case, the different papers document many different experiences so that there is much room for mutual learning.

An open discussion is still whether a high-tech strategy comparable to South Korea is a useful means for other catch-up countries as well. Is such a strategy promising, how should such a strategy be conceived, what are the disadvantages of such a strategy?