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**WP8.3 DEMAND DRIVEN POLICY DESIGNS FOR KNOWLEDGE GENERATION AND EXPLOITATION –
GUIDELINES FOR POLICYMAKERS AND PRACTITIONERS**

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Executive Summary

Innovation policies have mainly been designed to work on the supply side of knowledge generation. Supply-side innovation policies, such as subsidies to R&D, consider the correction of ‘market failures’ as the main rationale for public intervention. However, in the presence of creative consumers, demand can actually be the “pull” for the adoption of new superior technologies. Since classical free competition alone cannot sustain the creation of innovation, national policy, regulation and public procurement are essential. For example, they can help create lead markets, which are pioneer markets in their particular industries.

The driver of demand-driven innovation is arguably the small and young high-growth firm (the gazelle) which serves as a catalyst for growth. For example, a new startup gazelle can serve as a conduit for knowledge spillovers from academia and R&D institutions to the business sector to facilitate commercialization. Unlike established large companies, gazelles are willing to disrupt existing products by investing in radical disruptive innovation.

Regions diversify into new industries that make use of the specialized capabilities of those regions. For the development of new industries, capabilities available at the regional level play a greater role than capabilities available at the country level. Policy makers should shift their focus from the industries that are present in the region to those that could be present. New industries and new technologies do not start to develop from scratch; industries that are present in the regions should be connected to those that could be present.

Labor mobility across industries rather than intra-industry labor mobility should be encouraged rather than within-industry recruitment. Mobility between industries is more beneficial to the economy because knowledge itself tends to travel along with the people who master it. Traditional demand driven initiatives are exploiting incentives for the attraction of MNEs without attempting to maximize the linkages with the domestic economy – e.g. by embedding the MNE’s subsidiary into the local innovation system, introducing its role as potential partner rather than competitor.

Introduction

As stated in the Project Document of the Seventh Framework Program FP7 – PICK-ME, the objective of the Guidelines is to extract policy implications for public administration practitioners in order to support them in the future design and implementation of innovation strategies at different levels. Deliverable WP8.3 states the guidelines that should serve as a tool in the dissemination of the project results to policy makers and practitioners at the European, national and regional levels and in the promotion of policies for the support of innovation activities and regional economic development.

The deliverable D8.3 of WP8 elaborates the findings of the work packages of the PICK-ME project, namely WP2 through WP7, and structures unique policy guidelines to develop a comprehensive strategy in order to stimulate innovation and economic growth at the regional, national, and European levels.

The structure of this deliverable is as follows: In the first part, WP8 D3 describes the existing framework of innovation and regional competitiveness. The second part proposes policies for the design of demand-driven innovation policies and provides practical recommendations for policy makers. The second part is divided into practical policy recommendations at the regional level and at the national/EU level.

PART I: POLICY FRAMEWORK FOR INNOVATION AND REGIONAL COMPETITIVENESS

Regional Perspectives

Evolution of demand and dynamics of knowledge-base in knowledge intensive sectors (WP5)

The research findings in this WP include the following conclusions: (1) regions diversify into new industries that make use of the special capabilities of those regions, and (2) for the development of new industries, capabilities available at the regional level play a greater role than capabilities available at the country level. Thus, it is necessary for countries and regions to develop new economic activities to compensate for the unavoidable processes of stagnation and decline in their economies. It is recommended that local policy makers shift their focus from the industries that are present in their regions to those that could be present. Another policy implication is that new technologies are not developed from scratch; rather, economic renewal must connect industries that are present in the regions to those that could be present. In that sense, diversification can be defined as a process through which new activities develop out of existing ones, and the scope and outcomes of this process are fundamentally affected by technological and cognitive constraints at the national and regional levels.

Diversification policy should be based on local capabilities rather than on some desired or preferred industrial mix. This is because the underlying capabilities structure in regions provides a pool of opportunities but also sets limits to new developments that do not draw on this capability structure.

Inter-industry “relatedness” provides a powerful framework that allows policy makers to identify regional potentials and to target and select activities as potential sources for diversification. “Relatedness” is defined as the degree to which two firms are active in related markets and it is also associated with shared technological experiences, knowledge bases, and similar products and markets. Measuring the degree of technological relatedness between industries helps to identify opportunities for regions to diversify into new related activities. This requires substantial data collection to identify the degree of relatedness between industries in a region on the one hand, and with industries located outside the region that might be beneficial to connect with on the other hand.

Public policy should avoid ‘*picking winners*’ that do not fit into the actual regional and potential industrial space. It is also not recommended to strive for diversification per se, because this runs the risk of developing new economic activities like cathedrals in the desert that are not embedded in the region.

Yet, policy prioritization is still required, in the sense that related industries are targeted in regions where they have a strong presence. Therefore, we recommend avoiding the targeting of new industries that occupy a peripheral position in the industry space of the region, as these new industries will most likely fail to develop and will disappear as they cannot draw on local capabilities from related industries in the region, like relevant local knowledge bases and particular institutions. (Practical recommendations are summed up in Part II)

Demand and skills matching in local labor markets (WP6)

The analysis conducted in the context of WP6 is aimed at investigating the mobility of graduates and skilled individuals for three relevant countries: the UK, Italy and Israel. Mobility has been increasingly seen as a primary channel through which knowledge spills over space since knowledge itself tends to travel along with the people who master it. Powerful policy implications are linked to the demand for an innovation framework. Our analyses point out the need of attracting valuable individuals with distinctive skills, which are linked to local demand conditions. This evidence advocates the design of policy options that are aimed at tackling structural weaknesses, especially in peripheral regions, to favour retaining these valuable resources while strengthening local capabilities to take advantage of their skills and competencies.

Based on the findings of WP6, we recommend stimulating labor mobility across (related) industries rather than intra-industry labour mobility. Government action is required, as there is a natural tendency of all stakeholders (like employers, employees, public mediation organizations, sector organizations) to focus on their own industries, because of incomplete information, uncertainty and entrenched interests. It is necessary for stakeholders to be informed about which industries are “related” (in the sense of the definition of relatedness in WP5) to their own industry, in order to identify those opportunities. (Practical recommendations are summed up in Part II)

Evolution of demand, sectoral development and the organization of innovative activities (WP7)

The empirical analysis confirms that positive externalities (benefits) from multi-national enterprises (MNEs) into recipient industries may leak out through the process of learning through interactions. Yet, domestic firms’ absorptive capacities play a key role in facilitating the exploitation of the potential positive externalities arising from MNEs and in stimulating foreign enterprises to engage in such cooperation. Indeed we find that the effect of MNEs’ investments is particularly pronounced for

domestic firms which show significant engagement with their regional and national markets. This, in turn, is the locus in which different mechanisms of knowledge transfer from foreign to domestic firms operate. In addition, firms that are already part of a multinational group are less affected by the positive externalities coming from other MNEs. These economic actors have reasonably fewer incentives to engage in a pattern of cooperation since they already have access to the infrastructure channeling the diffusion of global knowledge. (Practical recommendations are summed up in Part II).

National/EU-Level Perspectives

Review and taxonomy of supply-side and demand-side innovation policies: Mapping National Innovation Ecosystems (WP2)

The literature review of demand driven innovation shows that classical free competition alone cannot sustain the creation of new technologies or innovation paths. Rather, national policy, regulation and governmental procurement are the most important in this context. National policy is essential, for example, in creating lead markets, which are pioneer markets in their particular industries and are crucial apparatuses in generating exports and enhancing economic growth.

Such strategic planning is normally regarded as “top down”, driven by the country’s political and business leadership. But the analysis of national innovation ecosystems has revealed the crucial importance of combining ‘top down’ strategic innovation policies with ‘bottom up’ policies driven by the infrastructure of existing capabilities. These capabilities find expression in the innovation ‘anchors’ in our analysis, which differ widely across countries in their impact on the evolution of innovation ecosystems and their ability to implement national strategic goals. These anchors, and the dimensions to which they belong, comprise the foundation on which nations can build their strategic innovation policies, by strengthening innovation-fostering processes that are closely linked to national objectives. Each country must therefore design its own specific national innovation policy, according to the strengths and weaknesses identified in its innovation ecosystem.

It is the combination of effective top-down innovation policies with bottom-up market-driven initiatives that create effective innovation ecosystems. It is an over-simplification to assign top-down policies to the ‘supply side’ and bottom-up initiatives to the ‘demand side.’ Yet, it is probably true in general that market forces have more of a ‘bottom up’ nature.

The importance of constructing visual innovation ecosystems goes well beyond their specific content. Effective consensual innovation policies rest crucially on an economy-wide understanding of the innovation system and its drivers. We envisage a two-stage process, in which experts from all parts of society meet to engage and interact on understanding and mapping the ecosystem, and only after reaching consensual agreement on how the system works (and why perhaps it does not), debating how policy interventions can be most effective. By achieving a deep understanding of national innovation ecosystems, and by studying those of other nations, European innovation policies will be more

innovative, more effective in their national impact, and more integrative in their Europe-wide design. (Practical recommendations are summed up in Part II)

The platform as a policy tool for a competent demand pull (WP3)

Innovation policies have mainly been designed to work on the supply side of the knowledge production process. The traditional approach to innovation policies considers the correction of ‘market failures’ as the main rationale for public intervention. However, demand can actually pull the introduction and adoption of new superior technologies only if and when it is ‘competent’ i.e. originated by creative customers. Moreover, it has to be accompanied by qualified user-producer interactions that make the necessary access to external knowledge possible and allow its effective use as an input into the recombinant generation of technological knowledge. “Competent demand pull” is defined as demand originated by creative customers, which have access to external knowledge and therefore can pull the introduction and adoption of new superior technologies.

When demand is not competent and takes place in a context in which firms are not able to make their reaction creative, its effects on upstream productivity are negative or negligible. Specifically, the effects of demand pull will be negative when the firms that receive the additional flows of demand use rigid inputs that can be changed only in the historical long-term. The effects will consist in an increase in prices and a reduction of the efficiency of the production process that takes place in out-of-equilibrium conditions. The effects of demand pull will be negligible, in terms of total factor productivity, when firms cannot access external knowledge, but rely upon flexible inputs – both capital and labor – that make it possible to adjust quickly to the demand levels moving on the existing map of isoquants in equilibrium conditions.

This framework leads us to focus attention on the types of knowledge interactions that link each sector to the others. Knowledge interactions are by definition bilateral: the active participation of both parties is necessary. Demand can pull the actual increase of efficiency by means of the introduction and/or adoption of superior technologies only if the pulled agents can actually generate new technological knowledge. This takes place if the pulled agents can activate fertile knowledge interactions with the pullers – the agents from which the increase in demand originates. The identity of both the pulled and the pullers is relevant in applying the demand pull hypothesis.

The analysis of the evolution of the procurement strategy of the FIAT group can be regarded as an outstanding example of “competent demand” pull. The competent demand pull strategy implemented by FIAT enables it to combine its internal know-how with that of its first-tier suppliers, thus being able to take advantage of synergies and technological partnerships through appropriate collaborative strategies. The demand of qualified customers that reaches upstream agents is defined as “competent demand”. The access to existing knowledge incorporated in such competent demand is essential, as is the access to external knowledge from all of the other sources (suppliers, competitors). The experience of competent customers, which plays an important role in the upstream production activities, is based on the exploitation of the existing technological solutions which can be passed over to their own suppliers and used to develop new products or new, more efficient ways of using the existing technologies. Demand can actually pull the introduction and adoption of new superior technologies only if and when it is ‘competent’ i.e. originated by creative customers. Moreover, it has to be accompanied by qualified user-producer interactions that make the necessary access to external knowledge possible and allow its effective use as an input into the recombinant generation of technological knowledge.

In FIAT, coordination strategies support the introduction of a variety of “de-layered” organizational relations, which benefit from a wider pool of resources and knowledge, where technological cooperation can take place vertically (i.e. within the FIAT supply chain), horizontally (i.e. between FIAT and different OEMs) and diagonally (i.e. through different supply chains by means of first-tier suppliers that cooperate with different OEMs). Innovation is the result of the integration of top-down and bottom-up innovative processes. It takes place through the bidirectional exchange and communication of technical information, innovative capabilities and the results of Research and Development and design activities developed both by FIAT and the first-tier suppliers. Here, transformation also includes changes in the number and quality of actors, integrating new suppliers and partners into the platform according to new emerging technological needs, and excluding old ones.

The adoption of a platform organization has implied important changes not only in the choice between make and buy, between internal production and external provision, but also and more importantly in the way in which FIAT coordinates its procurement and manages external supply. Platforms are effective tools to implement a competent demand pull strategy when, within complex innovation systems, an array of horizontal and vertical interactions coexists such as: vertical cooperation between Original Equipment Manufacturers (OEMs) and suppliers, shared platforms between OEMs, arm’s length transactions and spot contracts within modular networks of first-tier and second-tier-suppliers, and

quasi-integration between users and producers based on long-term co-design strategies. Innovation is the result of the integration of top-down and bottom-up innovative processes and takes place in a truly cooperative way, through the bidirectional exchange and communication of technical information, innovative capabilities and the results of Research and Development and design activities developed by the different actors involved in the network. This is the space depicted by articulated hierarchical networks and guided by leading firms. It combines both knowledge transactions and knowledge interactions as sources of external learning. Procurement systems centered on platforms are able to combine the advantages of the exploitation of knowledge complementarities among a variety of organizations with the benefits of network cohesion and the sharing of common goals. (Practical recommendations are summed up in Part II)

Demand and the rate and direction of R&D and innovation efforts (WP4)

Large incumbent companies are focused on the current market and technology and miss opportunities to address new market needs that new companies can fill. In other words, the incumbents have a vested interest against disrupting their existing markets. Therefore, in our approach, gazelles serve as the catalyst for growth: for example, a new startup can serve as a conduit for knowledge spillovers from academia and R&D institutions to commercialization in a new firm. Unlike the established large company, the gazelle is willing to engage in radical innovation that disrupts existing products.

Getting the incentives right for gazelles, especially fostering the creation of clusters, is an important policy implication of this research. Gazelles should be the target of innovation policies aimed at fostering the exploration of new technological fields. However, similarly to WP5, the above policies do not recommend picking in advance the sectors to be supported as it will not allow the most innovative gazelles the freedom to choose based on their creativity and entrepreneurial instincts. Even if industrial policy might have a rationale for large companies or national champions, it is mostly counterproductive for gazelles as it rests on fundamentally supply-based assumptions.

Barriers to the absorption of new ideas on the demand side can present severe obstacles to innovation: absorption of technology is not automatic and a lot of trial and error goes into the process of innovation. Institution building for innovation at all levels should cater to the needs of these firms which do the important job of widening the economy according to what the market demands whilst providing the

foundation or seed for future large successful corporations. (Practical recommendations are summed up in Part II)

PART II: POLICIES FOR THE DESIGN OF DEMAND-DRIVEN INNOVATION POLICIES AND PRACTICAL RECOMMENDATIONS FOR POLICY MAKERS.

Practical Recommendations at the Regional Level

Evolution of demand and dynamics of knowledge-base in knowledge intensive sectors (WP5)

1. Policy should not support declining industries that take a peripheral position in the industrial portfolio of a region. Such support is not a smart policy from a relatedness perspective because these industries already have a high probability of exiting the region.
2. Yet, an intervention might be justified when a related industry is confronted with a (temporary) demand fall, resulting in serious damage to the dynamics of other local industries to which it is technologically related. Policy intervention might be needed to avoid such a cascade effect which might erode the whole underlying capability base.
3. Policy should aim at diversification, with the objective of broadening and renewing the industrial structure of regions by making them branch into new related activities. This is achieved by encouraging and enabling crossovers between related industries that can provide complementary assets.
4. Policy should avoid a 'one-size-fits-all' approach. Instead, tailor-made strategies that capitalize on region-specific assets that are linked to technologically related industries are recommended.
5. Policy could play an active role in enabling and activating knowledge transfer mechanisms through which related industries can connect at the regional scale. This might be realized through entrepreneurship policy that focuses explicitly on experienced entrepreneurs that come from related industries. It might also be achieved through labor market policy that focuses on mobility across industries, with an emphasis on mobility between related industries, because this leads to the formation of knowledge networks and the transfer of skills between industries that provide complementary resources.
6. Policy could also focus on establishing collaborative research networks, with a focus on research cooperation between related partners within the same region or located in different regions. The latter underlines the importance of establishing linkages with partners outside the region to get access to external knowledge, in particular related knowledge.
7. This key finding of the study on Spain suggests that some capabilities should be developed locally to raise the probability of developing new industries at the regional level. In that context,

it would be wise to target policy intervention at the regional level, because it is at this level where the main assets to diversify successfully are present. This would bring us a step forward in the design of policy programs that are focused on regional diversification, despite all the unpredictability that is part and parcel of the development of new growth paths in regions.

8. Not all policy interventions should be conducted exclusively at the regional level, as many relevant policy areas are actually designed and implemented at the national scale (like labour market policy, education policy) and the international scale (like research policy), but the effects of policy will certainly have different impacts on different regions.

Demand and skills matching in local labor markets

1. Policy makers should discourage companies from recruiting labor from the same industry because, according to the WP's findings, such recruitment is not conducive to the good performance and productivity of labor.
2. Policy makers should discourage workers from changing jobs within the same industry because moving across skill-related industries seems to be more beneficial.
3. Private labor consultancy businesses, labour mediation offices, public employment agencies and labor offices should be requested to encourage companies and workers to make moves between industries, because it seems to be more beneficial for all involved than changing jobs within the same industry.
4. Institutional bottlenecks (laws, rules) that prevent companies from connecting and exchanging labour across industries should be removed to encourage inter-industry labour mobility.
5. Local policy makers should be encouraged to pursue policies which attract industries that could boost mobility across (related) industries.
6. Policy initiatives aimed at attracting knowledgeable individuals in light of the positive effect coming from an enrichment of the local knowledge base need to be complemented by capacity building strategies.
7. Policies targeting local firms, with the aim of increasing their capability to absorb and exploit external sources of information through effective linkages with other co-located actors, are a necessary complement to fully embrace the benefits of mobility.

Evolution of demand, sectoral development and the organization of innovative activities (WP7)

1. Policies should aim to encourage foreign enterprises to engage in innovation activities and effectively diffuse these innovations. In a demand driven context, this implies:
2. Upgrading human capital in line with demand and linking higher education programs to industries and specializations for which demand exists.
3. Undertaking a mapping out of the skills required by both domestic and foreign firms and well as improving cooperation between firms and other institutions.
4. Investing in public Research and Development in order to encourage existing subsidiaries to engage in high value added activities, while building domestic capabilities to take advantage of the uncompensated benefits associated with them.
5. Fostering long term research projects in key areas in order to generate outputs (e.g. patents or academic publications) that may act as relevant inputs for research establishments by MNEs and domestic firms.
6. Investing in particular sectors with the aim of developing specific innovations to meet the needs of the economic actors, both foreign and domestic, operating in these industrial contexts.
7. Putting in place an adequate system of incentives to favor the emergence of cooperation: this can be done by embedding the MNE's subsidiary into the local innovation system by introducing its role as potential partner rather than competitor.

Practical Recommendations at the National-European Level

Review and taxonomy of supply-side and demand-side innovation policies: Mapping National Innovation Ecosystems (WP2)

1. Introduce effective consensual innovation policies which rest on an economy-wide understanding of the innovation system and its drivers.
2. Design a national innovation policy according to the strengths and weaknesses identified in the national innovation ecosystem based on a combination of top down policies with bottom up policies.
3. Construct visual innovation ecosystems based on the following: (i) Engage experts in understanding and mapping out the ecosystem; (ii) Reach a consensual agreement on how the system works; (iii) Debate and agree upon how policy interventions can be most effective.

Development of an integrated analytical framework (WP3)

1. Moving towards a 'Learning Society': The growing evidence that the continuation of economic development requires an increasing differentiation of the economic system implies that the composition of the labor force, and in particular of its competencies, needs to change over time to suit the present and expected demand for labour. This can be achieved by moving towards a 'Learning society', a system in which people need to continue learning throughout the course of their career. This can only be accomplished through a combination of (i) reduced barriers to entry into and exit from particular sectors or activities and (ii) adequate training/education programs and facilities which can rapidly adapt the competencies of the labour force to the present labor market and to international demand.
2. Co-evolution of demand and innovation: Innovation could not have contributed to economic development unless a demand for the corresponding products had been created. Our recent work with the TEVECON model shows that demand and innovation need to co-evolve with feedback loops (which can be positive or negative) existing between the two. Thus, demand, innovation and the economic policies designed to affect them are not clearly separable. As a consequence, economic policies need to foster a productive structure capable of achieving both demand and supply related factors. Economic policies need to foster a productive structure which can generate (i) the disposable income required to purchase new goods and services and (ii) the exports needed to preserve a generally positive trade balance. Economic policies aimed exclusively at demand risk being unable to achieve either (i) and (ii) or both.
3. Heterogeneity of consumers as a driver of innovation: The complex influences of consumers on the innovation process are often over-simplified. To understand innovation, we need to understand the demand for it. With the help of an agent-based simulation model, we show that heterogeneity of demand and hence consumers are indeed one of the major drivers of innovation which should be taken in consideration. In more detail, our results indicate that (i) the heterogeneity of demand itself fosters the innovation engagement of firms and (ii) considering heterogeneous consumers, supply side subsidies can be less effective than demand side subsidies and furthermore can have major drawbacks.

Demand and the rate and direction of R&D and innovation efforts (WP4)

Government interventions to support both demand-led innovation policies and supply side instruments are both important and should be considered in conjunction.

1. Improve the business environment for innovative firms, which includes strengthening the legal environment, implementing anti-monopoly policies, improving standards that aim for product quality, and building human capital.
2. Use state-ownership as a tool for supporting innovation in key areas vital to state security and energy in which private businesses would not invest. Direct state control over R&D is considered to be essential.
3. Subsidize R&D in private companies using matching grants, loans, incubators, industrial parks, guarantees, share-risk in equity in venture capital funds, special economic zones etc.
4. Expand Public Procurement of R&D from private companies. Instead of the supply-side traditional state-ownership, PPI aims to motivate the demand-side of innovation and eliminate obstacles for markets to emerge in the first place. The aim is that via PPI, policy makers can provide the necessary demand-side incentives to bring about and/or sustain the innovation process at its very early and critical stages. (see WP8 Deliverable 1 for a full discussion of PPI).
5. Adopt policies to encourage participation in global Research and Development, as cooperation with researchers and multinational corporations overseas is an effective way to tap into the global knowledge pool, enabling both the technological and intellectual transfer of know-how. Global cooperation can include: (i) A cooperation-friendly intellectual property rights regime; (ii) subsidized exchange study abroad programs for scientists and those with doctoral degrees; (iii) Lesser restrictions on immigration of researchers, and incentives for multinational corporations to establish their Research and Development centers in host countries.

Each of these instruments might be suitable in a different policy setup. For example, PPI and state-ownership could be more suitable than subsidies because they allow closer control over the early stages of the innovation process in particular. However, subsidies are more appropriate instruments when flexibility is required of the instrument. They allow for stimulating products or services that governments cannot procure or for which there is no immediate demand within the public sector.