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A Framework for Policy-Oriented Innovation Studies in Industrialising Countries

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ABSTRACT

This paper argues that there is increasing need for the integration of policy considerations in the formulation of research questions and in the development of analytical work in policy-oriented innovation studies. Despite the fact that Evolutionary and Innovation Studies theories have offered new ways of incorporating policy, little explicitness in this regard has yet been achieved and there is a risk that academic research following the new perspectives will be of little relevance for policy. Rather than a ‘linear process’ starting with empirical research aimed at linking competitiveness and economic performance to technological capabilities (in a comparative perspective and aimed at identifying ‘best practice’), followed by very abstract and un-grounded ‘policy implications’, a new type of link between positive and normative economics in the field is required. Our approach suggests a new structure for policy-oriented and policy-relevant research, i.e. the integration of research on technological change and industrial transformation, with research on policy and the development of a conceptual framework for the design and implementation of innovation policies.

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INTRODUCTION

Innovation policy instruments have a central role in the evolution of science and technology capabilities in Industrialising Countries, both in the development of underlying knowledge bases, and in the provision of the physical and knowledge infrastructures on which technological progress depends (Mani 2002).¹ This makes the task of state-of-the-art policy research on conceptualising the appropriate rationales for the priorities of policy an important one, as a precondition for the much more demanding question of the efficiency of policy instruments and implementation methods.

The current debate on innovation policy in Industrialising Countries revolves around the problem of the justification of policy interventions and to a lesser extent it takes account of criteria for the introduction of policies instruments. The existing literature deals with these problems either in the 'market failures' framework or in the evolutionary tradition of institutional adjustment to exogenous changes (Stiglitz 1989 and Lall 1987 & 1992). The first direction of research suggests criteria for the allocation of resources and the second perspective emphasizes the importance of a systemic view of the accumulation of technological capabilities in Industrialising Countries that eventually will inform policy making by providing 'best practice' models/routines of involved agents and institutions.

In this paper we take the pragmatic view that in the current context of the internationalisation of economic activity, Governments in Industrialising Countries are using technology and innovation policy extensively for the promotion of growth and economic development (Bora *et al.* 2000). The scale and/or the extent of these projects are not that important from an analytical point of view. What is more interesting is to try to link policies to existing and emerging needs that arise from trends in economic activity and technological change. What is really needed is to bring together specific economic trends and the set of relevant policies that will address current challenges for sustainable, innovation-driven growth in Industrialising Countries in an integrated and efficient way.

¹ The innovation processes is a pervasive phenomenon aiming at the introduction of 'new ways of producing things' that is central to the operation of firms. This broad perspective is more relevant to Industrialising Countries where limited R&D takes place and incremental technological change plays an important role (Teubal 1996). The performance of innovation depends on the interactions between firms and between firms and other knowledge-producing agents. Innovation policy refers to elements of science, technology and industrial policy that explicitly aim at promoting the development, spread and efficient use of new products, services and processes in markets or inside private and public organisations (Pavitt 1987 and Mowery 1995).

The proposal we put forward is to shift the debate from ‘why we need innovation policy’ to ‘what kind of policy is needed’ at the various phases of development of a country (and for different types of countries).² We would argue that the better design of policies extends beyond a set of criteria for resource allocation or the better understanding of the complex interaction of institutions. Hence, the point of departure is the processes of transformation of the economy at different phases of economic development and industrialisation. A second level of analysis is to identify relevant policy issues which arise from empirical work on specific aspects of development and structural transformation. The third level of analysis should provide pointers or insights into possible policy conclusions; a process, which may require linking with macro-level problems related to the allocation of resources and co-ordination of different actors.

² This paper is part of a larger project on the Political Economy of Innovation Policy implementation in Industrialising Countries. Since 1997, a network of scholars was involved in the preparation of nine papers for the Journal *Economics of Innovation and New Technology*. A first section of papers examined the general issues that constitute the main elements of the research agenda for policy-oriented research [*A Framework for Policy-Oriented Innovation Studies in Industrialising Countries*, by Dr Anthony Bartzokas (UNU/INTECH) and Prof. Morris Teubal (Hebrew University); *Technology Strategies for Economic Development in a Fast Changing Global Economy*, by Prof. Larry Westphal (Swarthmore College); and *Some Implications of Endogenous Technical Change for Technology Policies in Developing Countries*, by Prof. Richard Lipsey (Simon Fraser University)]. The second section focused on a number of issues, which provide a first level of application of these analytical insights at the country, regional and thematic level [*Conditions for Successful Technology Policy In Developing Countries: Learning Rents, State Structures and Institutions*, by Prof. Ha-Joon Chang and Mr Ali Cheema (University of Cambridge); *Governance and the Implementation of Technology Policy in Less Developed Countries*, by Dr. Joachim Ahrens (University of Göttingen); *Global Production Networks and the Changing Geography of Innovation Systems: Implications for Developing Countries*, by Prof. Dieter Ernst (East-West Center, Hawaii); *Innovation Systems, Institutional Change and the New Knowledge Market: Implications for Third World Agricultural Development*, by Prof. Norman Clark (Director GSES, University of Strathclyde); *Building Technological Capabilities in a Liberalising Developing Economy: Firm Strategies and Public Policy*, by Dr. Rakesh Basant and Dr. Pankaj Chandra (Indian Institute of Management); and *Efficiency and Equity Aspects in the New Latin American Model*, by Prof. Jorge Katz (UN-ECLAC)]. Additional information on this project and downloadable drafts are available on <http://www.intech.unu.edu>.

NEW REQUIREMENTS FOR TECHNOLOGY AND INNOVATION POLICY

One first attempt for the introduction of technology and innovation policy in Industrialising Countries took place in the context of industrialisation programmes and it was influenced by contributions from Development Economics. The outcome of this debate was the introduction of formal Research and Development (R&D) systems in industrialising countries and the allocation of significant resources (at the scale of 0.5 - 0.8 per cent of GDP) to the operation of these systems that in many instances have operated as self-sustained enclaves in the local economy. These views paid little attention to learning processes and assumed that whatever technical progress was possible would automatically come with capital accumulation.³ Development experience in the last 30 years, however, shows that developing economies differ considerably with respect to their abilities to learn how to assimilate new technologies and how to adjust to new ways of producing things (Datta-Chaudhuri 1990). Recent contributions, from an innovation studies perspective in this debate, are concerned with the efficiency of existing institutions and they have proposed a 'second generation' of innovation policies that gives priority to diffusion-oriented policy instruments (Justman & Teubal 1986).⁴ A second group of contributions examined contradictory views on the role of imported technology: from policies designed to develop local technological capabilities to policies promoting openness and Foreign Direct Investment (FDI) which will facilitate the diffusion of knowledge to less developed economies (Mytelka 1996 and Westphal 2002). These studies have analysed the advantages and the risks of technological change in Industrialising Countries. Their empirical orientation has produced useful insights for policy and it has exercised significant influence on policy agendas.

Acceleration of the globalisation process including a new phase characterised by enhanced diffusion of Information and Communications Technologies, deregulation in product markets and in the non-traded goods sector and the increasing interconnectedness of the global economy have far-reaching implications for policy at both the 'strategic' and 'operational' levels. Some countries and some sectors within countries have adapted well to these trends, and others poorly. The magnitude of the new challenges and associated opportunities facing Developing and Industrialising Countries presumably helps to explain both the concentration of economic

³ Metcalfe (2001) contradicts the idea that development is related to accumulation only and introduces an evolutionary learning perspective.

⁴ Recent contributions on the efficiency of policy reforms in Development Countries have reached similar conclusions. Against the naïve belief that once the physical capital is installed, the subsequent problems of production and productivity improvement would automatically be

progress in some regions of the world economy as well as the increasing disparities in income per head across nations and regions. It is the presumption of this paper that appropriate technology and innovation policies constitute an important component of the capacity of countries and regions to adapt.

There are some main trends in the current policy debate on Innovation and Technology Policy in Industrialising Countries. One of these trends concerns the changes in the external and internal environment of Industrialising Countries, which necessitate a re-orientation of what traditionally was termed Innovation and Technology Policy (ITP) and an increasing recognition of the need to move beyond the imitation of policy recipes imported from advanced countries (Bartzokas 2002a). Another trend is that the rapid technological change and de-regulation have increased the need for more sophisticated policy frameworks and institutions that will respond to these processes. The process of policy responses to challenges is increasingly complex due to fact that the emerging forms of economic activities and competition (and the increased complexity and openness of systems of innovation and of the policy process itself) indicate new roles for policy. Much more than in the past policy should consider:

- learning processes and co-ordination problems;
- institutions (including the institutions of policy itself);
- new patterns of knowledge flows; and
- the complexity of capital markets and allocations of resources in a globalised economy (which increases the risk of exogenous shocks and imposes constraints on the conduct of macroeconomic and sectoral policies).

A major aspect of the above is that the ‘relevant’ system which both influences and which is influenced by ITP is much broader than what it was traditionally. This reinforces the need of adopting a broad conceptual framework that is both Evolutionary and based on a Systems Perspective. It also involves a more explicit analysis of the policy process.

We suggest that there are three main requirements to the adoption of ITPs adapted to these emerging trends at the beginning of the millennium.

1. Policy for the promotion of innovation-driven growth is considerably more knowledge intensive than in the past and this points out to the important role that research, including Academic Research could play in the new context;
2. New Conceptual Frameworks with an Evolutionary and Systems Perspective that will: a) consider – from the ‘positive side’ – not only technological development (and R&D) *per se* but also learning; co-evolution between the business enterprise sector,

resolved, it has been suggested that institutions and the actual policy implementation are factors of critical importance (Thomas *et al.* 1990 and Lewis 1994).

the supporting structure and policy; and b) will adopt from the ‘normative side’ a strategic perspective (Teubal 1999), a view of the policy-maker as adaptive rather than maximizing (Metcalf 1995) and will consider the policy process as part of the dynamics of the economic system (Johnson 1997, Teubal 1998, Teubal *et al.* 1997 and Edquist 2000); and

3. The introduction of new policy mechanisms that will stimulate the creation of ‘policy-oriented’ knowledge and its effective utilisation and translation in terms of national priorities for ITP; translation of priorities into a set of new ‘incentives’ programmes and institutions; and to assure effective feedback between policy implementation and policy formulation.⁵

In our opinion these requirements are of quite general validity in the sense that they are relevant to the process of ‘policy restructuring’ in a wide variety of cases and contexts. Moreover, it is important that the system of institutions and agents which influences and is influenced by policy will be made as explicit as possible. In what follows, we will detail some aspects of these requirements.

New Knowledge

Increasingly the results of ‘positive’ research on innovation and system transformation cannot be directly applied to policy making without an intermediate, explicit process of policy analysis. Policies are not obvious. Frequently a given outcome of ‘positive’ research that focuses on one variable, e.g. R&D and government subsidies to R&D, may lead to two opposing views of policy actions (e.g. increase subsidies or reduce subsidies); and the set of policies should be considered rather than one programme at a time. We will try to illustrate with a hypothetical example of considerations that usually exercise significant influence in the design of policy (Teubal 1996 & 1997). It all starts with the positive link that is usually found between government subsidies to R&D and productivity growth of companies. For some analysts that may imply the need to introduce a series of alternative policy options rather than increasing government subsidies. The argument goes that the scope for direct subsidies is limited in a context of industry funded R&D, which is carried out by emerging large companies with strong R&D capabilities that will eventually internalise externalities, leverage R&D and have greater access to world capital markets. In this context, past success is eliminating the ‘surplus’ of skills to a point that additional ‘demand’ for R&D related skills will either only raise engineers’ salaries if not reduce the actual supply even further.⁶ An alternative policy option is to increase

⁵ For an extensive analysis of these issues, see Teubal (1999).

⁶ If academic institutions cannot differentiate between salaries of Professors who teach in fields related to Business Sector R&D and salaries of Professors in other fields, then the former group of Professors might be enticed to leave to the private sector; a fact which will reduce the output

subsidies only if additional policies, both incentives and ‘institutions’ are simultaneously changed in a timely fashion. In addition, it may make sense to reduce subsidies to R&D if the above is not possible, or if the rapid emergence of Venture Capital (VC) makes subsidies much less important than before, or if the continuation of large subsidies to R&D due to the successful lobbying of large companies generated by past policies would lead to reductions in government allocations to primary education and other infrastructure.

The above analysis illustrates how ‘policy’ cannot be a simple afterthought that linearly follows ‘positive’ analysis or ‘application’ based exclusively on simple rules or Economic Theory principles. Significant knowledge and information about the wider system is crucial; and if this is not available then the design of ‘positive’ research may have to change.⁷ This conclusion concerns the integration of ‘positive’ analysis or research with ‘normative’ analysis. Our suggestion is that undertaking ‘positive’ research with a policy perspective, which follows System of Innovation principles, may radically affect the objectives, design and methodology of the former.

Following, for illustrative purposes, our example of different options for ITP in an industrialising economy, there are two possible situations: First, an important priority is to support R&D and new technology-based Start-Ups (SUs); and second, given the widespread diffusion of both R&D and the dynamics of new technology-based firms, the priority should be ‘stimulation of company growth’ and ‘generation of large indigenous R&D-intensive companies’ (rather than stimulation of R&D and SU). In the first scenario, positive analysis and the interviews will focus on the process of SU formation and on R&D; in the second, they will focus relatively more on the post-SU phase and on organisational, managerial, institutional and other non-R&D factors leading to company growth. Identifying such typologies and understanding their impact at the various phases of growth of the VC industry and of other drivers of technological change can only proceed through a first phase of interviewing and case study work. While econometric work would deepen our understanding and in some cases could

of engineers at Universities. The labour market for high-skilled professionals is facing many challenges in advancing Industrialising Countries. It exemplifies how the desirability of enhanced subsidies to R&D in the BS depends on ‘governance’ in the non-business supporting structure, and on the institutions linking these sub-systems.

⁷ A fascinating example in this respect is the difficulty in creating ‘policy-relevant’ knowledge in the case of Israel, an Industrialising Country with significant successes in high-tech development, despite abundant information. It concerns the implications of the existence of VC – a sector that co-evolved with High Tech during the 1990s – for government incentives to R&D in the BS. The amount of information about VC there is astounding; but insufficient codification of this knowledge and a lack of systematic study of its impact on company and high-tech cluster growth implies that up to now little policy-relevant knowledge in this area has been generated. This means that discussions about the size of the government R&D budget are not yet suitably informed about whether the activity of VCs is complementary or substitute to governmental incentives.

make an important contribution to knowledge, it should be based on the fieldwork just mentioned and on subsequent conceptual theory, which attempts to build a consistent overall picture.

Creating policy-relevant knowledge requires that we address also the subsequent policy analysis phase. Extracting policy implications is not a simple process as it is usually not a trivial or simple implication of the ‘positive’ analysis. Indeed, there are no simple policy implications – in certain areas VC activity could substitute existing incentives but probably not in other areas, e.g. Biotech companies and Seed Finance of SU companies (at early stage of the VC industry). Moreover it is important to look at government incentives to R&D in the broader perspective of the financing of SU companies, the stimulation of technological entrepreneurs, and the shift from the start-up to the mature phase of company growth up to the creation of indigenous, global IT companies with strong potential for generating value added to the economy (both directly and indirectly). In some cases it may be extremely important to retain subsidies in order for the entrepreneur not to lose control nor dilute ownership of his business so early after SU foundation.

The above examples illustrate what we have said in the introduction of this paper. The process of generating policy-relevant knowledge in connection with new and dynamic phenomena requires a multi-methodological approach. It should include both case study work and the application or the creation of conceptual theory in order to identify crucial parameters and arrive at some basic typologies relevant for policy; and for understanding processes as well (Appreciative Theory in evolutionary terms, see Nelson & Winter 1982 and Nelson 1995).⁸ It is also important to make a distinction between information and knowledge, in our case policy-relevant knowledge. To be relevant, information frequently has to be codified into a body of knowledge. Alternatively we may state that frequently this type of research is important for effectively integrating microeconomic research into Innovation and Technology Policy. Moreover such research also necessitates new mechanisms for generating such knowledge.⁹

⁸ This most important preliminary phase would be considered ‘pre-research’ by traditional Academic Economists as formal model building and large-scale empirical research has not yet been done. What they ignore is that: a) this so-called ‘pre-research’ requires the creation or adaptation of Appreciative Theory – a fact requiring considerable effort and originality as the ‘basic outline’ of reality cannot be assumed to be known; b) large data bases on relevant variables are not yet available; etc. In these contexts – which are numerous as we are dealing with very dynamic, new and increasingly complex phenomena – there is very little contribution that ‘traditional’ Academic research can directly make to Technology and Innovation Policy formulation.

⁹ All of this links with one of the main objectives of this project: to provide a new model of how to integrate policy into research on technology and economic growth (see Note # 2).

Relevance of ‘market failure’ and market failure analysis

A second issue concerns the validity of ‘market failure analysis’. In our uncertain world there is still room for ‘market failure analysis’ in the sense that policy should be based on the outcome of attempts to ascertain to what extent the Business Sector (BS) would by itself, without policy support, undertake those activities which contribute to attain the strategic objectives and priorities of the country/economy (Lall & Teubal 1998).¹⁰ The market failure approach offers only limited guidance concerning the specific problem of the combination and the timing, not to mention the management of policies, in a dynamic context. For example, while the market failure approach directs attention to the question of whether economic actors are getting the correct incentive signals from markets, a discussion about innovation dynamics in Industrialising Countries is in part the question of what the set of economic actors should be (Bartzokas 2002a). These endemic problems might help us to explain the weak link of this theoretical tradition to empirical research in recent years, the difficulty to offer testable hypotheses and the failure to predict recent developments in industrialising countries.¹¹

In an attempt to explore the feasibility of this statement, we would like to turn to the parallel development of theory and empirical work in growth theory and industrial dynamics. Academic research on issues related to industrial organisation and wealth creation is undergoing a regeneration of interest, the emergence of significant debates and a re-evaluation of neoclassical models.¹² The point of departure is the static resource allocation approach with optimum properties of competitive markets, which reached their finest theoretical formulation in the model of general equilibrium. It has been suggested by theorists in the Arrow-Debreau tradition that this model is a valuable tool for descriptive analysis at a higher level of abstraction, a first axiomatic approximation, which will progressively be removed to reveal a durable building that could encompass descriptive analysis (the ‘calibration’ stage). The application of this approach in studies of technological change has introduced many axioms and special assumptions. With the introduction of these inescapable characteristics of the real world, i.e. increasing returns, imperfect competition, unforeseen technological change, path dependency trajectories, the construction bursts asunder and the building itself collapses. In that context, we have seen a regeneration of interest, the emergence of significant debates and a re-evaluation of neoclassical models. This re-examination has been stimulated by the concern that neoclassical models are inconsistent with the evidence. Some recent studies take it one step further, suggesting that this

¹⁰ A reformulated, market failure approach, one that is closely related to country strategic priorities, is presented in Teubal (1998 & 2001).

¹¹ See John de Mothe (1998) and Wilkinson, F (1983).

¹² See also Kaldor (1996).

line of research is going through a significant transformation of its axiomatic formalism in model building.¹³

What needs to be examined, though, is to what extent these recent contributions provide opportunities for complementarities to the results of innovation studies. Indeed, recent work in growth theory has emphasized the contribution of: a) externalities resulting from capital and knowledge accumulation; b) accumulation of human capital; and c) continuing growth in the stock of productive ‘designs’ with the stock of ‘codified’ knowledge-facilitating mechanisms capable of generating long-term economic growth. This approach justifies a role for policies that affect efficiency of resource use such as co-ordination of investment decisions, investment in infrastructure and education as well as the development of science and technology policies. While it continues to be based upon individual optimisation, it now takes account of social institutions and structures by assuming that they are endogenous factors in the economic system. Once there is an endogenous growth mechanism in place, attention can focus on any market imperfection that affects the savings rate and long-run growth prospects. Some examples will illustrate this point. Research is shifting from the focus on what determines growth rates of a group of countries to what influences the growth rate of individual countries, and from the link of market conditions to innovation to the interlinkages between firms, market conditions and corporate performance. In both cases there is an increasing recognition that applied research reinforces theory and that realistic assumptions might offer a way out of declining returns of research efforts in areas such as the cross-country regression analysis studies.¹⁴ At about the same time, scholars working on industrial dynamics from a Schumpeterian perspective – mainly in the fields of trade theory and technological diffusion – moved to analytical models and research methodologies which are closer to the conventional approach of the Economics of Technological Change.¹⁵ Therefore, we suggest that there is increasing need to integrate these research findings in the broader territory of innovation and technological transformation studies in Industrialising Countries. This approach will bring the output of academic research closer to a better understanding of economic and technological trends (Bartzokas 2001b).

New conceptual framework — evolutionary and systems perspectives

The third requirement for shifting to a ‘new’ ITP concerns the New Conceptual Frameworks, in particular adoption and further development of the Evolutionary and Systems perspectives to policy with the explicit incorporation of the policy process and the institutions of policy into the

¹³ See for example many recent articles in the *Journal of Economic Growth* and for a critical review, see Fine (2000).

¹⁴ See, for example, Milgrom and Roberts (1990) and Temple (1999).

¹⁵ See, for example, Grossman and Helpman (1992). A first attempt to present this trend in a textbook was made by Stoneman (1995).

analysis.¹⁶ We are talking here of overarching conceptual frameworks which sustain a variety of more specific Appreciative theory efforts in different areas (e.g. the VC areas mentioned above). Systems of Innovation perspectives recognise the existence of at least four subsystems or main components involved in the production, utilisation and transmission/diffusion of information and knowledge relevant for the production of goods and services:

1. the BS;
2. the Supporting Structure;
3. Interactions, Institutions and Links; and
4. Culture and Social Structure (Teubal & Andersen 2000).

Currently the BS should be considered, for a variety of reasons, the backbone of the system and its 'restructuring' central for the transformation and successful adaptation of the system.

Some of the main features of an Evolutionary/Systems perspective are: a focus on the dynamics of the processes of System of Innovation transformation, including co-evolution between policy, the BS and the supporting structure; and an explicit analysis of the co-ordinated growth of supply and demand for new elements of the economic system such as VCs, Technology Centres and the study of links with the global economy. From the normative perspective, the central points in our opinion are: the need to abandon simple economic calculus for a broader strategic perspective leading to quite explicit priorities for Technology, Innovation, the BS and the Supporting Structure; and the need to consider simultaneously the set of policies rather than one policy/programme at a time.¹⁷ Other fundamental normative features include: the idea of adaptive policy-maker (Metcalf 1996); policy as judgment; and the context specificity of policy (Lipsey 2002, and references therein). What Lipsey says in connection with technology policy in general, we would like to say specifically about the strategic component of such policy: there will always remain an element of judgment, although policy should always be informed by theory, data and measurement. In this connection Metcalfe's view about an adaptive policy-maker is pertinent: strategy will constantly have to be adapted to changing circumstances, and of course this is a major reason for the increased knowledge and research

¹⁶ The main contributions to the systems of innovation perspective to technology and economic growth are Freeman (1988), Lundavall (1992), Nelson (1993) and Edquist (1998) although 'policy' in most of these works is incompletely formulated and rather unconnected with 'positive analysis'. For an explicit attempt to consider policy within an Evolutionary and Systems perspective, see Lipsey (1996 & 1998), Teubal (1996 & 1998); Metcalfe (1994 & 1998); OECD (1998) and Teubal & Andersen (2000), among others. There are also a number of attempts that focus on the institutional side of policy and the policy process, e.g. Caracostas & Muldur (1997), in the context of policies for the EU, Johnson (1997), Teubal (2000) and Edquist (2000).

¹⁷ The strategic perspective is a response to the fundamental uncertainty about the environment and therefore about the impacts of policy. The simultaneous consideration of the set of

intensity of policy. A crucial additional point concerns the policy process of, and the policy framework relevant to, a specific country.

Existing methodologies and proposed extensions

In order to meet these challenges, we have to bring theory closer to empirical research, if only because it might help us to ask the right questions. We don't suggest that a convergence of methodological assumptions is feasible. Market failure analysis 're-defined' is pertinent during programme implementation, and partly during programme identification/formulation. These are downstream policy process phases: they presuppose a strategy and a set of priorities. Moreover they relate only to those activities for which the BS has a comparative advantage over non-BSs of the Supporting Structure, e.g. Universities, Government Laboratories and Public/Private Research and Technology Organisations. Thus in developing strategic areas of Science or Generic Technologies, including certain categories of Industry-Specific Public Goods; or new components of the system of innovation, even 're-defined' market failure analysis will not be relevant. Two additional points should be mentioned. First, market failure coexists with other types of failure e.g. system or institutional failures; second, that is both a cause and a consequence of policy interventions (Lipsey & Carlaw 1998). The former does introduce ambiguity in deriving policy implications as what appears as an insufficiency of the BS (a traditional 'market failure') may simply reflect a system failure. Thus 'market failure analysis' by itself could not point out a clear direction to policy.

However, we think that there is scope to explore the potential of a comparative analysis of research findings from different analytical approaches.¹⁸ We can further consider the methodological implications by explicitly considering the 'old methodology' and consider their flaws in light of the above. The various phases of the accepted way of linking theory, empirical evidence and policy in the area of ITP can be summarised in the scheme below. This scheme is being widely used in conceptual models of technological accumulation at the firm/sectoral/national level in the context of Industrialising Countries. However its usefulness for the purpose of our argument is wider as similar schemes are used in other cases of policy-oriented research on issues related to economic performance and competitiveness. This approach consists of the following consecutive phases: a) fitting the facts to a model; b) best practice routines; and c) formulations of policy implications.

The first phase is that of empirical research guided by general hypotheses, e.g. linking the economic performance or competitiveness of Small and Medium Enterprises (SMEs) to their

programmes or policies relates both to 'ex-post' programme implementation and evaluation and to 'ex-ante' programme identification and formulation.

¹⁸ For further discussion on these issues, see Ruttan (1996).

technological capabilities. The second phase is based on comparing explicitly across countries how technological capabilities are related to the supporting structure and to policy-technological infrastructure; manpower and Universities; financial sector variables; and availability of advisory services, policies supporting technology transfer, training, advisory services and R&D. The argument goes that countries with the best SME-performing sectors will also be characterised by a particular supporting structure and by a specific set of policies. These would constitute 'best practice'. Policy implications would follow from this, e.g. one suggestion might be to promote those components of the structure supporting innovation in which the country is weak relative to the 'best practice' configuration.

Frequently, the major contribution of research to policy is to contribute to the way decision-makers approach policy or through its contribution to develop a policy-making capability in general rather than the identification of causal links among policies and impacts of broad empirical validity. The proposed extension in this paper relates both the facts-best practice link (the link between the Phases 1 and 2) and to the best practice-policy link (the link between Phases 2 and 3). Concerning the former, emphasis should be given not only on fitting the data but also in understanding the process linking performance to technological capabilities and even why some countries have achieved a higher level of performance than others. This type of causality analysis involves relating to a broader set of qualitative and quantitative variables, some of them specific to each country. The explanation can only in part be articulated in terms of the variables entering either an econometric or a comparative analysis at Phases 1 and 2. The emphasis is clearly to answer a series of 'why's' concerning the 'historical context' of the phenomena investigated, not only in fitting the data to a model. This explains the role of Appreciative Theory, within the facts-best practice link. Empirical research on economic and technological trends provides the general 'historical context' in which 'best practice' is being defined and causality links are being suggested and tested. Empirical studies on technological change start from general statements and seek to support them with empirical facts. The positive economics approach is to begin from axiomatic assumptions and test a number of hypotheses. What is being suggested here is that empirical research in our field is reaching a level of maturity that can provide valuable insights for the development of general assumptions on the behaviour of agents and on observable trends in the dynamics of the economic system.

Concerning the best practice-policy link the basic point is that policy implications –even after the extended analysis mentioned above has been performed – is not an obvious nor a trivial matter given the specificities characterising the policy environment of each country. The information, knowledge and insight coming from the first module or link frequently cannot be directly applicable without having developed a policy framework which is appropriate for the

problem which is being addressed. Creating or modifying a policy framework for a specific 'historical context' is also an exercise in Appreciative Theory.

This comparative perspective is a difficult and challenging task for researchers. To crystallise a strategy requires search/research with a multiplicity of approaches and methodologies such as those mentioned above: case studies to identify what may become new trends; surveys; statistical analysis; appreciative theory; econometric analysis; forecasting techniques, programme evaluations; political economy and political science comparisons of the policy system and the policy processes of countries. In addition, we should keep in mind that it is the framing of research questions in the context of the constraints dictated by scientific research programmes that transforms questions and puzzles into well-defined problems and extends their problem-solving capacity.¹⁹ The fact, for example, that research on innovation and institutions is widely used and it is being considered as a significant contribution to the current debate on growth and competitiveness is not a matter of putting forward novel new ideas, but a matter of suggesting a solution to a problem by incorporating it in an already existing research tradition. This in itself is an important lesson about theory development.²⁰

¹⁹ This view coincides with that put forward by Fageberg (1997) in a discussion of the role which empirical work should have in ascertaining the relevance of the assumptions used in new growth theory related econometric work.

²⁰ For the implications of these statements, from a methodological point of view, see Northover (1999).

POLICY PROCESS AND POLICY FRAMEWORK

Portfolio profile

A major concept in our approach is that of Programme Portfolio – the set of programs constituting a country's ITP – and that of Portfolio Bias.²¹ In previous work a distinction was made between various types of programs, e.g. those directed to the BS, to the Supporting Structure and others (which we will ignore here). Each one of these could involve Horizontal Programs, which are directed to the BS (or Supporting Structure) as a whole, or Targeted Programs, directed only to specific sectors or technologies (or to those organisations of the Supporting Structure facilitating them).²² Moreover, programs could be differentiated according to the function promoted. For simplicity, we will make a distinction between R&D, which is more relevant for the most advanced of the Industrialising Countries (Korea, Taiwan, Israel), and Diffusion/Transfer of Technology (more relevant to the less developed Countries). All types of programmes could play a role in the transformation of Systems of Innovation; no one should be excluded *a priori*. This does not mean that the programme portfolio of a particular country should not include a greater share of certain types of programs and a smaller share of others (compared to other countries). We have already seen that Policies are context-dependent and relevant country specificities could be extremely important.

A country's (programme) portfolio profile refers to sets of characteristics of a country's programme portfolio. Two major profiles come to mind: Profile 1 which directly focuses on the BS through implementation of Horizontal Programs, with little or no incentives given to the supporting structure. Profile 2, with almost exclusive support of the Supporting Structure (indirect support of the BS) through use of Targeted programs which support only institutions/organisations related to a narrow group of BS industries. Each one of these might have variants of their own depending on specific circumstances and on other factors such as the particular activities emphasized. H. Ergas, some time ago, made a distinction between Mission-oriented and Diffusion-oriented countries where the former involves

²¹ The following discussion focuses on policy instruments and incentives programmes. We don't discuss the more generic policies which are aiming at institutional change. It is much more difficult to find an adequate typology for the latter. Future work will have to deal with this problem.

²² See Teubal (1996 and 1997) and Jacobs (1998) for a discussion of the nature and role of Horizontal Programmes.

“...big science deployed to meet strategic problems” and “primarily relevant to countries engaged in the search for international strategic leadership...and the countries in which it dominates are those where defence accounts for a high share of government expenditures in R&D” (Ergas 1987, p. 53).

Somewhat in parallel to this distinction, and taking into account the developments that occurred during the 1990s in many countries, we would like to make a distinction between two extreme types of activity emphasis: R&D Orientation and Diffusion Orientation. The former emphasizes incentives to R&D, and is oriented to high-tech industries; the latter profile emphasizes other activities involved in the diffusion and adoption of new technology, and not particularly in high-tech industries. Thus Profile 1 may be either R&D oriented (variant 1a) or Diffusion Oriented (variant 1b). This distinction could also be relevant in relation to Profile 2. Thus 2a may be relevant for Industrialising Countries whereas 2b (R&D orientation) for Advanced Countries. The outcome is summarised in the following scheme.

Programme portfolio profile	Sub-system focus	Type of programme	Type of activity
1	Business Sector (BS)	Horizontal (direct support of all sectors and technologies)	1a: R&D oriented 1b: Diffusion oriented
2	Supporting Structure (SS)	Targeted (indirect support of a specific sector or technology)	2a: R&D oriented 2b: Diffusion oriented

Policy as an endogenous process — activities and phases

ITP should be regarded as involving a process with distinct phases and activities, as with the Innovation Process itself. The successful implementation of an ITP draws on the feedback from several consensus-building institutions. When it comes to the response to policy signals, the presence of business associations is also important. These policy priorities will face the challenging realities of the structure of local institutions in Developing Countries. The link that is being established in many Developing Countries between state intervention and corporatism might undermine any participatory processes (Lucas 1997). We have already mentioned a Strategic dimension which when activated ends up with a new set of country priorities for Innovation and Technology (and the BS as a whole). This would represent one or more higher level/upstream phases of the process. There are a number of steps or activities to arrive at such

priorities: first, the generation of a Vision about the future System of Innovation (SI) second, generating a Strategy to achieve this vision; and finally, translating Vision/Strategy into a Set of Priorities (Teubal 1999). Another phase would involve identification of the set of programmes (and institutional changes), which would promote such priorities, and the design of these programs (downstream phases)²³. One or two additional downstream phases concern programme implementation and impact assessment (Table 1). The feedback from programme assessment may influence both priorities and specific programme design that is either higher level and/or downstream phases of the policy process.²⁴

TABLE 1: POLICY PROCESS – PHASES (BS-directed Programme)

PHASE	OBJECTIVE	TASKS – ACTIVITY	OUTCOME
1. Upstream –Strategy Formulation	Formulate an Explicit Strategy	Search, Research & Interaction (stakeholders & experts), generating a Vision/Strategy	Set of Priorities in Innovation, Technology and for the BS
2. Downstream – Programme Identification and Design	Design of an Important new Programme	Identifying the Set of Programs; Preliminary Design; Trial Implementation, Final Design	A set of Programmes & Programme Designs which ‘fit’ Priorities
3. Downstream – Programme Implementation; Assessment	Successful Implementation and Learning	Full Implementation; operational adjustments; research on impacts and on Success/Failed factors.	Contribution to BS Restructuring; New Information about ‘Policy Needs’

²³ Programme design would involve the identification of the activity to be promoted; the BS focus; firm orientation; the tools to be used (subsidies, conditional loans, etc); the effective incentive rate; and the criteria for project approval.

²⁴ The above view of policy processes differs from the perspective developed by Edquist (1999) despite some correspondence between his categories and ours. His ‘problems’ come close to ‘strategic priorities’ in this paper, although there is little discussion of the various levels of specificity in the formulation of ‘problems’ (we recognise that this is difficult and a good solution has yet to be found). A second point concerns the transition from ‘problems’ to policies: while Edquist makes it depend on the political system with very little further specification. The framework presented here tries to flesh out some of the elements of the process (e.g. a typology of policy processes, policy framework profiles – see the following

The basis for initiating upstream phases is an understanding of the trends in world markets, technology and competition; and the implications of this for the country in question. Thus the shift to the Internet and to the New Economy, and the associated globalisation of asset and capital markets, may create numerous new opportunities for certain countries and not others, and then only for those who succeed in implementing a new set of programs and policies. An explicit Strategy may lead – in some countries – to a reconsideration of priorities in the direction of SU formation and VC (several countries in the EU); and in other countries it would lead to a renewed emphasis on indigenous, global company formation in advancing Industrialising Countries.²⁵ Whatever the final outcome of an explicit strategy, it is clear that identifying the implications of the above-mentioned trends for the national economy requires significant additions to knowledge. In our opinion, collecting information is not enough; it is important to generate conceptual theory for integrating it into a coherent whole. This means that Academic research may have to play a role, side by side with data collection and commissioning work to the ‘policy industry’.²⁶

Types of policy processes

As with the Chain Linked Innovation Process model (Kline & Rosenberg 1986) there are different types of policy processes (see Table 2). We make a distinction between minor, major and integrated policy processes. A Minor Policy Process involves Phase 3 “Programme Implementation and Feedback” exclusively. It concerns a programme already being implemented over which new decisions have to be made about budgets, structure of incentives and other matters of implementation. These would take place as a result of feedback from implementation and unexpected budgetary constraints. The outcome would be changes in programme implementation and maybe also minor changes in programme design, i.e. minor policy process deal exclusively with downstream phases of the policy process, especially the programme implementation phase. These minor policy processes will be occurring all the time almost as part of ‘programme implementation’ itself.

The more complex integrated policy process involves all three phases that are both upstream and downstream phases. It is triggered by radical changes in the environment facing the country (including its internal environment) and reception of new information about these changes. The

section in this paper). This approach could shed light on the interactions between the professional aspects of policy and the political ones.

²⁵ A well functioning high-tech cluster in Industrialising Countries may require a larger involvement not of SUs (of which it has plenty) but of larger, global companies as it is believed that this could ensure the ‘leveraging’ of R&D and other contributions to the national economy.

²⁶ A major bottleneck in commissioning such research and conceptual work to consultants is the capacity of the policy-making institutions to define objectives and to assess the capabilities and the findings/recommendations proposed by the organisations competing for the work.

radical change in the environment would generally lead to a new vision/strategy; and this will lead to new priorities. These new priorities in turn would lead to policy activity in both downstream phases – the design of new programs and their implementation. The result is a new portfolio of programs (and institutions) involving a subset of new programs of various kinds (e.g. horizontal vs. targeted programmes), the deletion of a subset of old programs; and changes in the design and implementation of some of the pre-existing programs. Finally, the intermediate type of policy process would be the design and implementation of an important new programme – such as the Magnet Programme or Yozma in Israel during the early 1990s – without a significant amount of policy activity pertaining to higher, strategic levels. This could be termed a major policy process.²⁷

TABLE 2: POLICY PROCESS – TYPES

Type of Policy Process	Objective	Phases Involved	Illustrations
Minor	Restructuring of Existing Programme	3	Adjustments of Horizontal programs during the Policy Cycle (Israel 1980s; Chile mid-1990s)
Major	Design and Implementation of Important New Programme	2 + 3	Design and Implementation of “Magnet” and of “Yozma”(Israel)
Integrated	A New Explicit Strategy; a Reconfiguration Programme Portfolio; & Implementation	Many different combinations	Finland (mid-1990s) Israel (early 1990s)

²⁷ These new Israeli programmes reflected changed priorities resulting from new circumstances such as the immigration to Israel from the ex-Soviet Union, an assessment of past impacts of policy and an assessment of new strategic needs for the national economy. Whether the policy process was major or integrated may be a matter of dispute. We would tend to characterise it as major given that the element of explicitness in the strategy and the extent of higher phase ‘policy activity’ was probably quite low. On the other hand, the upstream or higher level activity that did take place led to a number of new programmes rather than to a single programme. This by itself *might* justify defining what happened in Israel during the early 1990s as an integrated policy process rather than simply a major one.

Shifts in the policy process

Radical changes in the environment – such as the current changes in the world economy due to globalisation and the IT revolution – frequently necessitate a shift towards an integrated policy process rather than a continuation of prevailing minor policy processes (which are relevant under stationary conditions).²⁸ Our presumption is that this insight is of broad relevance, both for Advanced and for Developing Countries. It is the central reason why a SI perspective to ITP is so relevant in the current context– it explicitly looks at the various phases or levels of policy and in particular at the Strategic Level.

However, the need to undergo a change in the policy process is not enough to guarantee such a shift because changes in policy making of such a magnitude are not automatic and the conditions assuring such a shift are not well understood. The policy process could be considered as truncated and/or locked-in if such a shift does not take place. The shift to an integrated policy process requires more policy-relevant knowledge and new institutions of policy. Enhanced knowledge intensiveness derives from the need to set out new priorities that fit with the new circumstances facing the economy. Search for data and models, interaction with stakeholders, and Research (including Academic Research) are critical both for this purpose and for ‘articulating’ new priorities in terms of a reconfigured Programme Portfolio. As suggested above, a significant portion of such research must involve a hybrid methodology (involving case studies and surveys, appreciative theorizing, econometrics and policy analysis) and a multidisciplinary research effort (research teams with expertise in economics, political science and public administration).²⁹ As far as institutions for policy making are concerned we have identified two: one for commissioning and guiding relevant policy analyses (the objective is knowledge accumulation and it should start by underpinning the higher phases of strategy formulation); and another to translate such knowledge in terms both of new programs and new ‘institutions’. The latter may have to include an explicit ‘political’ component and should tackle the issue of the appropriate mix between ‘knowledge’ and ‘policy implementation’.

Policy framework

The ‘Policy Framework’ plays two main roles: 1. it mediates between ITP knowledge on the one hand and the specific ITP applied in a particular country; and 2. it guides the required shift in the policy process (when such a shift is required). The general principles of ITP knowledge,

²⁸ There are limits to the possibility of ‘stationary conditions’ as far as ITP is concerned. Even under an unchanged environment the successful application of policy will affect the BS; and in turn requires policy restructuring. Such co-evolution between policy and the BS has led to the notion of the Technology Policy Cycle (Teubal, 1999).

including Normative General Principles, are not directly applicable to a particular country as policies under a Systems of Innovation (SI) perspective are context specific – a major difference from a Neoclassical Perspective.³⁰ A process of adaptation involving further specification of options, which in part reflects constraints on action, will be followed in specific national settings. For example, the principles would translate differently for a country undergoing radical changes in its external environment compared to a country that is not subjected to such changes; or for a country with a socialist past or a past of corruption compared to a country without this history.

Traditionally SI theorists, like Edquist (1997) and Lundvall (& Borrás 1998), in their writings would consider the emergence of a ‘mismatch’ between actual and desired institutions as the background to policy actions (this also reflects their focus on institutions as the central component of SI transformation, at least implicitly, rather than the BS as is the case here). While this is undoubtedly an important component of a country’s Policy Framework, it is only one among many. Power relations within a country’s elite, bureaucratic routines, and ideology and policy capabilities are a few others. Finally, there may be preferences for certain programs (or programme designs) or for some strategic priorities. It follows that the notion of Policy Framework presented in this paper is a response to the context specificity of IT Policy so well explained by Lipsey (2002). It also means that there are many dimensions characterizing a country’s specificity than those that would flow from SI general principles. Thus for some countries the policy profile would lean very strongly to Programme Profile 1a, while in others to Programme Profile 2b.

The policy framework of a country also provides a focus for policy making. This is essential for policy making, as ‘focusing devices’ are essential for innovative engineers. When it comes to policy making for ITP, a general focusing device will help policy analysts to set the stages for a new type of policy process whose prime objective would be to set such new priorities and to translate them into new programs and programme designs. There are always general elements of the type discussed, but they also may be more specific ones, which reflect preferences and power relations. In this case, a further constraining of the set of all policy actions will take place, i.e. such aspects will then become part of the Policy Framework itself.

The policy framework of a country facing a radical change in its environment is also related to the possibilities and constraints it faces for shifting towards the integrated mode or pattern of policy making today. The conditions of some countries may be more favourable than those of others insofar as this ‘shift’ is concerned. For our purpose, we assume that there is partial

²⁹ See Teubal (1999) and Bartzokas (2001b), which developed the notion of *policy relevant research*. This feature is not fully recognised in Academia, yet.

³⁰ This was frequently pointed out by Richard Lipsey in his various works.

awareness of the need for change at the highest political level and that a policy formulation process is being initiated to draw the broad outlines of the required changes in ITP (the notion of Key Agent is relevant here).³¹

Typical components of a policy framework under these circumstances should include:

- elements of a broad vision of the future of the economy and elements of a strategy of transformation of the BS of the country;
- the set of priorities in Science, Technology and Innovation which follows from this strategy;
- a taxonomy of policies which is relevant for the country in question. From both empirical and theoretical research it might be important to distinguish technology support programs according to objectives (e.g. direct support of innovation or support of a component of the supporting structure), type of programme (horizontal, targeted), nature of incentives (neutral, selective) and other criteria;³²
- a profile of the policy process in a particular country, e.g.: how national objectives are set; their translation into priorities in innovation, technology and science; articulation of the latter into a programme portfolio, etc.; and as well the institutional underpinnings of the above policy process (the ‘policy system’);
- the types of information and knowledge which support decision making in policy: information on the internal environment of the country and of the various components of its system of innovation; information on the external environment facing the country and about the threats and opportunities this creates; various types of outputs of research such as programme evaluations, international comparisons of policy, and ‘policy-relevant research’ of the type proposed in this volume; and
- patterns of co-evolution between policy on the one hand and (policy-induced) processes of industrial transformation on the other.

The application of the ‘policy process approach’ that was illustrated in Table 2 would analyse how the new information and knowledge emerging from linking Phase 1 and Phase 2 will and should affect policy (alternatively, the link between Phase 2 and Phase 3). In some cases, effective applicability might require a modification of the institutional setting of policy (otherwise the policy effects may backfire). For example, a study showing a positive impact of

³¹ As in Finland during the second half of the 1990s; Hong Kong in 1997; and Israel during the first half of the year 2000. Note that the policy framework for a particular country should not be confused with a reconfigured ITP actually formulated and designed (the result of the *policy process*) – which would be one set out of a larger number of possible sets of policies.

³² The various elements of the Policy Framework appropriate to a particular country should strive to be based on theoretical and empirical underpinnings as far as this is possible. For example, there may be alternative taxonomies of policies which are relevant to different countries. This in some sense is ‘generic’ knowledge. This should not be confused with the taxonomy suggested for a particular country, which could be rather specific to that country.

R&D support by the government on productivity or other indicators of enterprise performance should not automatically call for additional government incentives to R&D. In fact this conclusion may frequently make no sense without transforming existing government agencies in charge of implementation into 'learning organisations' rather than simply agencies distributing money which may even, in the worst of cases, have been 'captured' by its clients (e.g. the beneficiaries of incentives which in some cases could even have been the agents created by policy). Were this not to occur, the impact of additional incentive – while generating more R&D – may be weak overall due to limited inducements of enhanced R&D learning and capabilities' generation in the BS. In some cases, additional R&D support may reinforce existing, non-productive, R&D trajectories.

CONCLUDING REMARKS

The context for policy-oriented innovation studies is one of a rapidly changing external environment that is increasingly ‘complex’ and of concomitant changes in the domestic context. The implications for policy relevant research and for ITP as a ‘field of knowledge’ are the following:

- Increasingly there is a need for explicit policy analysis;
- Integration of policy analysis with ‘positive’ analysis of the transformation of systems of innovation (both would constitute policy-relevant research);
- Strong need to develop a ‘theoretical’ base for policy; and
- A new Methodology for policy-relevant research.

While innovation and technology policy in the past has to a large extent focused on ‘incentives’ to technological development through the stimulation of the adoption of new technologies, and in some cases learning and R&D (either in the context of horizontal programs relevant for the whole BS or ‘targeted’ programs which are specific to particular sectors or technologies), the new context makes it imperative to take a much more broader perspective today. Over and beyond the usual links with foreign trade, taxation and macroeconomic policy the new perspective for ITP should consider:

- the ‘broad definition’ of such policy – to include in the definition aspects of industrial and science policy;
- partial overlapping and interactions between these and other areas such as regulation (e.g. of financial markets, telecommunications, etc); privatisation of national telecom companies; corporate governance issues and the adoption of a dynamic competition perspective;
- links with new infrastructures e.g. concerning training, education and physical infrastructures, including those pertaining to information and communication;
- consideration not only of ‘technology’ but also of non-technology and non-R&D factors such as changes in institutions, organisational development, management issues, a broad view of ‘innovation’, and the growth of companies and clusters; and
- links with the broader social context.

In view of the level of theory development and the challenges we are facing in policy-oriented research, the following priorities are being proposed for the research agenda of future work on innovation and technology policy studies in Industrialising Countries. Before initiating empirical and policy-oriented research, a sound understanding of the ‘historical context’ is

needed. At that level of analytical development, the diversity of different approaches could improve our understanding about ‘facts’. The second stage would be to work on the critical assessment of selected hypotheses and feed in this process general trends and empirical findings which emerge from observable facts.

The relevance to policy is important, but we should also aim at theory development. One priority in that direction would be to elaborate further on observations, findings and concepts that have been produced in the context of ongoing research on technology and industrialisation. We could easily draw an analogy to the early phase of Development Economics. It is widely recognised that some of the recent advances of growth dynamics theories were initially introduced by development economists (externalities, dual markets, investment decisions under constraints). In this context, we could point out that Development Economics reached the current level of analytical coherency when scholars of the post-world war period moved away from descriptive analyses to attempts in establishing causality links which managed to capture successfully the complex world of development dynamics and structural change (Bartzokas 2002a). Take for example, the case of empirical research on industrial organisation and technological change. This approach has focused on production processes and technological change. In this direction, research on corporate competencies and technological capabilities has been proliferating. What is missing though is: (a) the impact of exogenous shocks and (b) the issue of corporate finance (external finance and working capital). One suggestion might be that by taking account the issue of financial systems and capital structure we can extend the debate on technological accumulation to investment decisions and the links to the macroeconomic environment (Bartzokas 2001a).

In doing so, we should keep in mind that future work on institutions and technological change has to be informed from the historical account of previous attempts in this direction, especially in the context of innovation studies. Major considerations in this process of inserting policy into research should include the following. First, policy issues should be addressed explicitly at the beginning of the empirical analysis of policy-relevant research. This may even change considerably the design of the empirical estimation to be undertaken when the links between performance and capabilities of different countries have themselves been shaped by past policies. For example, policy-oriented research on the accumulation of technological capabilities at the firm level will take into account the overall macroeconomic environment in which corporate investment decisions have been taking place. By taking this view, the design of empirical research will consider alternative empirical estimates of the influence exercised by different macroeconomic regimes on corporate decisions regarding the development of endogenous technological capabilities. Second, the policy framework is much more than a

simple classification of policies. It should also address objectives and targets; policy sequencing and configuration of policy portfolios issues which follow from this; issues of programme design; and the institutional underpinnings of the policy process with special attention to policies designed to help economies adapt to external shocks and to macro-micro links. And third, the possibility that effective adoption of ‘policy implications’ may require the opening up of the policy process in the same way as the innovation system and the economy are being integrated in the global economy. Significant effort should be devoted to comparing how different perspectives deal with similar problems in order to identify convergence and complementarities, thereby keeping the policy perspective informed on different approaches on the link between facts and causality links. Thus when designing the possible institutions or mechanisms for policy it could be important to look into the literature of the political economy of institutions.

This approach will bring the debate on ITP in Industrialising Countries closer to the continuous assessment of economic and technological trends. This paper is aimed at contributing to the intellectual foundation for such a change in the policy perspective. Its focus is explicitly multidisciplinary and multi-methodological given our view that ‘effective’ policies require a much broader set of considerations and sets of information and knowledge than those which are normally produced in Academia (Economics Departments in particular). We take this view because we firmly believe that innovation, technology and science (and industrial) policy could have a broad impact on the overall efficiency of the economic system. These policies have the potential of exercising significant influence on knowledge and institutions. The importance of these mechanisms goes beyond innovation and the efficient adoption of new production techniques. It extends to the whole fabric of the economic system; this fabric also triggers policy and to some extent determines which policy should cope with external shocks and budgetary constraints.

Finally, this approach dictates a new structure for policy-directed and policy-relevant research. Rather than a linear process starting with empirical research aimed at linking competitiveness and economic performance to technological capabilities (in a comparative perspective and aimed at identifying ‘best practice’), followed by very abstract and un-grounded ‘policy implications’, a new type of link between positive and normative economics in the field is required. It is a more integrative link where policy considerations may have to enter even in the initial stage of empirical research; and where Appreciative Theory may have to be developed to define the questions, explain the facts and to answer the various why’s of the process of economic and technological transformation. Moreover, a conceptual Policy Framework may be required to translate the empirical findings into – among other things – a new portfolio of programs supporting either innovation in advanced countries or industrial restructuring in

industrialising countries. The biggest challenge ahead is to create a 'knowledge base' to the 'normative' side of the Systems of Innovation perspective to technology and growth (Teubal 2000 and Bartzokas 2001b). This involves not only further development of 'general principles' but also the development of a small number of policy framework profiles. The latter are part of the knowledge base underpinning specific country actions designed to arrive at a 'reasonable' portfolio of policies which follows systems and evolutionary perspectives.

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