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Divergent Opportunities of Innovation: When Time and Situation matter

Oportunidades Divergentes de Innovación: Cuando tanto el momento como la situación importan

I. INTRODUCTION

New technologies have a fundamental impact on society and economy. No matter whether one might think about new products based on biotechnology and genetic engineering or the most recently discussed the changes, which will emerge because of digitisation and industry 4.0. The example of artificial intelligence also indicates that innovation is more than just technology; it is also organisation, skills and education (see the contributions by Vassiliadis & Hilpert, and Hickie to this special issue). In the light of impressive technological change and because of a concentration of the discussion on gifted researchers and outstanding entrepreneurs the full picture of innovation widely escapes from view. The assistance of robots in manufacturing, the introduction of personal computers in offices, the reorganisation of assembly lines, or the increasing importance of suppliers and supply chains etc. clearly refer to the organisational dimension of innovation.

When paying reference to the innovative potential of new materials (e.g. in automotive industries and aircraft), biotechnology and genetic engineering (e.g. in crops, pharmaceuticals and medical treatment), and artificial intelligence and digitisation (e.g. in manufacturing, servicing and improving traffic) it is immediately obvious that the processes of innovation are highly divergent. They



EXECUTIVE SUMMARY

This paper investigates the rich diversities of innovation which are characterised not only by location or country and regional context of an enterprise but also by a wider context which can even be defined globally. The research argues that these diversities of innovation demand appropriate strategies and a concertation of capabilities in given situations. The paper shows how the opportunities emerge from technologies, organisation of manufacturing and research and how they are associated with constant changes of skills, products and demand. Moreover, the process describes how processes of innovation have become highly collaborative in R&D and also with regard to the supply of high-quality parts to international chains of innovation. These situations have also become important opportunities to contribute and participate based on specialised competences to take advantage of highly diverse processes of innovation and embeddedness in global division of labour. Finally, synergy with traditional competences may help to exploit opportunities in a unique way that create sustainable differentiation.

RESUMEN DEL ARTÍCULO

Este trabajo investiga la diversidad de la innovación que se caracteriza no sólo por la ubicación o el contexto nacional y regional de una empresa, sino también por un contexto más amplio que incluso puede definirse a nivel mundial. La investigación argumenta que estas diversidades de innovación exigen estrategias adecuadas y una concertación de capacidades en determinadas situaciones. El trabajo investiga como las oportunidades surgen de las tecnologías, la organización de la fabricación y la I+D y cómo se asocian con cambios constantes de habilidades, productos y demanda. Además, el proceso describe cómo los procesos de innovación se han vuelto altamente colaborativos en I+D y también con respecto al suministro de piezas de alta calidad en cadenas internacionales de innovación. Estas situaciones también se han convertido en importantes oportunidades para contribuir y participar sobre la base de competencias especializadas para aprovechar procesos muy diversos de innovación e integración en la división global del trabajo. Finalmente, la sinergia con las competencias tradicionales puede ayudar a explotar las oportunidades de una manera única que cree una diferenciación sostenible.

are based on different progress in technologies, demand divergent adjustments in manufacturing, and suppliers change their position and importance in the value chains. And since some technologies (e.g. robots and steering based on artificial intelligence) provide a constant replication of quality of products they can replace simple work and those who do the work - plus they may allow for a combination of new and modern technologies with unskilled or semiskilled labour in countries with low labour costs and weak regulations (Hilpert 2019). Thus, societies which are characterised by skills and education may perform differently and their economies and enterprises may take advantage of innovative opportunities differently.

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Consequently, locations are faced with highly divergent situations at different points in time. Different technologies emerge at different times, industries are characterised by divergent opportunities and challenges, and educated and skilled labour is demanded at different levels and for divergent purposes along the organisation of the process of innovation (Scherrer 2019). One could easily find even more dimensions which are influenced and it is important to see how these are interrelated. Finally, it is, of course, important to see this in relation with capabilities of scientific research, the development of technologies which suit the industries at the place and universities which are the home of outstanding research as well as being ready to educate knowledge workers and academic researchers (Hilpert & Lawton Smith 2014, and the contribution by Lawton Smith & Assimakopoulos in these special issues). Although the individual situation already provides for highly divergent situations, in addition, the context of a global economy and the globalisation of supply chains and value chains point to the importance of the context (Hickie 2019, and Hickie to these special issues). When turning to tariffs and trades which may protect a national industry or which may help to avoid unfair trade, it becomes immediately obvious, how critical the context is. The current example of the BREXIT indicates that an unchanged regional situation in a previously open economy can be become exposed to a situation characterised by tariffs and different trade – facing a new international context. Thus, there are rich diversities of innovation which are characterised not only by location or country and regional context of an enterprise but also by a wider context which can even

be defined globally – and thus provide for talent of labour from blue collar to academically educated labour. The diversities of innovation demand appropriate strategies and a concertation of capabilities in given situations.

2. REGIONS AND BRANDING

When paying attention to processes of innovation there is immediately a relationship with geography is to be identified. Regions do not equally participate in innovation. This is, of course, self-explaining in areas where no industries or research facilities are located (see the contribution by Sandulli to these special issues). It is very interesting how diverse the situation is, when more developed regions are taken into consideration. During industrialisation of the 18th and 19th century regions have transformed from rural areas into highly industrialised locations. This is most notable when it comes to iron and coal. These were basic materials to produce steel as a general basis for many other mass products which were developed and were introduced during this period in history. Steam engines, locomotives as well as rails, ships or cars were dependant on steel. Such regions – today called *old industrial regions* – were well known for the products and the use of steel made other regions well known. The automobile industry of Detroit made this region a world centre of cars and one expected to be among the highest competence of cars to be found. Shipbuilding even found its centres at harbours of particular countries which were in strong demand for ships for commercial use transporting goods or armed as navy equipment. Thus, as the shipbuilding indicates, even before the strong industrialisation locations were well known for the competence which was located there. Musical instruments, jewellery or precious textiles are further examples which refer to such underlying geographical information. Regions or even countries were experiencing a particular reputation which meant that whenever one would like to have a particularly high quality product or a technical problem solved one would search at such places. When more modern industries emerged (e.g. chemical industries, mechanical engineering, precision engineering, apparatus building) which did demand for scientific research or highly advanced engineering the role of knowledge and particular expertise increased. Regions which were not privileged by nature to have coal or iron ore were

KEY WORDS

R&D, Skills,
Innovation,
Globalization.

PALABRAS CLAVE

I+D, Habilidades,
Innovación,
Globalización.



put into a situation to manufacture industrial products based on knowledge and high competence. Skills, education, development of new products and leading edge research became fundamental for such processes of industrialisation which related to high value added during R&D and manufacturing. Consequently these regions, locations or even countries were known and branded for such products and competences (Bellini and Pasquinelli 2016). The more such knowledge became important for modern industries as compared with traditional “old” industries, the more such competences from research and engineering became demanded to find the best products adding to the already existing branding and reputation – and thus building synergy with competences from industrial history (see the contribution by Vassiliadis & Hilpert to this special issue).

This refers to competences in research and manufacturing of certain products but it also indicates capabilities to provide high-quality parts or semi-fabricated products which are demanded by other industries or enterprises. Electronic steering equipment or measurement instruments are easy to imagine as manufactured at one place and implemented into a different product (e.g. machines, industrial plants, automobiles, aircraft or pollution control) at a different location. But it may also be that the final products require for a constant high quality, reliability of supply or particular improvements (see the contribution by Hickie in this special issue).

Regional concentration of enterprises and leading edge research or engineering may help to develop particular visibility and to strengthen the position in trade of innovative products. Locations and companies of outstanding competence can take advantage of demand from other dynamic processes and related business (see the contribution by O’Gorman & Donnelly to these special issues). The success of Tesla cars creates a demand for parts which are assembled by Tesla. About 60 to 70 per cent of the parts used by Tesla are said to be bought in Germany, predominantly from Bosch (Hilpert 2019). Consequently, it is no more a hierarchy between OEM and suppliers rather than an interdependency and divergent contributions to innovative processes - and hence the branding and the continuously increasing competence of enterprises and at particular locations which take advantage of divergent situations and capabilities. The diversities help, benefitting such enterprises and

locations and indicate divergent competences, global value chains and a continuing participation in leading edge innovation.

3. INDUSTRIES AND SIZE OF ENTERPRISES

Geographic concentration and branding of competences relates closely with certain industrial profiles and expertise of enterprises. The emergence and identification of innovative clusters clearly refer to such agglomerations (see the contributions by Lawton Smith & Assimakopoulos and by O’Gorman & Donnelly in this special issues). Although their composition can be highly divergent it allows for recognition, employment and economic development. During earlier periods of industrialisation larger enterprises did characterise such geographic concentrations. When vertical integration was very low there was a concentration at particular locations because they did provide some advantages (e.g. traffic and transportation, raw materials). Old industrial regions did emerge where coal was accessible and where transportation by ship or railway could provide for iron ore. Similarly, chemical industries developed where river water could be used for processes. When the management of manufacturing changed by reducing vertical integration and smaller enterprises developed to supply the dominant ones such locations continued, but new enterprises with an interest in marketing their expertise and products complemented existing structures. During long periods of industrialisation the existence of large firms was a strong advantage for regional development and also for smaller firms as these did have local customers for their specialised products.

Already during such early periods of industrialisation technological progress and efficient equipment became highly important (see the contribution by Scherrer to this special issue). It did increase productivity and security. In mining new machines were developed and introduced and safety of mining was improved. Consequently, mining equipment was produced and exported also to customers at other locations. These new competences emerged and industries based on new knowledge and application of research were the basis for mechanical engineering, precision engineering or measurement instruments. Such lead industries were characterising the suppliers and the competences which were developed. The competences, of course, are not limited to these products to match existing customers



demand. Applying materials, constructing powerful machines etc. can be used in other contexts and for other purposes. The more heterogeneous such clusters become and the less dependant on a particular lead industry they were, consequently, the better these regions, countries or locations can adapt to changes because of declining industrial sectors. The development of knowledge-based enterprises, industries and products allow for application of such competences to new and other areas and products. The more advanced and marketable such competences are, the more demanded were these applications.

While lead industries were dominant and usually characterised by large firms producing large quantities, the suppliers were small and highly specialised. The demanded products were related to higher competences in manufacturing and smaller series or even specialised or adjusted products. An increasing number of suppliers also spread the development of competences over many more enterprises and provided a basis for further synergies of competences and knowledge. Divergent areas of specialisation of firms allowed the entering different markets and approaching different customers. As small and medium sized enterprises, these were both more flexible and could also take advantage of smaller market niches. The orientation in particular supplies was usually related to a specific competence. Consequently, the higher competence in selected areas allowed for change or additional products. The existence of other firms with specific competences, in addition, provided for the opportunity to merge when the specific demands of new customers emerged.

The change of industrial structures because of new competitors and the disappearance of traditional industries and enterprises based on mass-production weakened regions and clusters which were characterised by their orientation in such large firms. Simultaneously, emerging market niches because of increasingly free international trade allowed for smaller firms to find new economic opportunities for their competences. While such small and medium sized enterprises (SMEs) from old industrial regions had to pass through restructuring and to rearrange their strategies, SMEs from other regions which were not dominated by single firms or industries of a small range of products immediately could reorient towards these new and changing opportunities.



4. PRODUCTS AND MARKETS

When international trade and dislocation of plants for mass-production and less complex products towards newly industrialising countries became more intensive, this fundamental structural change did also introduce a change of products and markets. New technological opportunities allowed for more specific solutions of customer demands and introduced small series or products which were highly oriented to the demands of individual customers. The specificity of individual situations which demanded adjusted products and the application of new technologies increased the knowledge and competences required for both design and manufacturing of the products (see the contribution by O’Gorman & Donnelly to these special issues). Profits increasingly emerged from higher quality and from values added rather than from lowering costs through large series production. Plant construction, mechanical engineering, precision engineering, medical instruments, apparatus engineering or measurement instruments are examples of industries of increasing knowledge intensity which meet the changing and growing demand.

While global trade grew dynamically, transportation of goods and people increased also. Rapid train systems as well as aircraft created a strong demand for a higher quality of materials and for new materials. Environmental problems and regulations to reduce environmental impact in addition created a strong demand for research and new technological opportunities based on new research findings. Products, as a consequence, required a constantly increasing contribution from research and development. Electronics, biotechnology, new materials and informatics became driving forces of innovation and allowed for a rich combination with already existing industrial competences. The advancement in electronics and software allowed for fundamental innovation in mechanical engineering, robotics, measure instruments, control of plants etc. Current processes in digitisation and Industry 4.0 again reach out much further and induce processes of innovation in relation to the industrial opportunities or capabilities of a region (see the contribution by Gaddi, Garbellini & Garibaldo to these special issues). New materials allow for widespread innovation and are also addressed in many industries. Aircraft manufacturers and automobile industries both benefit from such new technological opportunities but some materials are also applied in many other products such



as machines, instruments or apparatus because of durability, hygiene or advantages when compared with traditional materials. Biotechnology and genetic engineering as a further example allow for changes in the process of producing pharmaceuticals, replacing traditional chemicals, allowing for modified plants, merging with medical instruments improving their precision as well as some genetic intervention helping to treat diseases.

Consequently, innovation is also oriented in traditional industries and products which allow for improvement when merging with new technological opportunities. Energy efficient cars and aircraft, improvement of health, precise measurements and dosing, or information for pollution control of air, water or soil, such innovation is build upon already existing competences and improves the quality of the products. This provides the basis for processes of innovation, which are already highly divergent because of the different industries, specific products and capabilities of the regions and locations. Those are divergent due to their effect on economic development, concerning the relationship with skilled and educated labour and because of opportunities to link up with techno-scientific research. Close linkages between techno-scientific research and industries ready to apply new opportunities provide for situations that are widely beneficial (see the contribution by Vassiliadis & Hilpert to this special issue). These situations also indicate the divergent arrangements which are fundamental to the processes of innovation to be identified in the individual region, location or metropolis.

Industries which are characterised by large enterprises, simultaneously, provide markets for suppliers and further business opportunities (see the contribution by O’Gorman & Donnelly to these special issues) - and benefit from the innovation which is realised by suppliers. Aircraft industries and automobile industries have developed a vertical range of manufacturers which give particular importance to suppliers and their level of innovation (see the contribution by Hickie to this special issue). Thus supply chains also turn into markets which demand for innovative goods and continue as long as such components of final products are delivered. While this indicates the role of advanced management in complex manufacturing processes, other industries and products can readily approach other markets more directly. Although these can be final products or original equipment manufacturers (OEMs) which also are often related indirectly with certain industries or multi-



national enterprises (MNEs), these firms enter markets not in the rather defined situation of suppliers. Demands of customers and capabilities of innovative firms as well as their innovative products can create a positive socio-economic effect only when markets are available and size of the market is sufficient. Because of the strong demand for innovative products and solutions from customers, for all participants in such a market free trade regulations are important. Producers as well as customers depend on the supply of markets. Thus, a highly diverse process of innovation is indicated by specific situations of regions, locations and metropolises but it can be realised only on the basis of a context in such situations which is formed through available markets where firms and their products may be competitively successful.

5. TECHNOLOGY AND LABOUR-FORCE

Such relationships between innovative enterprises and value chains which inhibit the application or development of new technologies also refer to divergent geographic opportunities. Products need to be manufactured and contributed along the supply chain. Thus, competences in technologies, leading edge engineering and research and transportation match and allow for merging within the chain, based on collaboration and are ready to contribute to the final product. Thus, developers of technologies and manufacturers of high quality products find their position within the value chain at similar, often converging locations. Public research institutes and private enterprises of outstanding technological competence or being well known for particular areas of manufacturing contribute to such processes. A close relationship between those who are engaged in techno-scientific research and enterprises engaged in high value products for dynamic markets allows for an economic orientation early on in periods of technology development and product design.

As diverse as the locations and the individual structures are, similarly diverse are the areas of innovation and the opportunities to participate in innovation. Although frequently certain countries are identified as drivers of innovation or considered to be particularly strong in some areas of research and technology, one needs to take into account that these capabilities are not evenly distributed over the country. Regions, locations and metropolises differ (Hilpert



2016). They allow for diversities of innovation across countries but also within countries – and even in countries which are considered to be strong in new technologies, scientific research and innovation, often, there are significant diversities. Such diversities emerge because of the agglomeration of institutes, knowledge workers and advanced industries, but, in addition, the individual profiles indicate diversities concerning the area of expertise.

Consequently, there are highly specific constellations based on different areas of leading edge research and demanding different education and skills of the labour-force (see the contribution by Vassiliadis & Hilpert to this special issue). Biotechnology is based on research in life sciences and Industry 4.0 or digitisation refers strongly to top research in electronics and computing. Similarly, progress on new materials or medical treatments as well as the development of new pharmaceuticals refers to outstanding competences and established capabilities in a region or at a location or metropolis. Increasingly the importance of cross-disciplinary collaboration, or even interdisciplinary research teams, and the agglomeration of capabilities, competences and labour-force provides a competitive advantage – and in many cases it is the basis of break-throughs which can be geographically localised.

It is the exchange and collaboration of expertise which creates synergy and indicates Islands of Innovation which are outstanding because of such situations and, in addition, these particular locations are building specific continental and trans-continental networks of collaboration. They exchange knowledge while carrying out joint research processes and they exchange knowledge-workers, academics and outstanding scientists as basis of further leading edge research (Hilpert and Lawton Smith 2013). Nevertheless, such networks, locations and opportunities address particular areas of research and expertise as a basis for exchange and synergy. The diversities of innovative locations are reproduced within wide networks among Islands of Innovation – the areas of expertise, research and competences provide the basis for such highly diverse processes.

While Islands of Innovation are centres of excellence in leading edge research and technology development, locations which are less central hardly have opportunities to participate in such processes of innovation in a similar way (see the contribution by Sandulli to these special issues). Once new technological opportunities are ready for



application there are opportunities for synergy when applying them in traditional products or to supply parts on a higher technological level. The examples of aircraft industries or automobile industries indicate the importance of innovation at the level of suppliers (see the contribution by Hickie to this special issue). Reducing the weight by the application of new materials or improving the energy efficiency of motors and machines is also based on design and improvement along the supply chain. This requires a lot of competences built through experience which needs to be merged with tradition. This does not demand links at central locations but for competences to constantly advance the products based on new technological opportunities and to be able to implement those in high quality manufacturing. Such processes of innovation allow for opportunities to continue and constantly modernise existing firms and industries.

While Islands of Innovation create a wide range of jobs for highly educated personnel who frequently hold higher university degrees such as Masters degrees or PhDs, on the other hand, manufacturing firms outside of such highly innovative regions strongly demand highly skilled blue collar workers to match the demands for innovation in quality of the products – and thus indicate that localities for talents vary with the industries and products manufactured. Such skilled labour is fundamental for regional development which takes advantage through application of new technologies without generating leading-edge technoscientific research (see the contributions by Vassiliadis & Hilpert and by Gaddi, Garbellini & Garibaldo to these special issues). The capability in manufacturing and a strong basis in engineering and design to match consumer demands provides for international champions in selected areas although the firms are not based in Islands of Innovation. It needs to be considered that innovation is socio-economically effective only if it is related with manufacturing and higher values added. Thus, the capability to manufacture such high levels of technology-based products creates further Diversities of Innovation by constantly improving capabilities in manufacturing. Consequently, the availability of labour and the skills and education are fundamental for making innovation socio-economically effective. The awareness of the relationship between manufacturing and innovation is also important when searching for a particular strategy of development. While the capabilities and areas of



research are creating clear diversities, in addition, industries are important for identifying the potential for manufacturing. Continuing and constantly strengthening the research basis of Islands of Innovation this provides for a wide area of opportunities realised at different regions, locations and metropolises. On the other hand, continuously increasing and modernising skills of the labour-force are fundamental to participate in innovation from locations in less central regions. Flexible response towards customer demands and the application of new technologies are based on organisation and management of firms: Skills, positive attitudes towards work and the modernisation of the products manufactured provide for the realisation of such processes.



6. CHANGE AND DURATION

Processes of innovation clearly are referring to changing and new needs and demands which may be matched differently than previously by new technologies or new products applying new technological opportunities. The process itself may also require changes in organisation, management, skills and education. Thus, technological innovation is not enough in its own. The realisation of innovation is also based on change which includes firms, societies, economies and government policies (see the contributions by Vassiliadis & Hilpert and by O'Gorman & Donnelly to these special issues). It is already frequently discussed, how widely new information and communication technologies, social media using the internet, new materials applied in cars and aircraft, new pharmaceuticals and the biotechnology and genetic engineering have both impacted and changed everyday life. Whereas the changes which were fundamental to allow for such processes of innovation – frequently associated with noticeable effects from new technologies – are rarely considered. Economic change, modernisation of industrial structures or the demand for new skills or educated labour is discussed in general from a perspective which either asks what is necessary to implement such new technological opportunities or how much such innovation affects existing situations, challenging the established processes and individuals associated with them.

Diversities of Innovation are taken into account implicitly only by empirical studies which refer to certain technologies, industries

or services. Clearly, divergences in technologies, size and scope of firms and their products, markets approached and research required for application indicate specific situations which are usually different from one another. Nevertheless, certain systematics of innovative processes converge but the divergences emerge because of the changing situations based on alteration of elements although individually such changes may be small. During processes of Industry 4.0 firms may find new market niches for specifically modified products, some alterations in the production chain, additional or new skills, and opportunities for transportation of products which individually are rather limited, but are matched to major changes of organisation and requirements which need to be met in the societal, industrial and research environment. One needs to bear in mind that within such constellations of innovative development even minor changes (such as five per cent in each of the areas mentioned) may add up to a significantly changed situation (it adds up to changes of about a quarter of the existing arrangements) - and thus even similarly innovative situations require one to take into account the Diversities of Innovation. This requires adjusted actions and strategies which are based on an understanding of diversification of processes on the firm level which mount up to challenging situations of industries, regions, countries and metropolises.

While this indicates the effect of combination of even slight changes, it needs to be taken into account that in practice certain core competences (e.g. industrial capabilities or particular products) are continued while other elements such as new or changing markets, new technologies or customers demands, may change much more widely. This may indicate even more, that in relation to certain established structures (such as industries or enterprises of outstanding reputation), opportunities for innovation are highly divergent but empirically are concentrated on particular situations and core competences (see the contribution by Lawton Smith & Assimakopoulos to these special issues).

A realisation of changes and adjustments take time. The application of new technological opportunities with traditional products usually take five to seven years until these are standard of an industry. In doing so synergy between traditional competences, updated skills, advanced education and modernised products to meet customers' demands is to be found. Such changes frequently follow from



longer lasting research which takes influences on new product opportunities. Long waves of innovation indicate the periods and changes which emerge during development, introduction and maturation of technologies (see the contribution by Scherrer to these special issues). This also indicates the changes required at different periods of innovation and how divergent the processes are which enterprises and industries have to cope with. Thus, time and duration are important dimensions to understand and to plan for such processes. Consequently, there are Diversities of Innovation according to the period of the process in which enterprises are engaging.

Even in cases when enterprises are in similar industries manufacturing similar products the different periods matter a lot. In particular at the forefront of innovation there might be a strong demand for new technologies and new products applying new technological opportunities. This confronts labour markets which usually are not prepared to supply such new and unique skilled labour. Systems of education and blue-collar skills need to be ready to adjust quickly or to provide such labour which is flexible to adjust to new challenges, and to match the newly emerging demand and manufacturing innovative products (see the contribution by Vassiliadis & Hilpert to this special issue). Nevertheless, a fast developing innovative sector may move faster than the opportunities provided by regional or national labour markets - and in some areas of skills and education even labour migration may neither be available nor ready to meet the new and dynamically emerging demand.

Thus understanding innovation requires analysing processes which begin long before the precise phenomena are identified. In contrast, a concentration on the new phenomena is only a kind of coping with techno-industrial change. To be prepared for innovation there needs to be a supply of labour, research and management of enterprises which are ready to adjust to the changing situation – and these processes need to be rather corresponding. These contributions, required to realise the socio-economic effects of innovation, are constantly changing and are characterised by on-going improvement. Thus change over time plays an important role and creates divergent opportunities of innovation which emerge in different periods and maturities of technologies.



7. CONCLUSIONS: SPECIFIC OPPORTUNITIES DURING CONSTANT CHANGE

Global development and export markets indicate a constant need for advancement and change. While there is much thinking about start-up enterprises, new technologies and break-throughs in research, in fact, existing situations and capabilities of industries, research and workforce are important conditions of innovation. Although some areas of innovation or niches to supply particular markets can be developed, in general, these structures are important to identify appropriate areas and opportunities for such processes in a country, region or metropolis. Industrial structures can provide a basis for application or are critical to both to participate generally in innovation processes and to have an impact on such processes. But, even where there might not be the core capabilities to develop new opportunities, international networks provide opportunities to participate in such processes, which generate the demand for specialised contributions to the entire process (see the contribution by Hickie to this special issue). Consequently, this creates highly diverse opportunities which are to be understood not merely on the basis of technologies but in particular with regard to potential socio-economic opportunities in the light of existing situations (see the contribution by O’Gorman to these special issues).

Participation in divergent areas of innovation is strengthening and modernising regional or metropolitan innovative potential and can also provide cross-sectoral opportunities by merging existing and new capabilities for new processes, products and services. As this strengthens and modernises a regional or metropolitan socio-economic capability it can also help a business which is not related to the innovation itself. Increasing incomes and increasing numbers of people with higher incomes will provide a purchasing power which has positive impact on supermarkets, shops restaurant, services, housing etc.. In addition, such customers demand products and services of higher value and are both capable and willing to pay higher prices. Consequently, processes of innovation are in the interest of inhabitants, employees and employers, shop owners and service suppliers in a region or metropolis. Public policies addressing such processes of constant innovation and modernisation, as well as supporting skill strategies of enterprises and continuous modernisation of the workforce, are clearly oriented





in a strategically important part of the socio-economic structure providing for processes oriented towards a prosperous future.

While doing so, research capabilities and a skilled workforce are fundamentally important to realise such processes and to attract innovative enterprises to come to the region or to stay at the location (see the contribution by Vassiliadis & Hilpert to this special issue).

While Islands of Innovation are usually located at metropolises they also indicate a growth of population. Highly skilled and university educated personnel increasingly are concentrated at highly innovative agglomerations while peripheral or rural regions have to face outward migration (see the contribution by Sandulli to these special issues). When preparing for the innovative processes addressed here, there is a need for a labour-force

ready to manufacture or to design higher value-added products, and for research capabilities ready to provide competences and results which suit the industrial structures and are related to the high-quality services of a region. Hence, government programmes which support such initiatives and help to build sustainable structures of skills and R&D underpin the need to serve the public interest in constant innovation and socio-economic development. Since the structures vary a lot across regions, consequently, the programmes and support required need to address different issues. A clear knowledge about innovative opportunities of the regional or metropolitan structures can help to select the appropriate policies and to allow innovative specialisation to blossom.

Such opportunities emerge based on technologies, organisation of manufacturing and research and, in addition, they are associated with constant changes of skills, products and demand. Since processes of innovation have become highly collaborative in R&D and also with regard to the supply of high-quality parts to international chains of innovation. These situations have also become important opportunities to contribute and participate based on specialised competences. Building specialised competences may help to take advantage of highly diverse processes of innovation and embeddedness in global division of labour. Such Diversities of Innovation are to be identified during constant change processes and in matching with new opportunities. Thus, synergy with traditional competences may help to make opportunities unique and to allow for a continuation of specific contributions to innovation processes which are based on diverse competences.

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