”The Swedish Paradox”

Presentation at IVA, October 22, 2009

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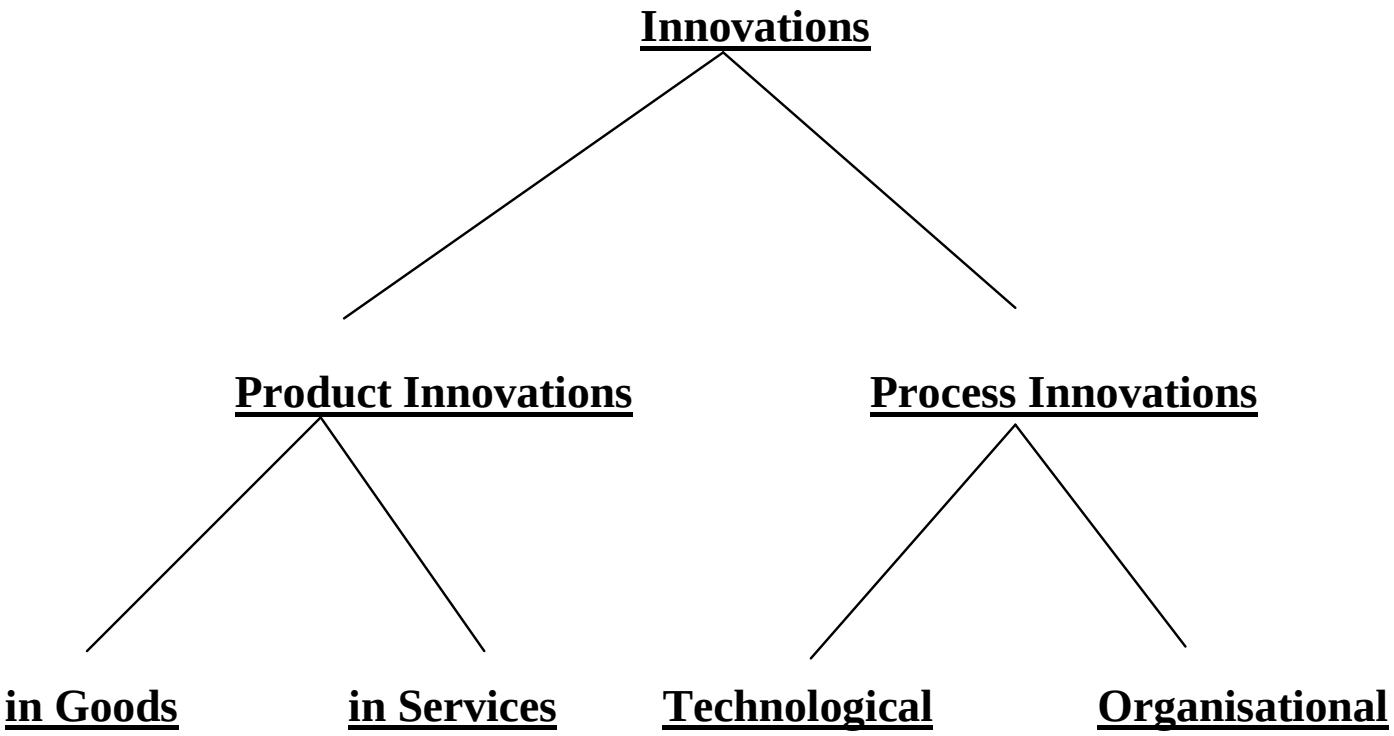
A Taxonomy of Innovations

- **Innovations** are here defined as new creations of societal significance.
- They include **product** innovations as well as **process** innovations.
- **Product** innovations are new – or better – products (or product varieties) being produced and sold; it is a question of *what* is produced. They include new material **goods** as well as new intangible **services**.
- **Process** innovations are new ways of producing goods and services; it is a matter of *how* existing products are produced. They may be **technological** or **organizational**.

A Taxonomy of Innovations



Sources of labour productivity growth:

- More capital: ¼
- Better education: ¼
- The residual = innovation: 1/2

Innovation is about value for users and citizens!

- Agricultural society
- Industrial society
- Knowledge society
- Innovation society

Innovation System(IS) =

- = All economic, social, political, organizational, institutional and other factors that **influence** the development and diffusion of innovations
- They are about the determinants of innovations processes – **not** about their consequences (which may still be extremely important)
- They can be national, regional or sectoral

Number of hits at Google (Oct 2009)

- ”System of Innovation” - 11 200 000
- ”Innovation System” - 1 100 000
- ”Innovationssystem” (Swedish) - 71 200

The Swedish Paradox: High inputs and low output = low productivity

- Input: **High investments** in R&D and innovation efforts (mainly by private organisations) = R&D intensity has been more than 4 % of GDP for many years = much higher that comparable countries
- First formulated by Edquist/McKelvey in 1991. Then it was expressed in terms of a high R&D intensity in Sweden coupled with a low share of high-tech (R&D-intensive) products in manufacturing as compared to the other OECD countries.
- It pointed to a **low productivity** of the Swedish NSI in this specific sense.

Problem identification:

- The **output** of an innovation system is - simply – **innovations** = what comes out of the system.
- A **policy problem** is a low performance of the innovation system = a low innovation intensity for a certain category of innovations.
- It is important to be able to **measure** the innovation intensities for specific categories of innovations = taxonomies of innovations are important.
- We want to know the **innovation intensities** for specific categories of innovations in different innovation systems (national, regional, sectoral) = **innovation surveys** are important.

Comparisons!

- Measurements of innovation intensities must be comparative – that is the only way to say if the intensity is high or low in a certain system.
- Such comparisons can be made between the same system over time or between different existing systems.
- The comparisons can not be made between existing systems and an ’optimal’ system.

Innovation output indicators for Sweden:
(Compared to Denmark, Finland, Ireland, Nethrelands and Norway)

[Source: CIS2 1994-96 and CIS3 (1998-2000]

Analysis updated in 2008 book on ”Small country Innovation Systems”:

1. **Introduction of a product or process innovation: Rank 4 of 5/6**
2. **Introduction of new processes: Rank 4 of 6 and 5 of 5**
3. **Introduction of new to the firm products: Rank 4 of 6 and 4 of 5**
4. **Introduction of new to the market products: Rank 4 of 5**
5. **Turnover due to new to firm products: Rank 1 of 5 (= the exception)**
6. **Turnover due to new to the market products: Rank 3 of 4**

Output: Out of six indicators of innovation output, **Sweden performed badly on five**

BUT:

The European Innovation Scoreboard (EIS) regularly places Sweden at the top of all EU countries in its summary indicator!

How come???

- The EIS collapses 25 different indicators into 1.
- The 25 indicators include 15 input indicators
- Among these are input of R&D expenditures
- 10 of the indicators are output indicators
- But only two of these measure output of INNOVATIONS in a proper sense

- HENCE EIS SUMMARY INDICATOR INCLUDES BOTH SIDES OF THE PARADOX AND IS DOMINATED BY THE INPUT SIDE. IT DOES **NOT** MEASURE INNOVATION OUTPUT!!!

- A wider perspective is necessary!

Components and Activities in Systems of Innovation (SI's):

- In the traditional systems of innovation approach the focus was strongly on the COMPONENTS in systems of innovation, i.e. organisations (the players) and institutions (the rules of the game).

- More recently some of us have focused more on what HAPPENS in the systems, i.e. on the **ACTIVITIES** in the systems. It is useful for policy purposes.

Activities

- The overall purpose of SI's is to develop and diffuse innovations, i.e. new products and new production processes.

- The factors that **influence** the development and diffusion of innovations are here called the **activities** in SI's.

10 important activities in SI's (1)

Provision of **knowledge inputs** to the innovation process:

1. Provision of **Research and Development** (R&D), creating new knowledge, primarily in engineering, medicine and the natural sciences.
2. **Competence** building (provision of education and training, creation of human capital, production and reproduction of skills) in the labor force to be used in innovation and R&D activities.

10 important activities in SI's (2)

Demand-side factors:

3. Formation of new product **markets**.

4. Articulation of **quality requirements** emanating from the demand side with regard to new products.

10 important activities in SI's (3)

Provision of constituents for SI's:

5. **Creating and changing organizations** e.g. enhancing entrepreneurship and intrapreneurship, research organizations, policy agencies, etc.

6. **Networking**, including interactive learning between different organizations - through markets and other mechanisms.

7. **Creating and changing institutions** - e.g. IPR laws, tax laws, environment and safety regulations, R&D investment routines, etc.

10 important activities in SI's (4)

Support services for innovating firms:

8. **Incubating activities**, e.g. providing access to facilities, administrative support, etc.

9. **Financing** of innovation processes and other activities that can facilitate commercialization of knowledge and its adoption.

10. Provision of **consultancy services** of relevance for innovation processes, e.g. technology transfer, commercial information, and legal advice.

INNOVATION IS CERTAINLY NOT MAINLY ABOUT R&D/S&T

Are some of the 10 activities more important?

- It is **not** possible to single out one or two activities that have been most crucial for all systems at all times.
- They **all** have to be present (although the support services may be less basic).
- Their relative importance depends on the **place** and **time** = context-dependent.
- There are **multiple** paths to innovation (and growth), but not an infinite number of paths = the **combination** of activites is crucial.

What to do?

- There is too much emphasis on R&D (=input) in Sweden and in the EU
- The Barcelona target is one-dimensional and represents a linear view (not taking feedback processes and demand into account)
- There should be more focus on activities 2-10 – and on innovation output = on the rest of the SI (not R&D)!
- Who is working on the other nine activities? The Minister of Innovation/The Commissioner for Innovation?!
- Possibly reallocate resorces in activity 1. More to needs-oriented R&D

Additional conclusions on Sweden:

- **Small firms** performed much **better** than large ones (smaller inputs – larger outputs)
- Swedish firms are **better at imitation than at creation**
- Performance was better in **services** (finance, trade) than in manufacturing
- The domination of **large** manufacturing **firms** is a problem

Emphasis?

- There is emphasis on supporting entrepreneursip, by incubation, seed funding, etc.

- But what is done to revitalize the big firms??

Causal analysis:

- An identification of a problem only indicates **where** and **when** policy intervention is called for – it says nothing about **how** it should be pursued.
- To design an appropriate innovation policy, it is also necessary to know the **main causes** behind the problem.

Causes = Activities

- The causes of problems can be identified by analysing the ten activities in specific systems of innovation.
- We have done that in a book on the national systems of innovations of ten countries i Europe and Asia.

Diagnostic analysis

= A combination of a problem identifying analysis and a causal analysis.

Such diagnostic analyses are strategic in all innovation policy design!

Objectives of Innovation Policy

- The objectives of innovation policy are politically determined.
- They can be economic, military, environmental or social
- If economic, they concern economic growth, productivity growth, employment and competitiveness

Reasons for policy intervention

Two conditions must be fulfilled for public intervention to be motivated in a market economy:

(1) Private actors and markets must fail to achieve the objectives formulated; i.e. a **'problem**' must exist.

(2) Public actors must have the **ability** to solve or mitigate the problem.

Problem identification

- A **problem** occurs when private actors and markets do not automatically realize objectives
- Problems can only be identified through **comparative** analyses between **existing** systems of innovation (over time and space)
- Comparisons cannot be made between existing systems and optimal systems
- This is **contrary** to most policy analysis

Why industrial policy should be = innovation policy

- **Policy** = action by public organisations
- Public resources are limited
- Public action should **not duplicate** private action – but supplement it (will return to this later)
- Private actors are weak where **uncertainty** is large
- **Innovation** is plagued by uncertainty
- Uncertainty is largest for innovation in **new** fields
- Hence innovation policy should focus mainly on **new** fields: it should serve as a **midwife** – not provide support towards the end of life. ”Framtiden har inga lobbyister!”

Uncertainty and timing

- Markets and firms perform least efficiently with regard to new activities, where uncertainty and risk are large.
- Large-scale and radical technological shifts rarely take place without public intervention.
- A minor intervention at an early stage in the innovation process may have a very large impact. A major effort at a mature stage may have only a small impact.

William J. Baumol: “The Free-market Innovation Machine – Analyzing the Growth Miracle of Captialism”, Princeton University Press, 2002:

“It can be argued that virtually all the economic growth that has occurred since the eighteenth century is ultimately attributable to innovation” (p. 13)

He also mentions, though, investment in human capital and investment in plant and equipment, and then adds:

“For the bulk of the population of earlier periods of history, bare survival was the critical problem, and it left only minimal resources for investment in education and productive capacity. Only the productive surpluses that innovation began to make possible……made feasible the enormous increases in investment in inanimate and in human capital that are widely judged to have contributed greatly to economic growth. (p. 13)

“…in key parts of the economy the prime weapon of competition is not price but innovation.” (p. ix)

References:

- Edquist, Charles **'Systems of Innovation – Perspectives and Challenges**', in Fagerberg, Jan, Mowery, David, and Nelson, Richard (ed.) *Oxford Handbook of Innovation,* Oxford University Press, Oxford, November 2004, 27 pp.

- Edquist, Charles and Hommen, Leif (eds.) **'Small Country Innovation Systems: Globalization, Change and Policy in Asia and Europe',** Edward Elgar Publishing, 2008, 544 pp.

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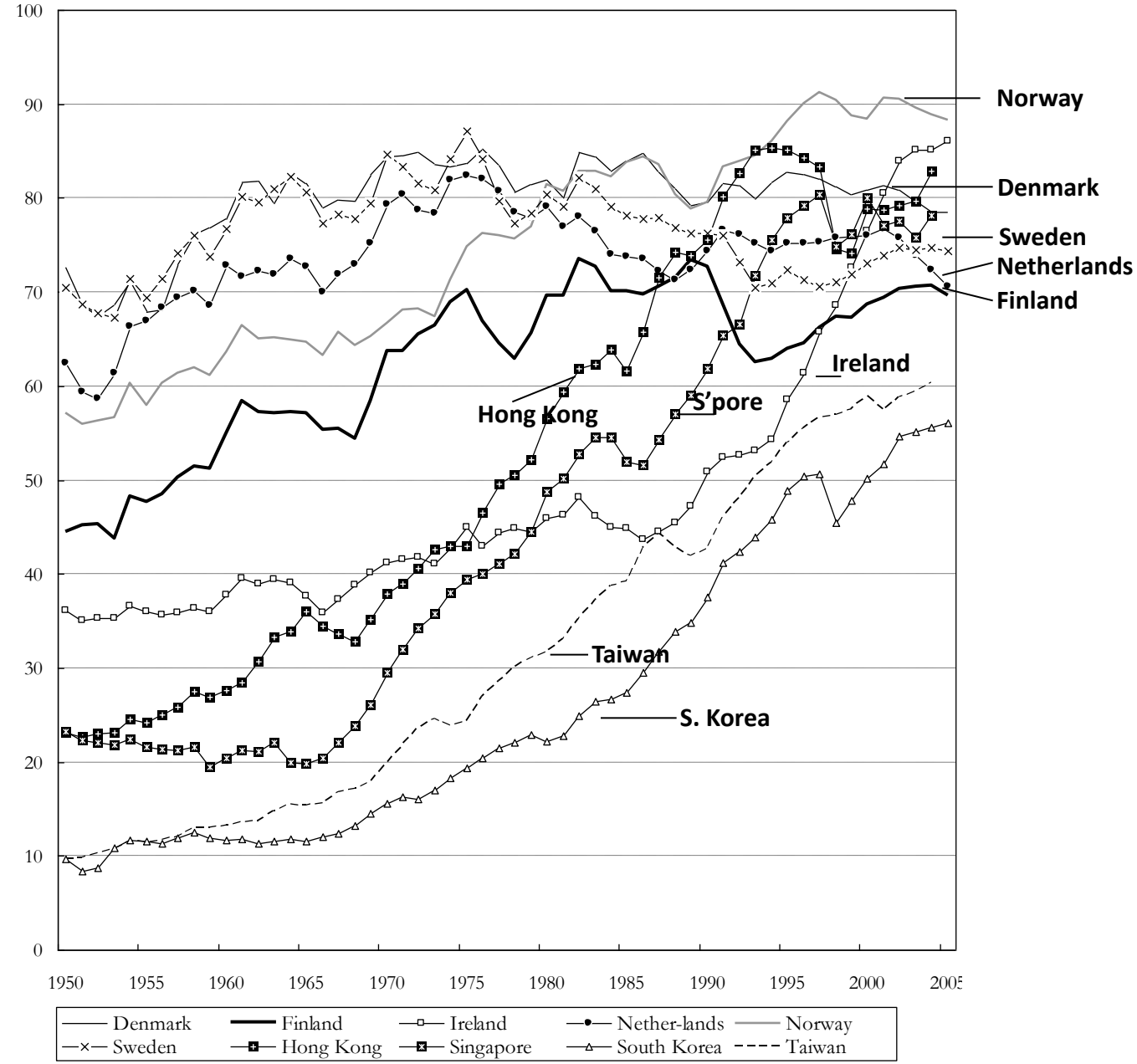
Hur skapar man ett framgångsrikt innovationssystem (1)?

1. Ett IS är en fråga om **determinanterna**, dvs det som **påverkar** innovationsprocesserna! (Inte effekterna!)
2. **Målet** måste vara klart! Till exempel: ”Välfärd genom innovationsbaserad tillväxt och skapande av högproduktiva jobb”.
3. **Produktionsstrukturen** och dess förändring är oerhört central! (Högproduktiva jobb skapas inte var som helst.) Tillväxt **är** förbunden med omfördelning av resurser till tillväxtsektorer – som ofta också är innovationsintensiva sektorer.

Hur skapar man ett framgångsrikt innovationssystem (2)?

4. Vi måste ha en **diagnos** – i vilket avseende är det existerande systemet bra respektive dåligt, dvs vi måste **mäta** innovationerna! CIS eller alternativ!
5. Organisationerna i systemet måste själva analysera och **förstå sin roll** i systemet – och hur de kan bidra till helheten! Kom ihåg: interaktivt lärande!
6. Vilka **aktiviteter** utförs bäst av vilka organisationer? Privata? Offentliga? Ska dom **komplettera** varandra eller **konkurrera**? Utförs vissa aktiviteter ineffektivt? Helheten!

GDP per capita 1990 GK $, USA = 100.
10 European and Asian Countries.



Why not efficient = explanations to the Swedish paradox:

- Sectoral allocation of R&D (and other policy support) is problematic
- There are structural obstacles to knowledge transfer from R&D to production
- Globalisation means that the innovation results of Swedish R&D is increasingly exploited abroad