OECD Global Forum on Trade, Innovation and Growth

DISCUSSION PAPER ON TRADE, INNOVATION AND GROWTH

Prepared by the OECD Secretariat

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1. Innovation and technological progress is a key determinant of economic growth. Much of the economic growth and rise in living standards in the post World War II era is due to advance in technology and innovation. Continued economic growth depends on our ability to maintain or increase current levels of innovation. There is today great interest in understanding how governments can enhance innovation and the economic benefits it should bring, as evidenced in the discussions at the OECD Ministerial Council in 2007.

2. A wide range of policies including R&D policy, intellectual property rights, education and human resource policy, and financial market policy affect innovation. Open trade and investment regimes have an important role to play in the performance of innovation systems, but not enough is known about how trade affects the innovation process. The purpose of this conference is thus to re-examine the role of trade and investment in the innovation process with a view to drawing some trade policy implications. Results will be reflected in a paper currently under way in the OECD Trade and Agriculture Directorate and will feed into the OECD innovation strategy which has been mandated at MCM 2007. In this discussion paper, we first look at the effects of trade on innovation and growth, followed by a look at some recent trends in globalisation affecting the relationship between trade and innovation. We conclude by presenting a list of possible questions for discussion at the Global Forum.

1. Definition of innovation

3. We define "innovation" for the purposes of our discussions as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations".[2] Three points are underlined. First, innovation includes **not only product and process innovations** but encompasses **new marketing methods and new organisational approaches**. Second, innovation is not restricted to **technology and knowledge creation** through R&D, but also includes **implementation or commercialisation of advances in technology**. Third, innovation is not restricted to a "global first" (i.e. the introduction/application of technology for the first time in the world), but includes the introduction/application of technology for the first time in a new environment.[3] Such a broad view of innovation is appropriate as we are interested in innovation and diffusion of innovation as they affect growth both in developed and developing countries.

2. The effects of trade on innovation and growth

4. Economic theory finds that trade can lead to substantial economic benefits through more efficient allocation of resources and deepening specialisation allowing countries to profit from comparative advantage (so called static gains from trade). This is the basis for most of the economic models used to calculate the benefits of trade such as GTAP. However, economic theory also suggests that trade can lead to **dynamic gains** in addition to these static gains (Nordas et al, 2006), in particular through transfer of technology and innovation, although it has been difficult to gain conclusive evidence. In the following sections, we look at three ways in which trade can affect innovation: increased technology transfer, competition and economies of scale.

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1 This paper has been drafted by Mr. Osamu Onodera, OECD Trade and Agriculture Directorate, with the valuable support of Ms.Csilla Bartok, Ms. Caroline Lesser and more particularly Mr. Stefano Mosso.

2 Oslo Manual – Guidelines for Collecting and Interpreting Innovation Data (OECD, 2005)

3 Some (e.g. Enos and Park, 1988) refer to this process as adoption, absorption and adaptation.

2.1 Technology transfer

5. First of all, **trade is an important conduit for the international transfer of technology** which increases the pool of technology available for the domestic innovation process. This effect has been found to be important for both developed and developing countries. Developing economies and smaller economies[4][5] are generally more reliant on foreign technology but it is also important for large developed economies.[6] It should be noted that trade in this manner can have both a **technology effect** and a **price effect**. Firms may acquire new technology embedded in capital goods and intermediate products through imports. For example, Samsung predominantly imported semiconductor manufacturing equipment from the US and Japan when creating its dominance in DRAMs (Dynamic Random Access Memories). The price effect may be no less important. Firms may acquire technology-embedded products at considerably lower prices than domestic prices enabling such technologies to be more widely applied. One estimate states that globalisation of IT hardware resulted in IT prices some 10 to 30 percent lower than they would have been based on domestic production and domestic technological advances alone in the 1990s in the United States (Mann, 2003). It should be noted that in both the technology and price effects, there would be **a one-time effect** (use of better technology and access to low price goods) and a longer term **dynamic effect** (better technology leading to modification and application to different uses, and access to low priced computers leading to organisational changes).

6. While trade is of great importance for technology transfer, four points should be borne in mind. First, **trade is not the sole source of technology transfer**. Other sources of technology[7] such as FDI, licensing, movement of natural persons, public information, or learning by doing etc. are also of great relevance and it is not always possible to isolate their effects. Second, the **import of capital goods and intermediate products is not a sufficient condition for the absorption of technology and innovation**. Even if technology is transmitted, if absorption capacity is insufficient, the technology may not lead to an increase in productivity. Third, businesses undertaking innovation often are subject to substantial risk and may need to undertake substantial capital investment. In such a case, the general business environment may affect provide constraints on the ability of companies to invest in innovation.

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4 Over 60% of companies in both LDCs and other developing countries found machinery and equipment to be one of the top three sources of technological innovation (Knell (2006) cited in UNCTAD, 2007). Coe et al. (1997) finds that total factor productivity in developping countries is positively and significantly related to R&D in their industrial country trade partner and to their imports of machinery and equipment.

5 Jensen (2007) finds that the introduction of mobile phones to fishermen in India led to an increase of 8% of profits for fishermen and a decline of 4% in consumer prices as fishermen could use the mobile phones to call several nearby markets from his boat to establish where his catch will fetch the highest price (Economist, May, 10, 2007).

6 According to the European Innovation Survey, 50 percent of total innovation expenditure is embodied in plant, machinery and equipment purchased by industrial firms, with own R&D accounting for just 20 percent (Evangelista et al., 1998). A number of studies such as Coe and Helpman (1995), Keller(2004), Eaton and Kortum (2001) find that imports have a significant role in international technology transfer. Mann (2006) points out that an Apple iPod includes "a hard drive from the Japanese company Hitachi, a battery from Sony (also Japanese), a controller semiconductor chip from California-based PortalPlayer Inc., a stereo digital-to-analog converter form Wolfson Microelectronics in Edinburgh UK, a flash memory chip from Sharp Electronics (Japan), an interface controller from US-based Texas Instruments, and a power management and battery charger from Linear Technologies in California".

7 Different sources of technology may have different characteristics. A main distinction could be drawn between codified knowledge that could be transmitted without further human intervention and tacit knowledge which requires person-to-person interactions to be transferred and therefore could not be 'embodied' neither in goods or in scientific publications (on the sources of diffusion of tacit knowledge see OECD 2001). Trade openness affects both sources of technology not only improving access to codified and explicit knowledge but also increasing what Freeman (2004) defines "the general openness of a society and the movement of people and ideas".

7. Fourth, **path dependency** in the development of technological capabilities may present considerable policy challenges to countries trying to catch up. In particular, the optimal reallocation of resources based on existing comparative advantages may lead a country to be specialised in low growth sectors which may be contrary to its long term development objectives. On the other hand, some point out that low levels of technology may allow countries to take advantage of new technologies through **leapfrogging,** or the deployment of advanced technologies in developing countries ahead of their deployment in developed countries.[8]

2.2 Competition effects of trade

8. Secondly, **trade enhances competition**[9], which affects rents and influences company behaviour, including the incentives to innovate. Two opposing views on the effect of competition on innovation appear in the literature. Under the Schumpeterian view, rents are the main source of innovation for companies to conduct research and development. Under this view, erosion of profits through increased competition is thought to reduce company's ability to innovate. The opposing view is that greater competition increases the incentives to improve performance through reduction of slack and innovation[10]. International competition through trade imposes competitive pressure on firms previously insulated from trade competition.

9. The empirical evidence has been mixed and neither of the one-dimensional views has been found to hold. For example, some studies have shown that industry innovation tends to decrease as the level of concentration rises,[11] and a look at the ICT industry, pharmaceutical and bio-technology industry shows that small firms can be highly innovative due to their small size and faster decision making. On the other hand, a majority of the patents filed are by large companies.[12] Others suggest that not only actual, but also potential competition affects innovation. [13]

10. Recent empirical research is beginning to reveal the more complicated relationship between market power, firm size and innovation. Aghion et al. (2006)[14] through an empirical analysis re-examine the **relationship between competition and innovation** and propose that the relationship is **an inverted U**

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8 This is because infrastructure based on existing technologies may act as an barrier to the introduction of new technologies. The most cited example of this is the diffusion of mobile telephony in the absence of fixed line networks, and the diffusion of decentralised electric power units in the absence of centralised electricity networks. Banking services using mobile phones are being used by about half a million users in South Africa mainly because there is a high demand for cheap and convenient ways to send money while only a fraction of people have a bank account (Economist, Oct 26th, 2006)

9 Past work in OECD on trade and competition have found a strong relationship between trade and competition and includes *"Core principles in trade and competition context*" (2002); "*Trade, competition and intellectual property rights" (2000)*; and "*The impact of pro-competitive reforms on trade in developing countries"* (2006).

10 For example Baygan and Mann (1999) finds that R&D expenditures in sectors that are protected from global competition do not translate into higher labour productivity, whereas R&D expenditures in sectors facing global competition do enhance productivity both for high and low technology types of products (Baygan and Mann, 1999 as cited in Mann, 2006).

11 For example, Acs and Audretsch (1988).

12 For example in the United States in 2005, 165,485 patents were granted, of which about 10% or 16,688 were filed by the top 10 companies.

13 For example, Kamien and Schwartz (1975). Even if there are no actual imports for a certain plastic part of a mobile hand set, competition either in the domestic or international market in the final product market may provide sufficient incentives to innovate for plastic part manufacturers.

14 Other authors have also emphasised the non-monotone nature of the relationship between innovation and competition (Boone, 2001).

shape. According to their results, lower levels of innovation was observed at the lowest (pure monopoly) and at the highest levels of competition (perfect competition), showing that competition can either enhance or reduce innovation depending on the existing level of competition.

11. There is evidence that **R&D intensity is higher for industries closer to the technology frontier**[15] which is consistent with the view that R&D gains in importance as industries or countries approach the world technology frontier. There is also some evidence that **levels of innovation fall more rapidly in response to less competition in industries closer to the technology frontier** implying that the costs in terms of innovation of having too little competition, grows as the economy develops and gets closer to the frontier (Aghion, 2006).[16] Mohnen and ten Raa (2003, final 2008) analysed how the distribution of rents between capital and labour can affect innovation, and found that labour rent negatively affected performance while capital rents had a mild positive impact on performance mainly though R&D.

12. While the relationship between competition and innovation is far from clear, one may conclude that **trade and investment** as driving forces of global competition **can either stimulate or suppress innovation** depending on levels of technology and on the level of prevailing levels of competition. In particular, if a country/sector/company is at the technology frontier, increased competition through freer trade and investment is more likely to lead to an increase of innovation.

2.3 Economies of scale through exports and learning by exporting

13. Thirdly, **trade, especially exports, extend the size of the market** over which margins can be earned, providing greater incentives for increased investment in innovation. A large part of R&D costs are fixed (i.e. do not change depending on the sales quantity) so a company selling to both domestic and export markets may be able to recoup R&D investments over a larger sales quantity. For example, Samsung, a leading ICT company in Korea spent 4.6 billion USD or 8.3% of total sales on R&D in 2004. Only about one sixth of the sales was domestic: if there were no exports, Samsung's R&D budget may have been cut to one sixth or even less.

14. Other studies focus on the relations between exports and performance enhancement, so called **"learning by exporting"**. Exporting firms have been found to have higher total factor productivity. However, while some studies find a causal relationship between exports and productivity, [17] others attribute the difference in productivity between exporting and non-exporting companies to self selection, not "learning by exporting". One study which finds that firms make deliberate decisions in terms of investment, training and technology to raise productivity in order to serve their export markets[18] may partly explain why it has been difficult to find a clear causal relationship between exporting and enhanced productivity.

3. The link between intellectual property protection and innovation

15. The increasing importance of the technology aspect of trade has led to the introduction of intellectual property rights (IPR) in trade rules (i.e. the TRIPs Agreement). IPR protection promotes innovation by creating an artificial monopoly and providing a greater incentive for innovation than is otherwise the case. IPR protection is considered necessary because the supply of innovation may be suboptimal as innovation may yield lower private returns than social returns when imitation is freely allowed. It is worth noting that strong IPR protection is not an end in itself.

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15 Acemoglu, Aghion and Zilibotti (2006) cited in Aghion (2006).

16 The study also recommended that countries close to the technological frontier should invest more in higher education to promote development of cutting edge technology as well as proceed with structural reforms in the financial and labour markets.

17 For example, Bernard and Wagner (1997) and Clerides, Lach and Tybout (1998)

18 Hallward-Driermayer, Iarossi and Sokoloff (2002)

16. As stated in Article 7 of the TRIPs agreement, the objective of TRIPs is to provide for "the protection and enforcement of intellectual property rights" so that they "contribute to the **promotion of technological innovation** and to the **transfer and dissemination of technology**, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations." It was considered necessary to close the gaps in terms of intellectual property protection, as the proliferation of products from countries who neglected IPR may lead to a reduction of the incentives for innovation in countries that have IPR systems in place. It was also considered that technology transfer from developed countries to developing countries may be promoted if technology receiving countries put in place intellectual property protection.

17. There has been criticism in development circles that the current multilateral rules on IPR tend to benefit technology leaders rather than followers, and that under the TRIPs, developing countries will no longer be able to learn and to appropriate technology through such methods as reverse engineering which were possible for some developing countries in the past.

18. Some of the criticisms such as the assertion that strengthening of IP protection in economies that are rapidly catching up may even create negative externalities in LDCs (UNCTAD, 2007) may be overstated while there is evidence that **countries with robust IPR systems have benefited from greater technology transfer**.[19] It is nonetheless true that the setting up of IPR systems requires considerable resources, and that there may be significant differences between countries as to the desirable level of IPR protection.

4. Recent trends in Trade and Innovation

19. Changes in the innovation model, the internationalisation of R&D, emergence of global value chains and rise in offshoring/outsourcing (also referred to as trade in tasks), and changes to the business model triggered by these emerging trends, have an impact on how trade affects the innovation process and thus may have important implications for trade policy.

4.1 From a "closed and linear innovation model" to "open innovation model"

20. The way companies organise, manage and conduct their innovation is significantly changing. While in the past, a "closed innovation" model of R&D departments developing technology for use only within the company (e.g. Bell laboratories) was the main corporate model for innovation, this model has become obsolete. Firms are moving **towards a more open system of innovation** where innovation is created through interactions within and outside the company (suppliers, competitors, customers, universities, research organizations) (Chesbrough, 2006). In this new paradigm of "open innovation," firms source ideas and technology externally and become more permeable to the flow of knowledge from outside the company. They also find new ways of exploiting their own inventions, such as through spin-off companies, licensing technology or releasing intellectual property in the public domain.

21. As freer trade and investment would lead to an increase in the interaction with suppliers, competitors, and customers, one would expect that the **shift to an open innovation model would lead to an increase in the importance of the role of free trade and investment** in the innovation process. Increased emphasis on the exploitation of patents through licensing technology would imply that international protection of IPR becomes more important to facilitate innovation and the diffusion of innovation.

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[19] See for example Park and Lippoldt (2004). Korea for example paid royalties on licenses of 565 million USD in the period 1962-81 (Enos and Park, 1988).

4.2 The internationalisation of R&D and innovation[20]

22. Until recently, R&D was one of the least internationalised activities in multinational enterprises (MNEs). However, R&D has become internationalised as companies have moved from merely adapting technology developed in the home country to local markets (which is termed as **"home-base exploiting" or "asset-exploiting" R&D**) and opened R&D centres as a way to monitor development abroad[21] and to utilise the foreign pool of research talent (also termed as "home-base augmenting" or "asset seeking" R&D).[22] This internationalisation of R&D has been driven by cross-border R&D investment strategies of multinational enterprises, the growing R&D potential of large developing economies, the progress of ICT technologies and the increased circulation of human resources in science and technology (OECD, 2006c). While there has been an **increase of developing country firms setting up R&D units abroad** (UNCTAD, 2005) and the combined R&D expenditure of China, Israel, Russia and South Africa was equivalent to almost 17% of that of OECD countries in 2004 up from 7% in 1995 (OECD, 2006c), the majority of R&D continues to be conducted in OECD countries. Developing country companies are also increasingly using mergers and acquisitions to access R&D capabilities (e.g. acquisition of Arcelor by Mittal steel).

23. Such internationalisation of R&D has evoked some concern depending on the country's level of development and position on the global R&D map. In the majority of developed countries, the main concern is the possible erosion of home based R&D that could result in a reduced capacity to absorb knowledge and technologies developed abroad, decrease downstream business activities and less national influence on business decision making. In catching-up economies that are strong attractors of R&D intensive FDI, the **main concern is that foreign-owned R&D facilities may not contribute enough to the development of domestic innovation capabilities** while absorbing a disproportionate share of the best human resources. The majority of less developed countries but also some OECD countries fears the risk of being altogether marginalised in the process of R&D globalisation. The **internationalisation of R&D** may imply that more countries have a chance in engaging in R&D, which is a high value added activity. However, there is a possibility that R&D may gravitate towards countries with a conducive environment for R&D.

4.3 Global value chains and innovation[23]

24. Advances in technologies in communications and logistics, and the decline of trade and investment barriers around the world have allowed production processes to be fragmented. The production process can now be divided into discrete tasks which can be conducted in either geographically concentrated locations or distant locations. This has led to the globalisation of value chains. It should be noted that the globalisation of value chains is an innovation in its own right as it is a new organisational method in business practices. Trade and investment is a key enabler of this new organisational method. The globalisation of value chains has been driven by a number of factors: search for efficiency, entry into new markets and access to strategic assets. The desirability of fragmentation will depend greatly on the nature of the industry,[24] transportation costs, and communication costs among other factors.

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20 This section is based on OECD (2006c) and DSTI/STP/TIP(2006)11

21 Asian ICT companies have often set up R&D facilities in Silicon valley to monitor technology developments and to utilise the human resources in the area.

22 The U.S. Committee on Science and Technology raises the following examples: Accenture's CEO announced that it will have more employees in India than the U.S. by August, 2007; IBM is projected to have 100,000 workers in India by 2010, more than one-quarter of its worldwide workforce; companies like General Electric, Eli Lilly, Google, and Microsoft are expanding R&D centres in India and China. See also DSTI/STP/TIP(2006)9.

23 This section is mainly based on OECD (2007a).

24 For example, industries such as electronics, where products have a modular structure and the interfaces are standardised may be more conducive to fragmentation of the production process. Other industries where the products have a more integrated structure (e.g. automobiles), the fragmentation may be more difficult.

25. The **fragmentation of the production process** can be observed in several forms: overseas investment of multinational enterprises, domestic outsourcing, and offshoring (international outsourcing or "trade in tasks"). While accurate data is not available, available data points to deepening of fragmentation. There has been a considerable increase in both outward and inward FDI stocks over GDP in most OECD countries[25] and intra-firm trade is becoming important.[26] Production depth (value added as a percentage of production) has decreased in many OECD countries, implying a greater reliance on intermediate inputs which can be due to domestic or international outsourcing.[27] The ratio of imported intermediates to domestic intermediates have increased between 1995 and 2000 in a majority of OECD countries.[28]

26. This increasing prevalence of **global value chains enhances competition and the pursuit of efficiency on a global basis**, as value chains compete with each other. While participants in value chains have an incentive to cooperate with each other in order to compete with other value chains, there is also competition within the value chain in order to gain a larger share of the final value added.

The debate on offshoring

27. The increase in offshoring has led to a considerable debate on whether this has adverse effects on the offshoring economy, even to consider whether it is desirable and/or possible to prevent offshoring. While there is no doubt that offshoring affects specific workers and adjustment costs can be considerable, recent evidence shows that effects of rising imports on overall employment or the unemployment rate seems to be relatively small (TAD/TC/WP(2007)7).[29]

28. To the contrary, some studies point to the **considerable benefits of offshoring** such as higher consumer incomes because of the low prices of imported offshore goods, the improved productivity of firms that engage in offshoring, better control over inflation and enhanced export capacity (OECD, 2007b). The same study points out that improved competitiveness of companies due to offshoring may allow them to expand their market shares, profits and capital spending, which can feed through to new job creation in their home countries.[30]

Expansion of global value chains to services

29. While globalisation of production was initially limited to goods, and OECD (2007b) finds that offshoring in goods remains the predominant form of offshoring, technological progress especially in ICT has led the way for the **globalisation of production in software and services**.[31] This has fuelled the above

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25 Figure 2.4 and 2.5 in OECD(2007a).

26 Share of intra-firm exports in total exports of affiliates under control varies from 20% in Japan to 60% in the US and 70% in Sweden (OECD, 2007a).

27 Figure 2.7 in OECD(2007a).

28 Figure 2.11 in OECD(2007a). Trade in intermediate products as a share of intra regional trade in Asia increased from 42% in 1980 to 60% in 2005, while in the same period, there was little or no change at 46%-50% both in the EU25 and NAFTA areas (METI, 2007). This may point to considerable regional differences in this phenomenon .

29 The data available shows that in the services sector new job creation offsets job destruction from all causes combined, including offshoring. However, the manufacturing sector, which in the vast majority of OECD countries is losing workers primarily because of technological change, is a net creator of essentially skilled jobs.

30 According to a survey, Japanese companies see considerable merit in business activities in the East Asian region through enhanced markets, increases in the export of intermediate products and specialisation in high value added products leading to improved productivity (METI, 2007).

31 See Engman (2007) for case studies on the outsourcing of business process services and information technology services to Chine, the Czech Republic, India and the Philippines.

debate on offshoring as a number of papers have indicated that millions of jobs which had previously thought to be unaffected by trade may be affected. OECD (2007b) finds that the data available shows that in the **service sector new job creation offsets job destruction from all causes combined, including offshoring**. As the globalized production of IT hardware has led to lower prices and wider diffusion of IT products leading to higher levels of innovation, expansion of global value chains to services can be expected to have a similar effect. Mann (2003) predicts that "since the demand for software and IT services is more price elastic than for IT hardware, the potential increase in investment, productivity growth and job creation for the globalization of IT services and software is even greater than that experienced in the 1990s from the globalization of IT hardware". One other difference in software services offshoring, compared to goods, is that it does not need the same physical infrastructure, such as ports, roads, and factories, and thus **can be set up more easily** and it is **more labour intensive**.

Changes in the global production network

30. The impact of global value chains cannot be discussed without reference to **changes in the structure of global production networks** which have given rise to increases in contract manufacturing or electronics manufacturing services (Luthje, 2003). **Contract manufacturers** are manufacturers who specialise in manufacturing products for brand name-firms (or OEMs). Six major contract manufacturers, Celectica, Flextronics, Jabil Circuit, Hon Hai Foxconn, Sanmina SCI and Solectron make various electronic products for a variety of brand names from mobile phones for Ericsson, Motorola, and Nokia to Ipods for Apple, and each employ between 50,000 and 200,000 employees globally and have sales between 8 billion USD to 16 billion USD (van Liemt, 2007). In the semiconductor industry, the emergence of companies specialising in the manufacturing of semiconductors (foundries) have opened the door to **fab-less design firms** who develop their own designs and contract with foundries to produce their wafers.

Opening up of new opportunities

31. The fragmentation of the production process and changes in the structure of global production networks has meant that **companies no longer need to excel in a wide range of areas in order to add value**.[32] While multinational national enterprises (MNEs) have been the drivers of the globalisation of value chains, global value chains present an opportunity for small companies to add large value by excelling in one part of the value chain. [33] New niches for the supply of novel products and services continuously emerge and allow SMEs to exploit their flexibility and their ability to move quickly (OECD, 2007a).[34]

32. Once a company has successfully entered a global value chain, there are **potential opportunities to enhance its position in the global value chain**, and some developing countries have been able to take advantage of such trends, especially in Asia.[35] Participation in a global value chain may induce the firm to improve its efficiency in individual activities; to change the mix of activities; or to try to innovate by moving into another value chain (UNIDO, 2004).

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[32] A US study states that the development of foundries, particularly in Chinese Taipei, likely allowed a wider range of fables companies to develop in the United States than may have been possible without the existence of foundries. These new developments allow smaller companies to overcome the high entry barriers posed by the costs of fabrication plants (US GAO, 2006).

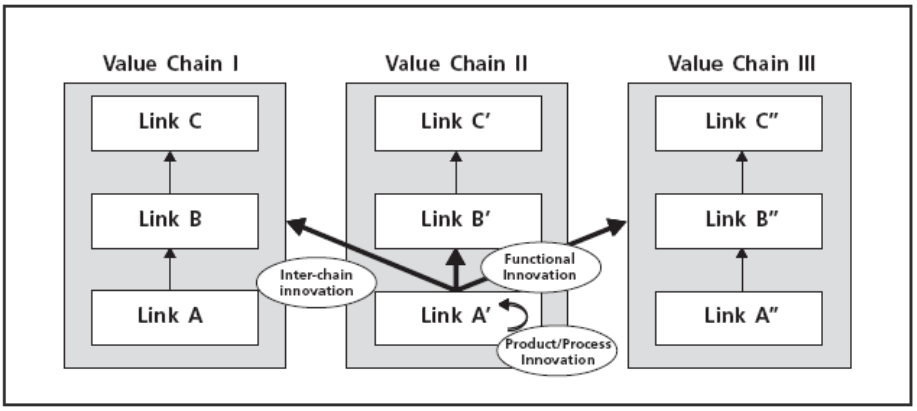
[33] One example is Qualcomm in wireless communications. Starting out as a small venture in 1985, it has fast grown into a global provider for Code Division Multiple Access (CDMA) technology. Another is Samsung which was the first to incorporate Qualcomm's technology in mobile telephones and used this to become a global leader within a span of a couple of decades. One may even say that neither Qualcomm nor Samsung would have been so successful were it not for each other (and trade which has facilitated this).

[34] A new study is being undertaken in the Working Party on SMEs and Entrepreneurship looking at high growth SMEs.

[35] Figure 2.18 and Figure 2.20 in OECD(2007).

33. Figure 1 illustrates four ways through which a company can enhance its position in the global value chain. The most basic ways are through product and/or process innovation. It is worth noting that late comers may have the ability to "leapfrog" technologies. Introduction of production processes to new environments also present room for process innovations.[36] Another way a company can enhance its position is through functional innovation where companies change the mix of activities. A typical example is where a company who only does contract manufacturing of clothing starts to design its own clothing. Yet another way a company can enhance its position is through inter-chain innovation where a company enters another value chain. Knowledge that had been accumulated in one global chain (e.g. circuit boards) may be applicable to another (e.g. mobile telephones) as could be seen in the contract manufacturing industry in electronics illustrated above.

Figure 1. Innovation Trajectories



Source: UNIDO, 2004

34. The global value chain thus may allow successful innovators having good and new products/processes to access global markets and provide a path to upgrade their position in the value chain. The flipside of this is that established companies, and in the same vein industries in countries, can be more easily driven from established market positions in the global market. From this point of view, one can state that the emergence of **global value chains is increasing the potential returns** for a successful innovator selling to the global market, while **increasing the risks associated with not innovating** and/or leaving some parts of the global markets untapped. The difference between winners and losers may be becoming more pronounced. From a national point of view, there is an even greater need than before to have in place a policy environment conducive to innovation.

35. The emergence of global value chains may imply that the **costs of tariffs and other barriers** to trade are becoming **more costly for governments than in the traditional trade environment**. This may in part due to the possibility for tariffs to be compounded as inputs are moved inside the global value chain to form the finished product. More important however may be the fact that as competition between global value chains become intense, processes may be moved to another country if the cost of conducting a certain process (importing the input, processing it and exporting the output) becomes too expensive. While in the traditional trade world, tariffs on inputs may have just led to a decrease in export competitiveness of the final good and decrease in sales, now tariffs on inputs may lead a process to be moved to an entirely new country.

5. Issues for discussion: trade policy to support innovation at the national and global level

36. To ensure balanced global economic growth, it would be important to make a concerted effort to maintain and increase innovation on a global basis by promoting (1) the continued creation of path-breaking

[36] A production process may often be modified to adapt to a new environment. For example, processes may be changed in response to higher abundance of labour.

technology, (2) its initial commercialisation, (3) the diffusion of technology, and (4) commercialisation of diffused technology in technology recipient countries.

37. Participants are invited to reflect on the following questions:

- What are the country/company experiences with technology transfer through trade and other sources of technology such as FDI? How can absorptive capacity and ability to innovate be enhanced?

- What role does IPR protection have in promoting technology transfer and in encouraging the creation of new concepts in developed and developing countries?

- Can transfer of environment-related technology through trade contribute to the achievement of goals on global sustainable development? What can be done, either individually or collectively, to this end?

- What are country/company experiences with the effects of trade competition on innovation (through imports, exports, investment)? Is there a difference between the short term and long term effects?

- How can trade policy be used to promote innovation through enhanced competition? Can a country use trade policy to undergo an optimal trade liberalisation path which modulates domestic competition so that companies will have an incentive to innovate?

- Have recent trends such as open innovation, internationalisation of R&D, global value chains, "trade in tasks", and new industrial organisations (e.g. contract manufacturing) changed the way trade barriers affect innovation? What opportunities and risks do these trends present for developed and developing countries respectively, and on a global basis?

- Is there a difference in the kind of policies that are necessary to enable the utilisation of global value chains in services as opposed to manufacturing?

- What are the country/company experiences with the effects of trade on innovation in the ICT sector? Regarding the links between trade and innovation, are there lessons to be learned for other sectors from developments in the ICT sector? What effects has the ITA (Information Technology Agreement) had on levels of innovation in the ICT sector?

- What kind of trade policies should be pursued to maximise these opportunities and minimise these risks, in developed countries, in developing countries, and on a multilateral basis? E.g. tariff reduction, trade facilitation, protection of IPR, investment deregulation, services liberalisation (especially ICT, logistics and financial services), harmonisation of domestic standards with international standards.

- What are the pros and cons of using FTAs to promote free trade and investment as opposed to the WTO in terms of promoting innovation? Is there a difference between an FTA with a technologically advanced partner and a less advanced partner?

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