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Abstracts

Conclave of Scientists

On

Regional co-operation in science and technology: Challenges and opportunities in the context of globalization

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Regional Cooperation to Prevent Major Systems Accidents

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Abstract

In the last 25 years there has been rapid progress on the understanding of systems accidents. The Reason model and its derivatives have focused our attention on what Reason has called "Latent Pathogens." On the other hand we have also become accustomed to discussions of "high reliability" and "resilience." Finally there is the issue of "safety climate" and "safety culture." Pulling these various concepts together, I will suggest that there is a spectrum of accident types, ranging from the model of the "third world accident" largely created through intentional violations of the rules to the "first world accident," which is often brought about by unseen design flaws. I will argue further that progress will be accelerated if we can move from a safety scene dominated by continuous rule-breaking to one where resilience is expected and practiced. Regional cooperation through accident bureaus, conferences, and data sharing can play an important role in shifting the way we try to create safer systems.

Innovation policy and technology foresight at the regional level. The Emilia-Romagna Region experience in Italy

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Abstract

The role of research for generating innovation is widely accepted, but more and more innovation is recognized and increasingly analysed as a complex phenomenon, which not necessarely requires research efforts for each improvement. The following pages go through three channels for analysing and supporting innovation.

1. *Various dimensions of innovation - Innovation strategies and economic performance in manufacturing firms in Emilia-Romagna region, Italy*

A recent research[1] based on a survey carried out via a questionnaire to manufacturing companies in Emilia-Romagna region, Italy, provides results to questions raised on the regional industrial system floating in the economic crisis and reacting with its innovative strategies.

The innovative processes observed during the past twenty years show three main characters: a critical role of knowledge embedded in both tangible and intangible capital; the link of organisational changes to technplogical changes embedded in instrumental goods; the pervasiveness in local and global contexts of the innovative phenomenon developed in technological-organisational terms.

Looking at the performance of the regional production system, two paths can be identified: the industrial sectors which, pulled by the external component of the demand, show a value added growth higher than the national average, also in terms of employment; on the other side, the service sectors show negative productivity dynamics which might represent an obstacle to growth. A sort of *unbalanced growth.*

Emilia-Romagna industrial system competitiveness drivers are mainly production *organisation* strategies and *technological* development strategies, accompanied by other strategic factors such as the *ICT* diffusion, *training*, *environmental* innovation and *internationalisation*. These different dimensions taken separately show strength and weakness aspects, and taken together show strong complementatity and synergy: links and coexistence of two, three or more strategies come out to be critical to generate and to reinforce competitive advantages, related then to a better economic performance.

The message for managers and policy makers is twofold: the existence of complementarities and synergies between the different innovative strategies should be taken into account and exploited by the innovative strategy; and policies to stimulate innovation – also

[1] Innovation, productivity, regional local systems. Innovation strategies and economic results. A survey on Emilia-Romagna manufactirung industries, conducted by a research team of composed by Davide Antonioli (Ferrara University), Annaflavia Bianchi (Faber Foundation and Ferrara University), Massimiliano Mazzanti (Ferrara University), Sandro Montresor (Bologna University), Paolo Pini (coordinator) (Ferrara University).

through *public procurement* tools – should also take advantage from the sinergies between the various innovative spheres.

Public policy should support organisation and technology drivers, especially in small firms, catch the opportunites related to the green economy, to healthcare tools and wellness services, and in general to areas of (new or requalified) specialisation to be intertwinned with actions addressing innovation-research-knowledge-environment such ad energy efficiency, renewable energy, and food, transport, services. Finally, value should be raised from the whole effort invested on research, involving also minor companies which, if well inserted in a system, can succeed using knowledge and competences and in working together.

2. A regional sectoral technology foresight for the advanced machinery in Emilia-Romagna

The foresight is a collective exercise which brings those who consider themselves stakeholders of an issue to open a dialogue on future perspectives, to put in common their knowledge in order to progressively refine the frame of possibilities in front of them and consequently to define their strategies for the future. Applied to sectoral technologies at regional level, it brings to identify those technologies which represent critical nodes of the crossing of business drivers on one side and technology enablers on the other side. The following step is the building of a cooperative strategy which relies also on the assumption of technology solutions available thanks to the research effort of external actors who decide to put their research results on the market. Social capital and professional profiles are also identified in their weak points to be reinforced for a better action for the future.

An application of this methodology to the advanced machinery sector in Emilia-Romagna[2] brought to identify the more critical technologies to work on – even through cooperation of firms – to let the industry sector increase its global competitiveness.

3. An innovation policy support project to the 21 Italian Regions

Again at the regional level, the third point concerns an attempt to provide support to regional government in formulating their innovation policies. It is a national (Italy) project[3] supported by EU funding, addressed mainly to ICT, administrative, development, urbanistic and transport regional government managers. After a general screening of the constraints and difficulties of innovation policy at the regional level, six working groups were formed, one on each of the critical issues to be studied in depth for reinfoncing the effectiveness of the innovation policy formulation at regional level.

The topics selected for the working groups are:

1. regional technology foresight
2. mapping and improvement of the selection process in the calls for funding of industrial reserch and pre-competitive development
3. criteria grid for ex ante selection of industrial reserch and pre-competitive development projects
4. multistep calls and public procurement
5. building of indicators for intermediary results
6. impact evaluation models

[2] Bianchi A. (ed.) (2006), *Regional technology foresight for the advanced machine tool industry*, Bologna, Fondazione Faber.

[3] Italian Agency for the diffusion of technologies for innovation, *Support to regional research and innovation policies*, ongoing project, Rome.

This activity is widely based on the hypothesis of cooperation between regions at all levels of the policy formulation and management, assessment and evaluation. For this reason, it might provide useful hints for larger scale cooperation.

Challenges and opportunities for renewable technologies in the Arabian Gulf

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Abstract

Renewable technologies are becoming internationally recognised as a vital contribution towards a sustainable energy future. An instructive case to consider is that of the principal oil superpower, the Kingdom of Saudi Arabia and the Arabian Gulf region. With at least a quarter of the world's proven oil reserves, it is also an increasingly urbanised and industrialised region that is blessed with abundant solar radiation and a reasonable wind resource. Nevertheless, despite several tentative undertakings in the field of renewables since the 1970s, its massive renewable energy resources have not yet been sufficiently exploited (Al-Saleh, 2007). A substantial number of *'energy scenarios'* have been developed around the world in order to provide a framework for the systematic exploration of energy perspectives and their potential implications. Many of these scenarios are quite often developed by means of the Delphi technique, where the aim is to identify future opportunities and challenges so that better-informed action can be taken today. Since energy infrastructure usually takes a very long time to build, most of the energy scenarios tend to adopt a very long-term perspective, typically looking ahead 30 to 50 years (Harmin et al, 2007). The Delphi technique is an expert-based method of eliciting, collating and refining anonymous group judgements on a complex subject typically through circulating a number of sequential questionnaires (Loveridge, 1999).

This paper reports a snapshot of findings from a doctoral research study completed at the University of Manchester in 2010 by Yasser Al-Saleh (supervised by Dr. K. Malik and Dr. P. Upham). Part of the study utilised a Delphi panel comprising of 35 members, including some international experts on the subject, as well as highly informed specialists and stakeholders (academics and industry managers), mainly from Saudi Arabia and other Gulf nations. Some of the participants (Saudi officials) did not wish to disclose their names due to the sensitive nature of the subject of alternative energy in a major oil producing economy. The Delphi part of the study lasted seven months comprising three formal rounds as well as other informal communications between the rounds. The three rounds started by asking the Delphi panellists to comment on (and justify where possible) whether or not they personally believed that renewable technologies would have a major role to play in Saudi Arabia by 2050? Further rounds reported on results of first round and the last round configured participant views along with an extensive literature review to form a prototype set of scenarios for renewable energy supply in the Gulf region (particularly Saudi Arabia) through to 2050. These prototypes were subsequently made available to the panellists for further scrutiny and feedback (Al-Saleh et al, 2008).

In this Delphi study, the factors that have consistently emerged as being both highly uncertain and very significant with respect to future renewables in the Gulf region are:

- The availability of fossil fuels (in the Gulf region):

Saudi oil reserves make up around 25% of the world's proven reserves and some experts suggest that Saudi oil production has already peaked, while others maintain that this peak in production is still far away in the future. Hence the Delphi team see this factor as being one of the most significant and uncertain when considering the prospects of renewable technologies.

- Actions on environmental protection (in the Gulf and globally):

Whilst a number of environmental concerns were expressed with regard to the continual reliance on fossil fuels, the issue of global warming received most of the attention amongst the majority of the panel. Although three of the panellists admitted their utter disbelief regarding the phenomenon of global warming, and argued that no country should sacrifice its economic and industrial growth for the sake of reducing carbon dioxide (CO_2) emissions.

- Choice of renewable energy technologies:

The mainstream view of the panellists did not consider nuclear power, not just because it is not a renewable source of energy, but mainly owing to the existence of some regional political reasons for it to be avoided. Throughout the Delphi study, solar photovoltaics (PV), wind power and solar thermal power have emerged as the most preferred technology options in the case of the Gulf region.

Our findings showed that all scenarios are developed on the assumption that the Gulf countries (especially Saudi Arabia) are mainly going to rely on imported foreign renewable technologies to begin with (say until 2025) and then will consider indigenous development further down the line (around 2025 to 2050). Suggested factors that could contribute towards the successful establishment of indigenous renewable energy industries in the case of Saudi Arabia include:

- political support especially in any monarchy, where authorities have considerable power and financial resources;
- move towards a more participatory system of governance and less bureaucracy;
- strengthening the national educational system and providing more vocational training;
- enhancing the linkages between Saudi universities and industry;
- allocating higher budgets to support science and technology, as well as widening R&D activity in both public and private sectors;
- acquiring equity stake in international companies which conduct relevant R&D;
- increasing the role of the private sector in electricity and water projects;
- developing a culture of patenting and entrepreneurship in the country;
- rewarding innovators and researchers in relevant fields;
- setting-up more international technology transfer joint venture programmes;
- provide inward investment opportunities for renewable energy technology firms.

Having mentioned the context within which the scenarios will operate and the factors that are considered common to most scenarios, it is now appropriate to present the renewable energy scenarios using the example of Saudi Arabia. These scenarios represent stories about the future where each narrative is designed to be read and explored on its own, considering all of the scenarios will help to establish a better appreciation of a wide range of different energy futures in the context of Saudi Arabia in particular and the Gulf region more widely. Here are the potential scenarios for Saudi Arabia:

Blue scenario: This would represent a continuation of the current trends in terms of the abundant availability of fossil fuels and limited strategic actions on environmental protection. There is some consideration for the renewable option of Solar Photovoltaics. However with

continuation of fossil fuel trend the country could choose to maximise its oil production and perhaps further expand its operations in the Far East in order to achieve a maximum market share and ultimately become the world's unsurpassed supplier. This could result in a drop of oil price to as low as $10 per barrel, which would guarantee the maintenance of reasonable revenue to Saudi, whose production costs are very low. Such an approach may also result in driving other high-cost oil producers (including OPEC members) from the market, as well as demolishing much of the global interest and research into alternative energy means.

Yellow scenario: Here global environmental concerns become significantly stronger and environmental actions become more coordinated. For example carbon capture and storage has become a widely-adopted technology and there is strong market growth in hydrogen fuels for transport applications. Solar thermal technologies can be seen as an attractive choice worth considering in this scenario, where countries in the Gulf region are blessed with very high levels of direct solar radiation, but increasingly face an increased demand for electricity and water.

Red scenario: This scenario is characterised by rapidly-dwindling oil reserves combined with carelessness towards the tackling of environmental issues. There is lack of commitment to reducing CO_2, with only a few residual emission trading schemes. In a world of scarce oil reserves, Saudi Arabia could decide to dramatically cut its oil production in order to economic advantage of the resulting skyrocketing oil prices. With high oil prices and the non-existence of a carbon-constrained world, the development of tar sands and Coal-to-Liquid (CTL) could become viable (although not of great significance). Also high oil prices might motivate research into alternative energy sources and thereby boost the global prospects for renewables, which are not being sufficiently encouraged by environmental arguments today. Given the huge land area and its reasonable wind resources, Saudi Arabia could contemplate the option of wind power in order to boost the share of renewables in the country energy mix.

Green scenario: The green scenario shares with red scenario the limited availability of fossil fuels. The global concerns of greenhouse gas emissions would become the subject of intense negotiations and strict international agreements. This would consequently enhance the viability of renewables and non-fossil energy means (including nuclear power) around the world. Moreover, hydrogen and biofuels would become widely used as transport fuels. Saudi Arabia could then pursue renewable energy technologies (i.e. solar thermal, solar PV and wind power) in order to meet rising domestic needs for electricity and water production. With regards to its remaining oil reserves, Saudi might decide to cut production and oil sales in order to stretch the lifetime of its most precious export and further expand its energy-intensive industrial capabilities. Consequently, the availability of a continuous flow of cheap fossil fuels into international markets would become increasingly threatened forcing Oil importers to act independently to enhance their energy security in order to avoid increased greenhouse gas emissions.

Finally, we would stress that a transition towards sustainable energy systems would essentially involve "innovation" leading to more sustainable technological and institutional processes. This requires not only innovation in the context of R&D for renewable technologies, but in the policy-making arena with more policies geared towards linking innovation to sustainable development for example. This relates to institutional reforms as well where innovation needs to be high on the agenda of Government ministries who need to have a joined-up approach to promote innovation. Renewable energy technologies, in general, also need to be regarded as a strategic option and a supplementary – as opposed to an alternative – source of energy in Saudi Arabia. In fact, what would really help in terms of both enhancing the legitimacy

of renewables and facilitating a point of departure away from oil is the emergence of a new, and most probably young and highly-educated, 'pro-renewables' generation of the Royal Family. Such a new generation could act as 'system builders', i.e. a set of actors who are politically and financially powerful enough to alter the existing political economy (and the organisation of power within the Saudi energy sector), and ultimately promote the development and successful diffusion of renewable energy technologies in Saudi Arabia. There is no doubt that these key actors cannot function in isolation, as they will, for example, need to team up with renewables-orientated entrepreneurs and investors who are keen to transform innovative energy possibilities into business opportunities.

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Energy Conservation and alternative source of Energy
Organic semiconductor based devices for energy harvesting

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Abstract

Energy resources like coal, petroleum etc. in the planet earth is being continuously depleted due to reckless use of these resources in the name of development. The rate of depletion is so fast that in the near future we will have an acute shortage of energy sources. Therefore it is high time to look for alternate renewable source of energy as well as more efficient and economical use of the existing fuel so as to save the next generation from severe fuel crisis.

Therefore, during the last few years, research based on energy saving technologies is being given high priority all over the world. General lighting is one area in which large quantity of electrical energy is being spend and substantial energy saving is possible by using energy saving technologies. Conventional light sources like incandescent filament lamps in which a major part of the energy is wasted as heat and is a less energy efficient technology is being phased out. Other technologies like gas filled electrical discharge lamps are more efficient but are polluting.

Therefore there is a need for energy efficient and clean light source and solid state lighting technology based on organic and inorganic LEDs has been predicted as the only viable solution for efficient use of electrical energy for lighting applications. Solid state lighting devices are very energy efficient and have long life time. Consequently, they are best suited for coupling with solar energy devices. Incorporation with rechargeable storage batteries and Photovoltaic cells the OLEDs/LEDs can provide light for rural lighting applications.

In solid state lighting using Light emitting diodes electricity is directly converted into light with the mediation of a semiconductor material. The characteristic color of the emitted light depends on the band gap of the semiconducting material. Since no heat is produced during the emission process LEDs are much more efficient than conventional light sources like incandescent lamps. Materials of different band gap (LEDs of different emission colors were in use for long time in displays and traffic lights but their use in general lighting is very recent one. This is due to the fact that for domestic lighting white light is required whereas most of the earlier LED materials were low band gap emitters. To have white light emission the usual practice is to fabricate blue LED and convert them into white LEDs using down conversion phosphors. The recent advance in the production of gallium nitride(GaN) based blue LEDs and the white LEDs produced using those devices have given a thrust in domestic lighting using GaN based white LEDs. But the cost related issues are severely hampering the acceptability of these sources by the common man.

Recent research on organic semiconductors have partially solved the issues related to cost. During the past two decades tremendous progress has been made in the development of Organic Light Emitting Diodes(OLEDs) which has the potential to revolutionalize the lighting industry. OLEDs are based on the property of electro luminance shown by some organic small

molecules and conjugated polymers. In this process charge carriers of different signs are injected from either side of an organic material through electrodes. They are transported inside the semiconductor and when they meet, molecular excited states(excitons) are formed. These excitons have very short life time and when they decay, they emit light which is characteristic of the semiconductor. Thee devices can produce high quality white light at low energy cost. These OLEDs can be made in large size using low temperature processing steps using cheap organic materials. They are highly efficient and flexible. Even plastics can be used to emit light. The white OLEDs demonstrated recently are more efficient than the gas filled tubes. These devices can even be printed using the well established printing process and roll to roll processing of these OLEDs have also been demonstrated. Even though there are issues related to stability and efficiency of OLEDs(which are being solved) , these devices have a very bright future and will be able to save substantial amount of energy to the country.

International Mobility as a Mechanism for Reproducing the Scientific Elite

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Abstract

The existence of elite scholars is a necessary condition for the functioning of science. In Soviet-Russia, the emergence and reproduction of the scientific elite was inextricably connected with a significant self-organizing element of the scientific community, known as a 'school of thought' (*nauchnaya skola*). Schools of thought played a major role in Soviet science. The elite not only matured in a particular school of thought, but this was how scientific work itself, as a scientist's free activity, could be done.

The post-Soviet social and economic transformations have led to significant changes in Russian science. The idea of a 'school of thought' as a self-organizing form in the scientific community was destroyed when claims to the rights of intellectual property began to emerge. The collapse of the various schools of thought implied that an important tool for reproducing the scientific elite was broken.

Old mechanisms are being replaced by new ones. The 'international mobility' of scholars proves to be a significant new instrument for reproducing the scientific elite. During Soviet times, Russian scientists had very weak links with the world scientific community, whereas in the 1990s they acquired a new quality and new opportunities for collaboration. International mobility is crucial for integrating Russian science into the global scientific community. The participation of Russian scientists in the world division of labor can help to solve difficult problems for post-Soviet science as the generations change.

Today, many young people are unwilling to work as scientists. There are several explanations for this situation: low starting salaries, poor equipment and facilities for research, uncertainties about their future career, and so on. However, a number of problems facing young researchers might be resolved with Russia's integration into global science. Involvement in joint projects and international scientific events, publication of research results in prestigious journals, internships at prominent scientific centers in Europe, America and Asia, receiving grants from foreign foundations – all of this helps to broaden the experience and to raise the status of young specialists. And it also helps to provide them with new opportunities in their own country through cooperative scientific development.

The paper will look at the processes of liberalization that are a condition for stronger mobility among Russian scientists. The author will present results of a sociological study "Mechanisms for Reproducing the Scientific Elite in Russia" conducted by the Center for Sociology of Science and Science Studies, Research Institute for the History of Science and Technology, St. Petersburg Branch, Russian Academy of Sciences.

Multinational R&D Consortia:
An Inter Organizational Perspective on Enhancing Regional Co-operation in Science and Technology.

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Abstract

While countries and supra national entities espouse and encourage cross boundary cooperation in regional and global science and technology endeavors, most initiatives signed with great fanfare by visiting Heads of State and senior Political and Administrative functionaries, invariable wither on the vine, in the face of harsh political, diplomatic and administrative/organizational realities. To understand why this happens, one must appreciate the behavioral dynamics that come into play when individuals and S&T institutions attempt to work together.

Organizations in general, and inter organizational institutions in particular, come into being because the work is beyond the scope of one individual or entity, and also because division of labor has the potential increase productivity dramatically, by ensuring a synergy of core supplementary and/or complementary capabilities. Such organizations or institutions survive and prosper when the inducements they offer equal or (better still, exceed) the contributions each party makes.

Hence, the key criterion is EQUITY, which could be depicted as follows:

NET GAIN = BENEFIT – (CONTRIBUTION + TRANSACTIONS COSTS)

Cooperation involves managing Interdependence, dealing with Diversity and coping with Uncertainty. In doing so, various Transactions Costs are incurred. Unless we minimize irritants that are the inevitable consequences of any joint activity, these could derail the collaborative effort.

Using the work of Emery & Triest and the Causal Texture of Environment, we will show that the best S&T arrangements are those multi lateral arrangements that are forged to handle the uncertainty posed by turbulent, mutually causal environments. Then using Meyer Zald's Political Economy framework, we will try to understand the forces that should be kept in mind. With the help of Coase's, Williamson's and Ouchi's concepts of Markets, Hierarchies/Bureaucracies and Clans, we shall explore the internal dynamics of such arrangements, before concluding with Kenneth Benson's Inter organizational Network as a Political Economy to understand how such arrangements can achieve an equilibrium that enhances their effectiveness.

Microbes Learn to Live Under Thermal Environments to Combat Global Warming

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Abstract

All life forms on Earth experience harsh environments at one or the other stage in their life cycle, which make them adapt to environmental extremes, as such environments become the driving forces for their adaptive evolution. However, understanding the mechanism of evolutionary adaptation of life under thermal environments has become a present-day concern in the context of global warming. Among the living organisms, microorganisms exhibit maximum diversity in varied environmental conditions, which make them most suitable model system for understanding/unraveling the secret of life at high temperature.

The dynamic nature of molecules, and particularly the microbial enzymes, with respect to cation-dependent decrease in the Arrhenius energy of activation (EA) for their high-temperature catalysis and their constitutive synthesis as well as rapid turnover appear to play important role in thermoadaptaion of microorganisms, without precluding the possibility of involvement of macromolecular charged environment and ordered cellular organization for their thermophilic existence. And, the contention that most macromolecules, including enzymes in thermophiles are inherently thermostable, does not seem to be true, as in thermophilic spore formers at least, enzymes are thermolabile, as they get inactivated even at growth temperature of the organism, which, otherwise, learn to live under thermal environments, exhibiting steady replacement of heat-inactivated enzymes by their rapid resynthesis or rapid turnover so as to counteract the destructive effect of heat, and thus combating global warming.

Prospects of Liberalization for S&T Policies in Russia: Institutional Analysis

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Abstract:

The objective of the paper is to define the trajectory of economic institutional reforms in Russia as a framework of S&T policies. The methodology of this research is based upon the institutional matrices theory (Кирдина, 2001; Kirdina, 2003). The hypothesis claims that the "institutional nature" of Russia defines its prospects of liberalization and needs the active implementation of liberal market institutions policy only within a framework of modernization of redistributive state economic system. Modern S&T policy in Russia demonstrates the implications of such kind of development. The new institutional form of State Corporation that is non-profit organization under government regulation has been widely developed for last 3 years. The main sphere of State Corporations activity is high-tech development. The share of State Corporations in the state budget is more than 20% and it is constantly increasing.

Role of parliamentarian in the development of Science and Technology in Africa

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Abstract

The role of a parliament is to conduct robust evidence-informed scrutiny of Government and to provide a forum for debate on matters of public interest. In order to fulfill this role, Members of Parliament (MPs) in both the developed and the developing world are increasingly required to handle issues of a highly technical nature, from tackling climate change to control of pandemics. However, few MPs come from a scientific or technological background. In the UK MPs have support from the UK Parliamentary Office of Science and Technology (POST), an internal office of the UK's Houses of Parliament which has been providing scientific analysis advice to UK parliamentarians for 20 years, as well as from specialist staff working within parliamentary libraries and select committees. However, many MPs in developing countries lack support to help them tackle issues of a scientific nature. As a result, parliaments may fail to scrutinise government effectively in matters relating to science and technology. In this talk I will discuss lessons learned by POST on providing independent scientific advice to parliamentarians, and highlight the growing need for parliamentarians in developing countries to have access to such advice, in order to conduct robust scrutiny of their governments. I will discuss the effectiveness of a range of capacity building initiatives underway in this area, such as shadowing schemes to link MPs and scientists, and training to increase the scientific literacy of parliamentary staff. I will focus on lessons learned from POST's Africa programme, an initiative funded by the Gatsby charitable foundation, which aims to work with African Parliaments to strengthen their capacity to handle policy issues relating to science and technology, focusing on the Parliament of Uganda.

“Science, Technology and Industrial Development in the Peoples Republic of China”

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Abstract

In a short period of three decades, China has moved up from a “third world” country to a leading second largest industrial nation in the world surpassing Japan. The gap between the first such nation, the United States and China is still substantially large. But some projections suggest that growing at about 10% annually, China may catch up or even surpass the United States by the middle of this century. The so-called “Chinese Miracle” has, however, not been achieved without serious social and environmental costs. This presentation will highlight the following main points and their subsidiaries:

(1) Mechanisms that have propelled the “Chinese Miracle.”
(2) Unintended consequences of technoeconomic growth in China
(3) Lessons of the Chinese model for both the developed and the developing countries.

Impact of science and technology on Rural Development

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Abstract

Motivations

The choice to focus on the interactions between S&T and rural development has two main *motivations*: (i) the fact that rural communities and rural societies still cover most of the world population; (ii) the assumption that the redefinition of the use of S&T starting from these areas and forms of life may contribute to the development of tools and methods able to bring S&T out of the current downward trend of performance which causes unsustainable and intolerable living conditions in urban areas and in industrial societies. This bottom-up approach is not limited to functional and institutional areas, but is introduced from the bottom of the pyramid of people - their needs, desires and aspirations - from which lay down priorities, forms and rules governing their lives.

The context

The research project "Triple European Mezzogiorno" finds its sources of inspiration and guidelines in the reopened EU dossier about the EU social and economic cohesion introduced in 1999 (*ESPD European Spatial Development Perspective. Toward Balanced and Sustainable Development of the Territory of the European Union, European Commission*, Luxembourg 1999), and in the elaborations provided by the *Regio Futures Programme* coordinated by the Polish Ministry for Regional Development since 2007 (P. Jakubowska, A. Kuklinsky, P. Zuber (eds): *The Futures of European Regions*, Warsaw 2007; K. Rybinski, P. Opala, M. Holda: *Gordian Knots of the 21st Century*, Ministry of Regional Development, Warsaw 2008).

These documents introduce two main innovations in the development perspectives and policy orientation of the European Union: 1) They state and emphasise the existing interdependencies among the social, economic, cultural and territorial dimension. 2) They establish a multilevel approach in the analysis including the local, regional, national and meso-regional levels.

The achievement of these objectives should of course be sustained by economic policies oriented to the reduction of inequalities in wealth, income, and employment conditions within and among regions and member states; but their implementation should take place not following general principles of standardisation and harmonization, but in coherence with regional and national cultures and behaviours, environment conditions and local resources.

The "innovations" and "efforts" made by regional studies and policies have been concentrated on how to adapt local economies and regions to the new territorial distribution and labour division, well-knowing that they were not welcome in the new "core" of the Global economy and that the success of some "good practices" would have been possible only at the costs of a coherent spatial and social strategy. As this research demonstrates, the innovation proposed by regional studies has been build on the denial of the existence of consolidated dualist structures in European Regions (i.e. Italy's Mezzogiorno), with the attempt to purse a fragmentation of the territories in order to obtain the colonization of single parts or elements of them. (Amoroso. B. & Gallina A. ed., *Essays on Regional Integration and Globalisation*, Federico Caffè Center, Roskilde, 2002; Amoroso B., *On Globalization, Capitalism in the 21st Century*, Macmillan Press, London 1998; Sachs, Wolfgang (ed.); *The Development Dictionary. A Guide to Knowledge as Power*. London, Zed Books, 1992)

Theoretical objective

This contribution has a theoretical and a historical-empirical goal. The theoretical goal is a critical review of theories of development with regard to areas considered underdeveloped or backward within state and national systems and the role attributed to S&T as a tool of development of these areas. The dominant theories attribute the causes of backwardness to environmental factors (diversity) and their insufficient integration in the overall development of the country. The S&T is considered an independent variable that can remove the causes of backwardness. The problem of the relationship between economies and markets of underdeveloped areas and the forms taken by the state and the national market, is not considered relevant. Attention has been focused on the backward areas as endogenous phenomena and ignoring the external factors that cause it. The problem of backwardness is thus seen as a problem of technical delays within a given institutional framework and not as a problem caused by this institutional framework and market forms. This will charge the S&T of tasks that can not help to solve if we do not retrain its role, form and applications.

Empirical objective

These considerations are applied to specific historical cases of dualism in European societies that make impossible the attempt to integrate national markets. In all these cases - Southern Italy, East Germany and East Poland - S&T applied concepts and false premises of modernization have aggravated the existing problems. The case of rural communites and agriculture in the Italian Mezzogiorno will receive specific attention.

Finnish Mosaic of Regional Innovation System – Assessment of Thematic Regional Innovation Platforms Based on Related Variety".

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FINLAND

Abstract

This present study is an attempt to shed light on the current phase of Finnish innovation system facing the new paradigm. The Finnish innovation system is seen as a mosaic of regional innovation systems. The regional innovation systems are analysed through a developed framework including elements of theories of innovation systems and theories of international trade as well as two recent strategy papers. One of the main concepts of the study is related variety in regional innovation platforms. The present study is also an attempt to use the power of related variety in the research setting by combining two theoretical frameworks seldom seen in the very same research article. The empirical data was gathered in workshops in all the Finnish regions during the year 2008. The result is a descripition of Finnish thematic regional innovation platforms fueled by related variety.

Recent Devices in Nanomaterials Based Biosensors

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Abstract

The biosensors are rapidly covering the market of clinical diagnostics, toxicity analysis, food industries, environmental monitoring and quality control[1-2]. These interesting biomolecular electronic devices have the potential to replace or complement the classical analytical methods by simplifying or eliminating sample preparation protocols and making field testing easier and faster with significant decrease in costs per analysis. And nanobiotechnology is rapidly evolving to unravel new materials useful in solving challenging bioanalytical problems, including specificity, stability and sensitivity. In this context, nanomaterials including self assembled monolayers and nano-structured metal oxides are being increasingly used for the development of nucleic acids based sensors. I will focus on some of the recent results obtained in our laboratories relating to development of nanomaetials based biosensors for clinical diagnostics [3-5].

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Science, Technology and Innovation in Africa: Is it Rhetoric or a Serious Business?

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Abstract

The contribution of science, technology and innovation (STI) to national development cannot be underscored as there is evidence that points to the strategic linkage between STI and economic development (Frempong, 2006). For instance, since the industrial revolution, countries with well-developed S&T capacity have experienced rapid growth and increasingly becoming wealthy.

In effect, access and use of scientific and technological knowledge will greatly contribute to the material well-being and improved quality of life (Watson, Crawford and Farley, 2003). Given the important contributions of STI to economic development, it is necessary for African countries to become more serious about the development, application and utilisation of STI. The situation has become more critical since the continent is plagued with rapid population growth, poverty, poor health and food insecurity among others (Economic Commission for Africa, 2002). The Commission argued further that the continent urgently needs a rapid, sustained, and broad-based economic transformation. Such development can be achieved when the continent has scientific and technological capacity to effectively address these challenges (Hassan, 2009).

Interestingly, Africa has long recognised the catalytic role STI plays in national development. This is evidenced by the number of continental declarations, resolutions and plans to radically develop the requisite capacity to effectively harness STI for development. There was the Lagos Plan of Action for the Economic Development of Africa, (1980–2000) which recognised the importance of science and technology (S&T) and called on African countries to seriously integrate S&T into their development agenda.

More recently, the African Union declared 2007 as the Africa's year for Science and Technology and declared to commit 1% of GDP to STI activities. This declaration is merely re-instatement of an earlier one under the Lagos Plan of Action. The Africa Union working with the NEPAD has launched Africa's Science and Technology Consolidated Plan of Action in 2005 with the objective among others to help Africa harness and apply STI to eradicate poverty and achieve sustainable development (African Union, 2005).

However, still remains under-developed and its role in the global STI development and utilization is also low. For example, in terms STI human capital, Asia in 2007 had 41.4% of the world researchers, India had 2.2%, while Sub Saharan Africa (excluding South Africa) had 0.6%. (UNESCO, 2009). Almost all the sub-Saharan African countries (excluding South Africa) performed poorly in terms of the UNDP human development indicators.

Evidently, there is a problem of implementation of these declarations and raises the question about Africa's seriousness in employing STI for the continent's development. Or were these declarations on STI mere rhetorics?. This paper looks at STI development in Africa and

gauges Africa's general performance in the global STI development. It identifies challenges and proposes ways to reinvigorate the development, adoption and utilization of STI by African countries. It will be argued strongly that Africa needs to be business-like in integrating STI into its development activities.

The paper draws largely from literature and dependence on the author's knowledge about the STI landscape in Africa and hopes to contribute to the on-going discourse on catalyzing African countries to seriously adopt S&T for development.

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Science and Technology Manpower Capacity Building in the Transition towards Knowledge-Based Economy

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Abstract

During the last two decades Thai economy has been going through the transition from resource-based, labor-intensive and low value-added manufacturing and services towards a more knowledge-intensive and higher value-added production. Science, technology and innovation (STI) becomes a key driving force for this change. Nevertheless, development of STI in Thailand has not been well progressing as much as it should be.

Recently, the International Institute for Management Development (IMD 2010) ranked Thailand's competitiveness in science at the 40th out of 58 economies (Singapore and Malaysia were ranked at the 12th and 27th respectively). There are a number of factors reflecting weakness of scientific capacity of Thailand. Examples include:

- Number of scientific publications – about one time less than Singapore's. In 2007 Thailand published about 1,700 scientific papers while Singapore turned out about 3,800.
- Number of patents granted to residents – about two times less than Malaysia and almost five times less than Singapore. In 2008 Singaporean, Malay and Thai citizens produced 469, 230 and 99 (invention-type) patents respectively.
- Total expenditure on R&D as percentage of GDP – about 12 times less than Singapore and three times less than Malaysia. In 2008 Singapore spent US$ 5,038 million on R&D (2.68% of GDP). Malaysia spent US$ 1,586 million (0.72% of GDP) whereas Thailand spent US$ 593 million (0.22% of GDP).
- Total R&D personnel per capita – about ten times less than Singapore. In 2008 Singapore had 33,200 (full-time equivalent, FTE) R&D personnel (6.85 FTE per 1,000 people). Thailand had 42,600 FTE (0.65 FTE per 1,000 people).

The above indicators imply that Thailand is in desperate need for policy and measures to strengthen STI capacity. This needs to be done in a number of aspects including, development of STI infrastructure, readjustment of related laws and regulations to accelerate progress of S&T, improvement of incentive systems to promote R&D investment of the private sector, and last but not least, the development S&T manpower.

In Thailand it is generally accepted that S&T manpower is one of the most important issues in STI development. One of the main obstacles to the development of STI is the shortfall of high quality manpower. Statistics show that, in terms of quantity, although overall there is a gap between demand and supply of S&T personnel; only those in some specific fields of certain educational levels are in desperate shortage. This reflects a mismatch demand and supply of human resources. To take an example, in life science, Thailand has a large pool of molecular

scientists whereas there are very few bioprocess engineers. The lack of bioprocess engineers becomes a key bottleneck for development of biotechnology industry. While a large part of national policy is set out to promote bio-based industry, current capacity of universities is not favorable to production of personnel in shortage (but critical) fields, e.g. bioprocess engineers. Universities and colleges appear to have limitation to quickly adjust production of graduates responsive to industrial demand due to inflexibility in terms of e.g. faculties' skill and expertise, lab facilities, and so on.

Apart from the quantitative mismatch as mentioned above, quality shortfall of the workforce is another point of great concern. The major problem concerning manpower quality is the gap regarding knowledge, skills and attributes of personnel – between which industry required and which educational sector produced. The policy question is that how such quality gap can be reduced. Experience of both advanced and developing countries tells us that effective linkages between university and industry is imperative. University-industry links which allow flows of information and knowledge between the two parties significantly accelerate innovation. Such a flow of information and knowledge becomes more effective when the collaboration gets to be more in-depth.

To this extent, producing high quality S&T manpower to meet industrial demand needs in-depth university-industry collaboration. The key word is 'in-depth'. It means not just only knowing the requirement of industry but also that the university has to be open for the industry to take active participation throughout the process of graduate production. On the industry side, it is also important that firms needs to play active role in the education process, from determining of future skills required, development of curriculum, supporting industrial frontier knowledge, providing facility and personnel for student training and opportunity for university staff to have exposure to industrial technology and practice. The industry also plays an important role in creation of career part for S&T personnel. In certain circumstances, the industry may also partly provide funding for education.

S&T policy in Thailand in the next decade appears to have emphasized the so-called public-private partnership (PPP) in development of S&T and using S&T to drive development. In the PPP approach, the government will play facilitating and catalyst roles and allow and encourage the private sector playing leading roles. The government will create favorable environment through, e.g., fiscal and financial incentives, relaxing regulation, providing technological infrastructure services and assistance, and so on. The private sector will work on marketing and investment in S&T capability development such as R&D and commercialization of R&D.

Regarding S&T manpower development, the policy also gears towards the PPP trend. Currently, there exist, a number of industrial-based initiatives. Examples include early recruitment – firms employ students before they graduated and actively participate in design and development of university curriculum, work-integrated learning and industrial M.Sc. and Ph.D. In some cases the industry takes almost absolute role in human resources development to fill their specific demand. For examples, large firms in some sector such as retail, food, tourism and auto industries set up their own educational institutes to supply high quality manpower as to meet the demand of their own as well as of the industry.

Migration of the Highly Skilled from Pakistan and Bangladesh and its Impact on Technological and Economic Development

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Abstract

The dynamics of globalization has been characterized not just by the international flow of capital, commodities, goods, services and information but more so of labour. The global labour market, particularly for the highly skilled[1] is expanding. According to a recent OECD study the migration of the highly skilled from developing countries is rising. The study reveals that out of 59 million migrants in OECD countries alone, 20 million are highly skilled. Migrants in OECD countries of UK, Canada, USA and Australia with tertiary level qualification reflect colonial and linguistic ties with dominance of South Asian countries including India, Pakistan, Sri Lanka and Bangladesh.

The knowledge-intensive economies of the developed countries are expanding to absorb more knowledge workers and are competing for foreign scientists and engineers. Several countries are offering scholarships and other incentives (such as extended stay after completion of higher studies) to attract bright young foreign students. Some other incentives include programmes such as H1-B visa programme in the United States, Green Card scheme for information technology experts in Germany, introduction of the Highly Skilled Migrant Programme in the United Kingdom and Australia. Developing countries such as Pakistan, Bangladesh, India and China, which are major contributors of highly skilled migrant workers particularly scientists and engineers, are confronted with challenges of directing additional resources to higher education to increase access (often at the cost of compromising quality) and to offer higher salaries and other incentives in order to retain a critical number of scientists, engineers and other professionals at home.

Scientific communities are more international in scope than other professionals. The quest of scientists for continuous learning and to keep themselves abreast with the current frontiers of knowledge keeps them mobile till they anchor themselves in a knowledge hub. The foremost priority for migration of scientists has been identified as the desire to be part of global knowledge networks. Most of these networks are concentrated in developed countries of Western Europe, USA and Eastern Asia led by Japan. These networks comprising scientists from developed and developing countries hold the potential of helping the developing countries build their scientific capabilities (Tim Turpin, 2007). Some developing countries such as India and China have realized this potential and are offering attractive incentives to engage their Diaspora in their development programmes.

Developing countries require a critical mass of highly qualified scientists, engineers and other professionals to attain socioeconomic progress. High quality professionals are needed not only for industrial growth and competitiveness but also for provision of social services such as

health, sanitation, energy infrastructure, education and agriculture. Migration of scientists, engineers and medical professionals is generally known to bear a negative effect on a country's economic and social development. Source countries lose out not only on the investment they have made on training highly skilled people but are often forced to hire foreign consultants to meet specific development needs at a high cost to tax payers.

This paper provides a brief review of literature on migration and maps trends of migration of the highly skilled scientific personnel in Bangladesh and Pakistan. It reviews impact of migration in terms of institutional weakness to plan and implement projects related to building of local technological competence and the resulting economic implications. The current state of technology capacity is assessed using standard input and output indicators and comparisons are made with the neighbouring countries of India and China. Conclusions draw attention towards much needed policy interventions for arresting migration and for engaging the Diaspora to help reform institutions, technology transfer and promotion of knowledge based entrepreneurship.

Proper Waste Management: An Economic and Environmental Imperative

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Abstract

Mismanagement of waste not only causes adverse impacts on the ecosystem but also produces serious and often irreversible effects on human health. The Industrial Revolution of the late 18th century that propelled humanity from its limited "muscle power" to unprecedented machine power, heralding the onset of industrialization, has revolutionized our lives for more than two centuries. Industrialization is still considered the economic engine that drives the social and cultural life of a nation and is closely tied to its standard of living, despite some controversies about how well it helped raise the living standards of factory workers themselves (Horrell and Humphries, 1992). One of the most prominent examples of how industrialization can transform a nation's living standard comes from South Korea, a country that was devastated by the Korean War of the early 1950s but rebuilt itself to a formidable economy in about 25 years. With a per capita annual income of US $87 in 1962, the earnings rose to $4,830 in 1989 and shot up to $20,000 in 2007. However, this economic well being did not come without a price—massive pollution accompanied rapid industrialization that resulted in air pollution in large cities, acid rain, and pollution of water bodies from the discharge of sewage and industrial effluents (CIA, 2010)

Along with the economic benefits, industrialization has also produced ecological devastations in its wake. The complex nature and voluminous amount of industrial wastes have inflicted dreadful effects on ecological health. Detroit River—marking the international boundary between the U.S. and Canada—got heavily polluted from industrial and urban discharges during the 1950s and 1960s resulting in death of 1000s of migratory birds during the spring nesting seasons. Concentration of dissolved oxygen dropped to levels that could not support fish and other aquatic life forms, causing mass migration of fish and rendering the river unfit for any contact sport (Hartig, 2009).

The presentation reviews the nature and types of waste generated in modern society, and their chemical and toxicological characteristics, along with selected case histories to highlight environmental problems caused by mismanagement of hazardous and toxic wastes generated by industries. Lesson learned from past mismanagement of waste in the United States and other developed countries are included to illustrate the huge economic cost for remediation of contaminated sites and restoration of environmental quality. Procedures and steps needed for proper management of industrial waste to keep pace with economic growth while maintaining a sustainable environment are outlined. The presentation concludes with recommendations for adopting realistic policies to ensure environmentally-sustainable economic development of India.

Suggestion is offered to formulate development policies based on three key factors—environmental, social, and economic—rather than the old model based on sole consideration of the economic cost-and-benefit analysis.

Keywords: Waste management, Industrial Revolution, new development policy, environmental-social-economic model.

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Changes in Healthcare Expenditure Structure in South and Southeast Asia: Where is it Heading?

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Abstract

This paper attempts to examine the critical issues that ought to be addressed when evaluating healthcare issues in South and Southeast Asian countries. It starts by reviewing the dominant arguments on ownership and healthcare provision, *viz*., neoclassical, evolutionary and heterodox and politics of interest groups. Given the imperfections and asymmetries, as well as, its properties as a social good that should reach everyone, the paper adopts evolutionary and heterodox approaches, and the views of political scientists on interest groups and civil society. It than explores privatization trends in the world with a focus on developed and developing economies. It is obvious that privatization has increased dramatically in the developing countries when government funding still dominates healthcare financing in most developed countries. Whereas the share of privately funded healthcare in the developed countries of Denmark, Japan, Sweden and United Kingdom remained over 80 percent of overall healthcare expenditure in 2000 and 2007, the commensurate shares for the South and Southeast developing countries of Bangladesh, Cambodia, India, Laos, Malaysia, Myanmar, Pakistan, Singapore and Vietnam remained or rose to exceed over 50 percent.

Three major policy trends can be observed in the recent evolution of healthcare services in the South and Southeast Asian economies. The first takes on a two-prong approach that guarantees medical support for the poor while at the same time encouraging private hospitals to expand. Singapore has taken on this approach utilizing private insurance to reduce the burden of British-style government funding. However, because the resources available for public hospitals in Singapore is better or equal to that in private hospitals the provision of healthcare service in the country has remained strong. Indeed, even the salaries of healthcare employees in public and private hospitals do not vary significantly. Private hospitals primarily compliment public hospitals as in Canada and Taiwan. The second is an approach taken by countries such as Malaysia and Thailand, which have been promoting private services will reducing the share of national budget going to health. Although some qualified staff have remained in government service, the growing differences in resources and remuneration between private and public hospitals has produced a two-tier healthcare system in these countries. The third has emerged in low income countries where a rich middle and upper class has increased the demand for private healthcare in urban locations because of the poor resources available in public hospitals. The transition economies of Cambodia, Laos and Myanmar are some of the countries facing heavy privatization as the lack of government hospitals has driven greater expansion in private hospitals to meet such demand. A significant number of the middle and upper class from these countries actually seek treatment in Thai hospitals. The second and third trend types has even driven originally non-profit and with religious and other related philanthropic objectives into converting themselves to for-profit hospitals.

Deliberate changes were made in the regulatory framework to affect the restructuring of healthcare services in most South and Southeast Asian countries. The Singapore government has a stringent regulatory framework that vets *ex ante*, monitors and undertakes *ex post* appraisal of hospitals registered to carry out such services. Strict adherence to compliance, regular adjustments to meet national goals and appraisal of policy instruments have been the pivot of healthcare provision in Singapore. Whereas new regulations were instituted in countries such as Cambodia, Laos and Vietnam to establish regulations to allow private ownership, in countries such as Malaysia privatization not only facilitated profiteering but also a range of generous tax privileges to stimulate expansion. Greater autonomy and the expansion of paying customers through the promotion of healthcare tourism has supported the payment of higher salaries in private providers such that there has been a dramatic movement of doctors and nurses from government to private hospitals in Malaysia. Government linked companies have also forayed extensively into private hospitals. The city state of Singapore does not have problems of the rural population, the strong concentration of resources on private hospitals has also aggravated rural-urban divide in the remaining countries.

Following the assessment of the changes that has been taking place in the whole region, this paper will draw policy relevant conclusions for healthcare governance in South and Southeast Asia in light of the argument that healthcare is a utility that must reach everyone.

Micro Solutions of Complex Human Diseases: Role of micro-RNAs in Health & Pathogenesis

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Abstract

A great mystery following the excitement of the sequencing of the entire human genome at the turn of the last century was that the number of proteins that constitute the entire structural, catalytic and signaling components in the simple worm and humans encoded in the complete genomes were about the same, using less than 95% of the human genome. This paradox can be stated as if majority of the genomic DNA did not encode the building blocks, but had some mysterious purpose as it is copied faithfully from generation to generation for millions of years without apparent function. Then why do humans have huge amount of extra DNA if it does not encode proteins.

The intriguing answer came from the little worm *Caenorhabditis elegans* in early 1990s, when a number of publications pointed to the existence of small non-coding RNA molecules called micro-RNA or miRNAs that are transcribed in animal and plant cells, but do not encode any protein, but instead act as regulators of protein synthesis and are conserved across diverse species from worms, and flies to the primates including humans. Thus, micro-RNAs have emerged as important regulators of gene expression in mammals; miRNAs consist of short nucleic acids, on average ~22 nucleotides in length.

The miRNAs exert their effect by binding directly to target messenger RNAs (mRNAs) that code for proteins and inhibiting mRNA stability and translation. Individual miRNA can bind to multiple targets and many miRNAs can bind to the same target mRNA, allowing for a complex pattern of regulation of gene expression. When a miRNA binds to their targets, miRNAs can suppress translation of the mRNA by either sequestration or degradation of the message. Thus, miRNAs function as powerful and sensitive posttranscriptional regulators of gene expression, and not only contribute to the normal embryogenesis and development and play important role in virtually every cellular process in health and disease.

MicroRNAs mediate several forms of cancer and leukemia and altered levels of miRNA expression contribute to insulin resistance in diabetes, cardiac hypertrophy, Alzheimer disease, mental retardation, Tourette's syndrome, amyotrophic lateral scleorosis, and asthma. I will summarize what is known about miRNA biogenesis, expression, regulation, function, mode of action, and role in disease processes with an emphasis on miRNAs in mammals. I will also discuss some of the methodology employed in miRNA research and the potential of miRNAs as therapeutic targets for novel drug development. The role of miRNAs in signal transduction and cellular stress is reviewed. Lastly, we identify new exciting avenues of research on the role of miRNAs in cancer and the possibility of epigenetic effects on gene expression.

S&T And Economic Development Policies for S&T Development in Korea

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Abstract

In the knowledge-based economy, S&T-based innovation is increasingly important, since it determines industrial competitiveness and plays a key role for sustainability of economic growth. For last four decades, the Korean economy has been able to transform itself successfully from resource-based economy to innovation-led economy. The S&T development in the process of industrialization over the period is underpinning of such a transformation of the economy. In addition, the unique characteristic of the Korea's economic development is "the economic development led by the government." That is, industrialization and S&T development had been initiated and driven by government policies..

Thus, it will be interesting to make a review of the government policies focusing both the industrial policy and S&T policy. In this presentation, the process of industrialization of the Korean economy will be discussed in historical perspective, which created and fostered needs for STI over time. On the other hand, a historical review of S&T policy and evolution of STI system will be presented, which has led the Korean economy into the knowledge-based economy.

Finally, using historical data, we make an investigation of the relationship between R&D investment and economic growth, and the nature of technical change of the Korean economy. Such investigation would provide an interpretation and implication of behavior of R&D investment with regard to economic growth and furthermore some emerging issues facing the Korean economy.

Persistent Toxic Substances: Problems and Prospects in Developing Countries

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Abstract

Persistent Toxic Substances (PTS) are chemicals that persist in the environment for long period, accumulate in the fatty tissue of living organisms, circulate through atmospheric, aquatic or biological transport over long distances and are thus globally distributed detectable even in areas where they have never been used. These chemicals have serious health and environmental effects that include carcinogenicity, reproductive impairment, developmental and immune system changes, and endocrine disruption thus posing threat of lower reproductive success and in extreme cases possible loss of biological diversity. PTS include intentionally used manufactured chemicals like organochlorine pesticides, polychlorinated biphenyls (PCB) and by-products unintentionally formed in industrial processes like polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF). The twelve persistent organic pollutants (POPs) often called as dirty dozen represent a subset of PTS, which is a broader concept than POPs. In May 2001 the Stockholm Convention on POPs was adopted to address the issues surrounding POPs. An expansion of the list of the substances included in PTS project was sought from Geneva Convention on Long-Range Transboundary Air Pollution (LRTAP) under the auspices of the United Nations Economic Commission for Europe (UNECE). The additional entries on the LRTAP list are chlordecone, hexabromobiphenyl, hexachlorocyclo-hexane and polycyclic aromatic hydrocarbons (PAHs). The Stockholm Convention targeted a ban on the production and use of POPs in countries that have ratified the Convention. A basic and early requirement of any country to meet its obligations as a Party to the Stockholm Convention is the preparation of a National Implementation Plan (NIP), and associated Action Plans to eliminate or reduce the release of these chemicals into the environment. Many least developed countries, however, lack the necessary capacity and skills to adequately develop such strategic plan. There are some inherent problems that developing countries are facing. The most important of which is the lack of awareness among different sectors of society, industry and policy makers about potential health effects of persistent chemicals. Other problems include proper regulations for all the chemicals, enforcement capabilities and illegal usage, availability of cost effective replacement chemicals and a lack of trained manpower and sophisticated techniques and equipments for the analysis. Another important challenge for developing countries is to safely dispose banned chemicals. The remedial measures taken by UNEP and their impact will be examined.

Internationalization of (ICT) Innovation: The Concept and Evidence

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Abstract

The presentation reports some results of an analysis how R&D and in particular ICT R&D is taking place across various regions of the world within an increasingly internationalised environment. In order to cast some light on the internationalisation of ICT R&D, a set of empirical analyses of R&D internationalisation in the ICT sector is presented and discussed.
The motivation behind taking up the subject of internationalisation of ICT R&D activities are manifolds. However, this analysis is driven by the following two issues:
First, having internationalised their production activities, large multinational ICT companies seem to be increasingly internationalising their R&D activities. If most international R&D activities of EU firms still seem to take place within the EU and between the EU and the USA, there also seems to be an emerging internationalisation trend towards Asian countries. Thus, taking into account the benefits of knowledge creation and the economic importance of knowledge-intensive industries, such as the ICT sector, it appears valuable to investigate the current state of this process.

Second, the scarcity of data illustrating the developments in R&D activity together with the lack of full understanding of the process creates a challenge for informed policy making. These deficiencies create a certain amount of concerns among policy makers. For example, from the European perspective, it seems that a major concern is that location of R&D facilities of European companies in non-European countries might have a negative impact on domestic R&D expenditures and on the domestic knowledge base. The increasing role of developing countries, in particular in Asia, may create additional competition for R&D resources and may lead to a reduction to the amount of R&D investments in Europe. If the R&D internationalisation trend is verified, Europe and non- Europe companies may be increasingly locating R&D sites outside of the Europe. Another concern is the fact that internationalisation of R&D seems to take place in knowledge intensive industries, such as the ICT, chemical or pharmaceutical sectors, in other terms in industries seen as essential to advanced economies.

The above described perspective creates an image of R&D internationalisation as a zero-sum game. However, the internationalisation of R&D may also have positive effects for all parties involved. For example, by accessing a wider pool of knowledge, companies improve their competitiveness with a potential for positive spill-over effects at home. Furthermore, by building up research facilities abroad, firms get access to potentially relevant knowledge located outside of their original location. Similarly, because firms need to increase the pace at which they bring

products to the markets, they need to be close enough to react and adapt to local market needs. Consequently, to address the ambiguities concerning R&D internationalisation, it is necessary to follow the developments of the global knowledge creation network with particular attention to the complexity of the knowledge creation process and companies' strategies behind the decision taking on R&D site location.

In my analysis, I look at the process of R&D and its internationalisation from two perspectives. On the one hand, I focus on the input-side of the inventive process. In more concrete terms, I analyse the regional distribution of ICT R&D sites with respect to companies' headquarter location and, eventually, create a global map of ICT R&D sites location and ownership. The results of this exercise reveal that up to 43 per cent of ICT firms' R&D sites are located in a different region than the region in which a company headquarter is. On the other hand, however, when the output of the internationalised ICT inventive activity is examined, measured as the amount of patented inventions developed between inventors from different regions, very low levels of international inventive collaboration can be verified.

These somehow puzzling results can be explained by the complexity of the inventive process and various motivations that are behind the decisions to locate R&D sites away from the home country. For example, not all international R&D sites are created with the aim of delivering new inventions that can then be patented and transferred to other locations. Instead, some of them are meant to adapt existing products and technologies to new markets and consumer preferences. This might explain why, for example, despite a strong concentration of American and European R&D sites in Asian countries does not result in a large number of patents developed be these companies together with domestic researchers.

However, as illustrated by the rapid upsurge of joint patenting between American and Asian researchers since 2000, the ICT sector in general and its R&D activities are subject to very dynamic conditions and constant changes. Thus, similar to the fast changing composition of the ICT production network, the global ICT knowledge creation network is in the process of constant transformation. In other words, firms are very quickly responding to disparities in regional conditions of both production and knowledge creation and allocate their resources accordingly. As a result, this process has significant implications for countries or regions in which new R&D activities are being set up or from which these activities are being withdrawn.

"Reproductive health Concerns: The Impact of Environmental Toxicants on Reproductive Health of Women/Men"

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Abstract

With the increased technological advancement there has been an entire change in the environment around us and what it has left behind is a pool of environmental toxicants affecting our health adversely. A major concern is the potential effects of the environmental toxicants on women health and that is regardless of her reproductive plans. More than 75,000 synthetic chemicals and metals are currently in commercial use in various countries. The toxicity of most of these is unknown or incompletely studied. In humans, exposure to some may cause cancer, reproductive and developmental disorders. Reproductive effects are of concern because of important consequences for couples attempting to conceive and these may have lifelong and even intergenerational effects. Unfortunately, toxicological information is often incomplete. Animal testing usually looks at health effects using one chemical at a time. This strategy fails to provide information about interactive effects which may occur with exposure to more than one chemical. Moreover, animal tests often fail to examine for subtle, delayed, or difficult-to-diagnose conditions. Epidemiological (human) studies are often limited by inaccurate exposure assessments and incomplete information about health outcomes.

Some of the specific synthetic chemicals or metals are known to harm human reproduction or development. These (endocrine disruptors) may be found in many everyday products– including plastic bottles, metal food cans, detergents, flame retardants, food, toys, cosmetics, and pesticides. Previous research has shown that women exposed to endocrine disruptors at various life stages may have increased risk of disorders and conditions related to hormonal problems such as menstrual cycle irregularities, infertility, endometriosis, autoimmune disorders and cancers of the reproductive system. Bisphenol A (BPA) is a controversial plastics ingredient (chemical) used primarily in the production of polycarbonate plastics and epoxy resins. It is found in items such as: plastic bottles, food storage containers, compact discs, and water supply pipes. People, including children, are exposed to BPA when it leaches from the coatings of canned foods and from plastic products, with the highest estimated daily intakes of BPA occurring in infants and children. Benzene present in inks, glues, gasoline and paint remover can cause damaging effects on the developing reproductive system. Lead and mercury exposures are associated with spontaneous abortions in female workers. Several specific solvents have additional adverse effects — glycol ethers damage male reproductive function. Toluene and naphthalene present in household related products are known reproductive toxicants. Many farm workers are exposed to mixtures of pesticides and are at increased risk of spontaneous abortion and birth defects in off spring. Some pesticides, like the fumigant, ethylene oxide, used to sterilize medical equipment, or the fumigant, methyl bromide, and herbicide, cyanazine, used in various countries are identifiable as particularly associated with adverse reproductive outcomes. While the scientific evidence is weaker and still emerging, many other chemicals are also likely to adversely impact human reproduction. Suspects include manganese, several solvents including xylene, styrene, and perchlorethylene, and numerous pesticides and plasticizers. New research

from the Harvard School of Public Health reports that men who eat a high amount of soy-based food products have lower total sperm counts. Soy is rich in estrogenic compounds known as isoflavones including genistein, daidzein, and glyciten. Organochlorines and certain pesticides are linked to high incidence of prostate cancer.

We believe that Laws should take a precautionary approach, should guide risk management and regulatory decisions. This means that the issue of safety should be thoroughly considered before human and environmental exposures are permitted. No hazardous substance should be allowed to slip through the cracks because of a lack of information, time, or funding. Where there is some evidence of human or environmental toxicity, the precautionary approach demands that exposures be avoided or minimized.

Going From Local to Global: Solving Local Problems - Inserting Into Global Science

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Abstract

In a world that is in perpetual flux, we observe new ways of doing science, new purposes for the development of technology, and new impetus and organization for innovation. Countries that traditionally have been behind in the production of science are now in the forefront, particularly from South Asia and South East Asia. New inter-disciplines and trans-disciplines consolidate by their own right. New opportunities evolve for scientific development of Third World countries. New means for information interchange open unexpected opportunities for collaboration between the countries that "have" and those that "have not", between their respective scientists, and between scientists and other social actors in a myriad of new fora outside the traditional channels of academic exchange. New "invisible colleges" (Wagner, 2008), connecting scientists both North-South and South-South emerge. The world's arrival to the era of knowledge is changing the role of science and technology in society. Some current trends point out to the production of knowledge linked to fulfill the needs of a global market, somehow described by Gibbons and associates (Gibbons *et al.*, 1994; Nowotny *et al.*, 2003, 2005) as a new mode of knowledge production called 'Mode 2'. It claims to be "more socially accountable" than the traditional way of doing science, identified as 'Mode 1'. However, in the past years new forms of doing research have appeared in some countries that do not correspond to this trend. Although they share some characteristics of 'Mode 2', they differ drastically in the sense that they are actually more socially accountable (Jiménez, 2004, 2007, 2009; Jiménez and Escalante, 2007). These forms respond to current local or regional problems and opportunities, dissociated with global markets, hence making science really more socially accountable. A new model of learning gearing to research in a Latin American country is described. The Center for Innovation and Educational Development (Centro para la Innovación y Desarrollo Educativo, CIDE, 2003), features learning by problem-solving, individual and group study, individualized study plans, and intensive use of Internet, in an environment with no physical installations nor laboratories. Once the students identify their local or regional research problem they wish to work on, they try to contact leading scientists, with specific requests, using the information and communication technologies. The interaction with these top scientists often leads to collaboration and participation in international conferences, gradually introducing them into mainstream science. By the time students defend their doctoral dissertations their involvement in international scientific networks is a reality. The conclusion is that some segments of society, in congruence with 'the spirit of Budapest' (Mayor, 1999; World Conference on Science, 1999a & b), are concerned with local or regional problems and opportunities that can be solved with scientific research. India, having similar characteristics in their needs for research geared to solve local/regional problems as Mexico, is a target to seek similar academic enterprises as the one

presented here. We are in the process of obtaining funds to realize a comparative study. These projects are putting in practice alternative models of doing science with emphasis in social accountability, opposite to "Mode 2" tendency. This type of knowledge generation is called 'Mode 3' (Jiménez, 2008).

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Boosting National Competitiveness through science, technology and innovation

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Abstract

According to the recent survey of the World Competitiveness Ranking 2010 by the Institute for Management (IMD), Thailand was ranked 26th out of 58 economies in overall competitiveness ranking. While the country's ranking in economic performance is as high as sixth, ranking for infrastructure is a disappointing 46th.
Scientific infrastructure is one of the above-mentioned infrastructure. It involves key variables such as research and development expenditures, research personnel, private sector involvement in research, number of patents. A thorough investigation found three key scientific indicators that need to be improved which are 1) Gross Expenditure on Research and Development (GERD), 2) the number of R&D personnel, and 3) private R&D expenditure.
Recently, the policy office has been working out three strategic goals in order to raise the competitive platform of the country through research especially in science and technology. They include:

1) increase Gross Expenditure on Research and Development (GERD) from currently 0.21 percent to 1 percent of GDP by 2016 (the end of the next national social and economic development plan)
2) increase the ratio of R&D personnel per population from currently 6.76:10,000 to 10:10,000 by 2016
3) stimulate R&D investment in the private sector through public-private partnership, e.g. to increase R&D expenditure in the private sector from the current ratio between private and public R&D expenditures of 40:60 to 50:50 by 2016.

While detailed strategies are currently being crafted to realize these goals, the government has implemented additional measures, which include tax and non-tax benefits, low-interest loans and matching funds to stimulate R&D in the private sector. A joint public-private committee on science and technology (PPST) chaired by the Minister of Science and Technology has recently been set up to bridge the gap between the private sector and the government. Meanwhile, the concept of 'innovation district' –where incentives are given to encourage private-sector investment in science and technology (S&T) infrastructure like, for example, a R&D-based industrial park, and to stimulate R&D investment of the tenant companies – is being explored as to find effective ways of adoption in the Thai context.

"Translational Research: Challenges and Opportunities"

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Abstract

Of late there has been much talk about the Translational Research, all over the world. There is a feeling that advances in, and accumulation of, scientific knowledge has not provided many solutions for the benefit of the society. It is particularly so in the field of human health and related issues. Western countries have attempted to respond to this by creating special networks, institutions and enhanced industrial corporation. In the developing world, although the need has been felt, it is not yet clear what path can be followed, which structures needed to be in place and how to organize translational research. This is one of the major challenges in front of funding agencies as well as scientists in the developing world. It is also believed that there are many leads in research institutions, universities and even in the industrial set up in India that can be developed into useful products. Although some beginnings have been made in India, the scientists have yet to figure out how to realize potential of their research findings and translate them into products. Examples of experimental malaria vaccines against both P. falciparum and P. Vivax malaria development at ICGEB, and with short peptides with important biological activities will be discussed.

"Capacity building of Tumba College of Technology (TCT)" in Rwanda
South-South Cooperation on AE development

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Abstract

Japan has been assisting many developing countries to build their technological capability since long. It is a developed country with high technology, which underdeveloped countries cannot easily adapt. Such development assistance may not be as effective as expected, because of socio-economical and technological differences between donor and recipient country.

JICA initiated a different model of development assistance to Rwanda through the South-South Cooperation between two similar developing countries Rwanda and Nepal. They are both hilly countries with agriculture as the main occupation. They are both land locked countries with similar energy problems.

This 5 year project assistance to Tumba College of Technology (TCT) in Rwanda is "Strengthening the Capacity of Tumba College of Technology" from August 2007. A Technical school (ETO Tumba) was converted to TCT in view of developing higher technicians at Diploma level (A1) with three courses, namely: Information Technology (IT), Electronics and Telecommunication (ET) and Alternative Energy (AE).

The AE department is being assisted by the Nepalese consultants. The subjects of alternative energy are: microhydro, biogas, solar thermal, solar PV, biomass and improved cook stoves. The Institute of Engineering (IOE) in Nepal has been conducting Master Degree Course in Renewable Energy since a long time. This long experience is the basis for collaboration.

The project cooperation focuses mainly on:

1. Basic management system of TCT
2. Development of Curriculum/Course manual on Alternative Energy
3. Improvement of pedagogic abilities of teachers
4. Training of teachers of the AE department
5. Technology/knowledge transfer through interactions and lectures

More than dozen teachers have been trained in Nepal. More than 20 (long term as well as short term) experts are constantly engaged in the capacity building of TCT. The first batch of the students graduated last year and 60 % have jobs and are successfully working in different industrial and commercial establishments.

Microhydro sector envisages establishing one micro hydro power station up to 30 kw in future. A small turbine fabricated in Nepal has already exists in TCT as teaching aid to illustrate the basic principles of microhydro. As recognition of capacity of TCT, GTZ in Rwanda is now in the process of requesting TCT to provide training for people in Microhydro.

Rwanda still depends on heavily (95%) on biomass energy. Nepal too depends heavily of traditional energy sources. Technologies that have produced positive impact in Nepal such as

improved cook stoves, biobriquettes, cheap fuel saving stoves and charcoal from waste biomass have been introduced/demonstrated to TCT and rural areas so as to reduce fuel wood consumption. Cooking beans is a problem as it takes more than 2 hours, but introduction of pressure cooker has reduced the time more than half. Plenty of waste biomass such as banana waste, papyrus, pine needles was used as fuel instead of wood charcoal.

Rwanda has plan to setup 15,000 biogas plants in near future and the success story of biogas in Nepal can certainly contribute in technology transfer and training of manpower to fulfill the above plan. The capability of TCT has been recognized by the Ministry of Infrastructure (MININFRA) and assigned the job of training and installation works in biogas to TCT.

Small solar water heaters and solar home systems are the main focus areas in the solar sector with repair and maintenance as an integral part.

The midterm evaluation of the project has indicated following achievements

- TCT has formulated its operational plan and academic program since August 2007
- Curriculum and course manual have been developed
- Technical, pedagogical and managerial skills of TCT staff have been improved
- The management capacity including employment promotions and income generation activities is enhanced.

This is a unique type of collaboration between developing countries with financial support from Japan. The technologies, developed and transferred, are simple, cheaper and suitable for Rwanda. Japanese technology would be more expensive, and perhaps not as suitable for Rwanda. Experts/advisors of developed countries probably are more expensive than from developing countries. This will reflect in the overall project cost. Extra or surplus money can be utilized for additional activities, training and equipment support.

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"Models for Innovation Policy in Late Industrialising Countries - Endogeneous vs. Exogeneous"

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Abstract

"Regional cooperation in science and technology: Opportunities and challenges in the context of Globalization", Delhi, 26-29 November 2010

Science and Innovation (SI) is becoming part of global politics. This paper develops the argument that since the 1990s governments of Late Industrialising Countries (LIC) have started defining their SI policy strategies under increasing exogenous influence. Growing international competition in the global economy and a 'pluralization' of international actors in science and politics build a framework of 'globalization' which shapes the domestic policy making processes. As states rarely define their policies in isolation, policy transfer and learning are more and more common practice. Furthermore international governmental and non-governmental organizations promote policy *models and guidelines*, particularly in the developing world.
In the international system the special status of LIC can be characterised as 'in between', with high rates of income inequality, on the one hand, and increasing technological capabilities and world class research in some sectors and regions, on the other. LIC define their SI policy strategies towards three partly diverging targets, driven by related *endogenous* and *exogenous* forces: domestic pro-poor and social inclusive policies, domestic technological promotion in national firms, and internationalization, e.g. via the UN or in collaboration with the OECD or the G8.

The paper presents a framework for the analysis of SI policy-making in LIC; for a comparative analysis we chose Brazil and South Africa applying the logic of the Most Similar Case Study Design.

Response of Europe and Asia to the new Global Order

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Abstract

Traditionally the explanations of globalization have been related to the analysis of capitalist world order where industrialization has provided one of the key explanations. However, the redistribution of production and employment are today more nuanced, and the policy choices are increasingly selective. Globalization has also changed the divisions between technological centers and peripheries: small open high-tech economies and new big developing countries, such as India and China, have been more resistant than other Europe and the US to global economic instabilities. Especially 2008-09 world-wide turbulences, which still have dramatic impacts on the components of global growth, have set traditional growth policies of western advanced countries under reconsideration and scrutiny. Also the social dimension has become more important.

The European Union has pursued an exclusive policy with aggressive competition strategies aiming to win the game with the US and Japan for the world economic super-power. From the European viewpoint the rise of new Asian countries has been mainly seen as a threat to the sustainable European development. In "Creating an Innovative Europe" (2006) the Independent Expert Group on R&D and Innovation that was set up by the European Commission, speaks of innovation-friendly markets, the 3% target (3% of R&D expenses of GDP) and multi-level mobility. As such, there is a demand for a new conception of mobility, flexibility and adaptability. "Europe 2020"defines the EU´s strategy of growth to be smart, sustainable and inclusive. It sketches a vision of reorientation in a situation where "economic realities are moving faster than political realities". The increased rapidity of economic realities is also sensitive to deeper globalization that in turn is difficult to estimate. At the same time new global blocks are emerging, e.g. between India, China, Brazil and Russia. Moreover, irrespective of their low economic and social performance, the African countries already provide an example of possible future trends of globalization.

From the Asian viewpoint Europe is far away and can no longer serve as a model of modern global policy according to which talented workforce together with powerful technological and industrial base gives a new impulse to global competition. Surely the rise of the level of education of local work force is necessary both in the developing and emerging economies. The views of the World Bank and the Unesco are very similar. The mobility patters do not, however, follow the earlier models of the transfer of local work force. Some jobs are worth of transferring from the advanced countries to the developing countries, some are not.

Today China and India are listed as new rising economic powers almost interchangeably. Therefore, it is worth to pay attention to their differences: India has been able to develop high-

tech of its own while China rests more on technology transfer, China is a totalitarian country whereas India is a democracy, the Indians can speak English, but the Chinese cannot, Chinese university system is new, India has both public and private universities. Therefore a deeper comparative analysis of the elements of new global order in these countries is provided.

Japan's New Growth Strategy and its "Green" Innovation Policy

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Abstract

The world is now facing unprecedented global challenges needing for a wide range of systemic change in the ways we live relating to climate change, renewable energy, global health issues such as food and water security. The green growth strategy has called for the advanced economies in the world to respond to such grand challenges by reorganizing and redirecting public funding programs on large scale research, development and drafting innovation policies concentrating resources and efforts on specific missions targeting climate change and public health areas.

The recent spread of the green growth strategy among the leading economies prompted Japan to adopt its own growth strategy coined as "green innovation and life innovation." In 2009, the landslide victory of the DPJ in the lower house election led to the end of the era for the LDP who had led the government more or less continuously since 1955. The new government under the DPJ has initiated a series of structural reforms of the government organizations to pick up where the previous regime had left since the 1990s. However, the DPJ government, like the previous LDP, has initiated these reforms without paying much attention to the problems revealed among R&D communities in the last decade. In fact, the current government strongly pushed even harder these reforms before constructing their visions outlining the directions of Japanese R&D policy under the new leadership. Meanwhile, it has coined the economic stimulus package and the new growth strategy with "green" and "life" innovation. They even included a target in the growth strategy of R&D/GDP to be more than 4% by 2020 without the assurance of expanding government spending.

The importance of the reform of national labs or independent administrative agencies relating to R&D is how to restructure the R&D organizations so that they serve their missions and function well within the national innovation system. Since 1999, Japan's R&D related public organizations including national labs and funding agencies are going through a series of fundamental structural reforms without clear objectives and directions from the government. It is becoming more apparent that the gap exists between the government policies pursuing administrative reforms, on the one hand and "green" and "life" innovations, on the other, which is creating unprecedented confusion and division between the scientists and the policy-makers.

In addition, the new decision-making style of "Politicians lead not Bureaucrats" introduced the reform of the Council of Science and Technology Policy (CSTP) under the Cabinet Office which was established as a result of the administrative reform of the late 90s. Meanwhile, as the last effort before the reform, the CSTP has prioritized the 2011 Budget for R&D programs under two main themes, Green Innovation and Life Innovation with eight priority research areas.

The reform of R&D organizations is not the only challenge for the green growth strategy. The creation of effective demand for new green technology is also the essential factor for encouraging innovation in this area. The development of new green technology depends on the widespread adoption by individuals and firms of a diverse range of technologies. The public R&D programs should focus on long-term support for the development and improvement of relevant technologies rather than looking for a one-time technological breakthrough. Thus, the quintessence of green innovation policy is based on a demand-pull factor. Furthermore, public R&D investments must be complemented by and not be clouding out private investments. Thus, the real challenge is the development of process for identifying where and how public investments can complement and augment private sector investment.

In addition, government should structure their programs to support and encourage wide dissemination of the scientific and technological knowledge created by their R&D investments. Since the green growth operates in the global scope, one must consider its global nature of technology and institutional settings; but it also contains regional context as localized adaptation of these technologies are equally important.

The paper will reveal the fundamental problems associated with Japan's effort to restructure public R&D organizations in the last decade, which is the critical aspect of the "green" innovation policy. The paper will also examine the recent proposal by the Japanese government to create "East Asian Science and Innovation Area" to see whether the initiative actually helps to diffuse the knowledge adequately to catalyze the innovation in the region.

ICT and the Changing Face of Higher Education

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Abstract

Computers have been used in education since the late 1970s when they were primarily deployed for computational purposes, either for research work or for preparation of data concerning students and their examination results. However, the proliferation of World Wide Web and the Internet revolutionized the use of Information Communication Technology (ICT) in the field of education. During the last three decades, there has been an exponential growth in the quantum of new information and knowledge produced around the world. This has given rise to the need for effective knowledge management and its sharing among different communities in real time.

In recent times the demand for higher education has been continuously increasing. The quest for life-long learning, the need for equity and access to higher education by the marginalized and vulnerable groups, movement of students from one institution to another throughout the globe, internationalization of higher education, and the demand for quality education, have exerted further pressure on higher education. Such challenges can not be overcome unless the institutions of higher learning, imparting education using conventional methods, adopt new technologies for teaching and learning. Moreover, in the integration of ICT with education, there are issues of lack of quality curriculum, poor IT infrastructure, lack of qualified faculty with IT skills, fear towards adoption of new technologies, insufficient funds for ICT implementation etc., which need to be examined. This work tries to demonstrate how ICT can address and overcome the above-mentioned challenges, with the aim to transform the Information Society into a Knowledge Society.

In comparison to traditional classroom teaching, which is basically teacher-centric, the ICT offers a learner-centric environment where the role of a teacher is that of a facilitator - motivating, evaluating, and developing students, and making them useful for the society. Many leading universities and institutions, the world over, are now offering quality online courses using ICT, which are often free. Moreover, digital resources like e-books, e-journals, open educational resources (OERs), open source software, and other e-materials on a variety of subjects are now available on the web that can be easily accessed. The use of Web 2.0 in education has added new dimensions to collaborating learning. It includes Blogs, Podcasts, Wikis, Social Networking Sites (e.g. Facebook, Twitter, Linkedln), Bookmarks (e.g. del.icio.us) etc. which have provided additional forums where teachers and students can share knowledge with one another. Learning Management Systems (LMS), like Moodle, offer better learning environment through key functionalities, such as delivering contents to students and assess them through online quizzes and assignments. Through virtual labs and online laboratory experiments,

students can now perform sophisticated experiments which are not available in their own laboratories. In higher education research, ICT is very useful, linking researches globally and improving the quality of research.

At the end, a case study of a university is presented, where the implementation of ICT has been done right from the scratch. Issues related to establishing IT infrastructure and its maintenance, capacity building of the faculty and staff for developing IT skills, implementing Management Information System (MIS) in the university, application of MIS data for decision making by the administration, and introducing e-governance for efficient handling of various functions of the university are analyzed.

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NISCAIR–The CSIR's Scientific Information Resources for Science and Society

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Abstract

National Institute of Science Communication and Information Resources (NISCAIR), a constituent of CSIR, has been involved in dissemination of information through the publication of 19 scholarly journals of international repute, 3 popular science magazines (Science Reporter, *Science-ki-Duniya* and *Vigyan Pragati* in commonly known languages like English, Urdu and Hindi, respectively), books, training courses, various information services, etc. covering all the major disciplines of science and technology. NISCAIR, the erstwhile PID and NISCOM is in the service of the nation for the last more than 50 years. In the fraternity of CSIR laboratories, NISCAIR has a special, and a very important mandate- that of providing a platform to scientists and researchers for communicating scientific achievements for the development of science for society globally. Further to communicate scientific achievements and issues of topical concern and inculcate scientific approach in young and innovative minds, the next major jump in NISCAIR's services to science and society is the online open access availability of its scholarly research journals and magazines. NISCAIR is a proud nodal centre for implementing CSIR e-journals Consortium, a major network project of CSIR. NISCAIR's focus on assertive talent development through the Associateship in Information Science (AIS) programme continues to find favour with students of MBA, B. Tech, MCA, M. Sc, M. Lib, etc. National Science Library (NSL), NSDL, NUCSSI, Indian Patent Database, Bibliometric services, and RHMD are some other information products and services which this institute is providing to the science and society.

Since 1942 NISCAIR has been a custodian of The Wealth of India-an encyclopaedic publication on plants and animals biodiversity and mineral resources of India which is a ready reckoner on natural resources for researchers, entrepreneurs, students and policy planners. Concerted efforts are made to revise and supplement the information to keep it update. Accordingly, original 11 volumes are now available in total 23 volumes encompassing monographic articles on more than 6000 indigenous plant species, 50 on animals and 73 on minerals of economic importance.

SARRC documentation centre (SDC), set up in 1994 at NISCAIR is continuing its activities to fulfill its objectives to disseminate S&T information among SAARC member states.

NISCAIR is a recognized study centre for MCA, MLISc, and BLISc of IGNOU sponsored programmes. Graphic art and print production division is the backbone of NISCAIR which is supporting not only in-house but consultancy jobs received from many Government and private agencies. The division is maintaining its own printing press in the premises and doing single as well as four colour jobs. A detailed presentation for the purpose of interaction with participants will be given during the conclave.

Recent Technological Developments in Cleaner Production and Green Development for Control of Green House Gas Emission and Climate Change

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Abstract

The green house gas emission from degradable liquid and solid wastes contributes nearly 50% of the carbon emission on the climatic change. The domestic and industrial wastes from most of the developing countries in the world are generally collected without proper segregation and disposed in an organized way thus triggering to primary, secondary and tertiary environmental impacts. Highly degradable solid and liquid wastes generated mainly from agro based industries such as Agriculture wastes, abattoirs, distilleries, sugar mills, tanneries etc., have large potential for biomethanisation and energy generation which are currently wasted to a large extent. In addition the quantity of the degradable wastes gets reduced by 50% to 90% there is potential for control of green house gas emission and convert them into useful energy. The digested residual sludge becomes a bio- fertilizer.

Development, operation and maintenance of centralized waste management systems to tackle liquid and solid wastes generated from major urban towns is one of the difficult tasks due to technical, socio – economic and logistic constraints. Though part of the industrial waste and domestic sewage mainly from major towns are collected and treated in central treatment units, major part of the domestic and industrial wastes are yet to be tackled. This could be managed by developing appropriate cleaner production, green development and sustainable wastewater management. With a view to ensure environmentally compatible and sustainable development, demonstration projects have been implemented and disseminated under Clean Development Mechanism (CDM) in India and other countries. This paper deals with the "Recent developments in Cleaner production, Green development in waste management such as Bio energy and bio fertilizer generation, recovery and reuse of chemicals, water etc.

Backloading Natech Considerations into Technological Innovation and Application: An Urgent Call for Global Collaboration

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Abstract

Natech disasters are the second-order consequences of serious technological failures that originate from large scale natural events such as hurricanes, floods, earthquakes, and the like. This complex relationship is expressed in the term “Na” for natural and “tech” for technological. Such events often significantly threaten human life and environmental devastation. In addition, it is now evident that these types of disasters have, during the past several years, increased in number and severity. As Brunsma and Picou (2008) point out:

Sociologists are becoming increasingly aware of the changing nature of risk in late modernity and the shifting landscape of the sociological study of disasters. This increased "consciousness of catastrophe" is directly related to the empirical fact that the number of "natural" and "technological" disasters have increased substantially over the past 30 years. In the past eight years, some 422 disaster declarations have been issued in the United States alone – etching disasters as an important part of contemporary American experience). The number of people and communities affected by this most recent spate of catastrophic events reflects a global intensification of death and destruction that invites analytical and empirical application of a critical sociological imagination. While affecting society as a whole, these "focusing events," or "destabilizing events," have also had an impact on scholarly enterprises, shifting the attention of sociologists from more traditional areas of professional inquiry to the expansion and application of innovative concepts and methods to the study of disasters This paradigm shift means that disaster research is being actively re-imagined throughout the broader discipline.

During the past decade, a considerable body of research findings and theoretical analysis has been developed on the subject of natech disasters. Contributors to this work include engineers, environmental scientists, policy specialists and social scientists – literally, from all parts of the world. And, between 2003 and the present, several international conferences have been held on the subject. The advances in knowledge that has been accumulated from this work, along with the nature of these events themselves, suggest that the time has come to apply the lessons learned in a global policy context. The proposed presentation reviews the events and research conducted about them to make the case that a process akin to technology assessment (TA) and environmental/social impact analysis (E/SIA) should be incorporated into planning to innovate and/or apply technologies likely to be involved in natech disasters. This would involve careful study of the ways in which the technology might be compromised by likely natural hazards along with plans to mitigate or eliminate such outcomes – up to and including foregoing proposed innovations/applications. The term “backloading” is used to underscore the difference

between this approach and more traditional types of TA and E/SIA. Whereas in the latter case, the focus of research is on the potential impact of technological innovation on the environment and human activity, and/or application the emphasis in the "backloading" approach is on the impact of environmental (and possibly social) events *on technology*. Because of the substantial intermingling of naturl and technological factors, natech disasters are inherently global in scope, either directly (when global-level resources such as oceanic and atmospheric quality are involved) or indirectly (because higher-order impacts ultimately shift from the local to the global level. Moreover, so many elements are involved in natech disasters: physical, environmental, economic, and sociocultural, it is argued that it is imperative for these assessments to be undertaken by international, interdisciplinary teams.

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Sustainable Development and Carbon Dioxide Decomposition by Plasma Route to Combat Climate Change and Global Warming

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Abstract

We will define development and subsequently we will define sustainable development for clean and green environment in the present century. We will summarize some ways that the science and technology will play its role in the development of present century. Production of energy and per capita expenditure of power by any country are considered to be important components of development in the present century. However, the present methods adopted have affected our environment appreciably increasing the emission of carbon dioxide resulting in climate change and global warming. The approach suggested world over is sequestration of carbon dioxide in the deep sea which is extremely expensive. We have suggested the plasma route to decompose carbon dioxide into its constituents and recycle carbon. There are some previous attempts by plasma route on decomposition of carbon dioxide but there is partial decomposition of carbon dioxide resulting into carbon monoxide which is highly poisonous. We will summarize some of these earlier attempts. We propose a scheme which uses an array of high voltage electrode system and give some details of our approach to bring back the balance of carbon dioxide in the environment.

Building infrastructures to better ensure ethical science policy

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Abstract

What future do we want? How can we reach that. The societal and policy infrastructures to guide the development of wise and ethical science need to be carefully constructed to utilize the creativity of humankind expressed in the scientific endeavour. The pursuit of a good life is a goal that all persons can hope for. We can consider the four imperatives of love for ethical science, as self-love, love of others, loving life and loving good. Love is not only a universally recognised goal of ethical action, but is also the foundation of normative principles of ethics. The love of of good, beneficence, is the foundation of the public enterprise of scientific research. Global responsibilities for promotion of good for all (not only humankind) is necessary for our sustainable future.

Modern technology has been a catalyst to reawaken social interest in ethics, but do we need a new ethics to cope with the challenges of modernity and globalization? The underlying heritage of ethics can be seen in all cultures, religions, and in ancient writings from around the world. Ethics is learning how to balance different benefits, risks and duties. In recent decades renewed impetus has been given to ethics through its application to consider the challenges of new technologies in life sciences and medicine. Bioethics includes ethical issues related to all branches of knowledge, including the environment, life sciences, and medicine and associated technologies. Concepts of bioethics can be seen in literature, art, music, culture, philosophy, and religion, throughout history. Their integration into policy making has been expressed in various mechanisms.

Moral dilemmas are faced in a range of professions. Critical thinking capacity is essential for empowering persons to cope with changing times. Participation can promote the creation of ideas and individuality, which we all need in the era of globalization. Sound policy and policy review is also essential for sustainable science policy and use of the results of science. Despite the unanimous acceptance of international declarations relating to ethics of genomics and human rights in UNESCO, and related international instruments by other UN agencies, there are gaps in the implementation of these standards into national laws and guidelines in many countries. This paper will discuss the situation relating to implementation of ethical standards in science, and the accompanying debates, in particular in the Asia and Pacific region. Strategies to better implement these standards will be compared, along with identification of the gaps between needs of different sectors of the communities in countries at a range of different socio-economic levels.

A Model for Transforming the Research Outcome of Science and Technology to Commercial Applications

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Abstract

The prime objective of this paper is to develop a strategy planning model for transforming and linking the S&T (science and technology) research outcome (accrued from research institutes) to potential industrial uses/commercial applications in the industrial sector. During last several decades, research-based development of S&T and government action in ensuring or strengthening methods of transferring technology from research institute over to commercial application in the industrial sector gradually began to receive more emphasis, but appropriate methodology has yet been developed to these issues. Especially with respect to factors such as technology characteristics and the commercial production capabilities of the industrial sector, discussions of problems such as how research institutes are to develop a particular technology and transfer its results to industry so that commercial applications may be found for the technology have yet to appear in the literature. Once a technology is selected for development, applied research institutes develop the chosen technology. The next issue is how the research institute is to transfer the results of its S&T research over to the industrial sector so that the commercial applications for the technology become possible and successful.

The strategic model is intended to be applied to the development of an industry. First, an industry is identified for strategic development by the public or private sector; next, public or private sector-sponsored research institutes develop generic technology for that industry; finally, the institutes transfer the technology to the industrial sector. The planning process in the development of an industry is more a matter of subjective judgment than of conforming to concrete principles. The planning procedure is as follows: a transfer mechanism is formulated, an industry situation within the transfer mechanism is identified, and a viable strategy is formulated from analysis of the industry situation. In identifying industry situations, this paper includes factors such as: research institute R&D, the risks involved in transferring R&D-stage technology to the commercial production stage, and the commercial production capabilities of the industrial sector. In some situations technology transfers are more likely to occur; in these cases, research institutes can adopt transfer strategies, such as joint research projects, technology dissemination, and spinning-off new businesses, to allow technology to meet with commercial application. In other situation, where technology transfers do not occur easily, research institutes can find ways of using government-supported research and development projects to implement development strategies, such as technology development or establishing pilot plants, to stimulate this type of situation to evolve into one where transfers may occur easily. Thus through the use of transfer and development strategies, research institutes can succeed in linking technology to commercial

applications. In this way, technology developed by research institutes may be incorporated into the industrial sector under circumstances where the characteristics of the technology and the commercial production capabilities of industry are already fixed. A case study of the Technology Research Institute's (ITRI's) discovery of Jute's 'Genome Sequencing' or Gene Code in Bangladesh 2010 (applied to WIPO for patent right): is used to confirm the feasibility of the transfer mechanism formulated in the paper. 42 scientists of Bangladesh worked in this joint venture research project for 4 years.

This paper incorporates formulating a transfer mechanisms for linking the technological R&D of research institutes to commercial applications in the industrial sector, and then, within this transfer mechanism, identifying the situation of an industry. Secondly, using the results of the situation analysis, the transfer strategies and development strategies are discussed that may be adopted by a research institute. Finally, to describe a case study of S&T research in Bangladesh pertaining to discovery of Jute's 'Genome Sequencing'. This case study is used to confirm the feasibility of transfer mechanism formulated in the paper.

Keywords: technology transfer; technology development; discovery of Jute's 'Genome Sequencing' in Bangladesh; situation analysis; spin-off companies; BUET Technology Research Institute, Dhaka.

Biocatalytic Synthesis of Polymeric Materials for Drug & Gene Delivery Applications

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Abstract

The importance of polymers in medical applications has been well recognized. They are most widely used as pharmaceutical carriers in drug delivery, and a considerable amount of research has been directed toward the use of natural and synthetic polymers as polymeric drugs and drug delivery systems.

Taking the above advantages of drug delivery system into consideration, we have developed a chemo-enzymatic methodology for the synthesis of functionalized amphiphilic polymers based on glycerol, polyethylene glycol (PEG), and alkyl / aryl moieties that aggregate in aqueous medium to form nanospheres. We used poly(ethylene glycol)s, PEGs, because they are known to be biocompatible, nontoxic and, water-soluble. Glycerol on the other hand is one of the most versatile and valuable chemical substances and is utilized in a variety of commercial products with no known adverse pharmacological or environmental effects. Moreover, it exhibits good chemical stability and inertness under biological conditions. One of the unique properties of these amphiphilic polymers is their ability to self-assemble in specific solvents forming micelles, thus enabling them to encapsulate small molecules. We have studied the molecular encapsulation of small hydrophobic drugs using these polymeric materials. The recent interesting results would be discussed in the Seminar.

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Information & Communication Technology (ICT) for education in Afghanistan

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Abstract

The development in science and technology has revolutionised the world during the last few decades and most people around the world have benefited from such development, as their quality of life has significantly improved because of such development.
The innovation in science and technology has drastically improved the following sectors:

- Agriculture
- Industry
- Mining
- Transportation
- Telecommunication
- Commerce
- IT

The above sectors and others have directly affected the quality of life of people around the world. However, because of decades of wars and instabilities, the people of war torn countries such as Afghanistan have not fully benefited from such a revolution.
The objective of this paper is to explore possible ways to accelerate the applications of best science, engineering and technology practices that will increase the chances for further development in war torn countries such as Afghanistan, with the main aim to improve the quality of the lives of those who live in such countries. One of the major factors in order to achieve such an objective will be to improve the quality of education in subjects related to science, engineering and technology, as qualified and experienced workforce will drastically improve the chances of success in such countries.

The education institutions in Afghanistan have been devastated because of decades of wars, neglect and instability. Improving the education system, especially in subjects related to science and technology at school and university levels, is crucial for future development in the country. Limited progress has been achieved during the last seven years. For instance, the number of students has increased; some new institutions have been established and effort has been made to upgrade the experience and qualifications of existing academics in such institutions. However, the overall quality of higher education is still significantly lacking. This paper will investigate the integration of the best possible technological practices and tools that will accelerate the improvement of education in Afghanistan, as improving the education sector is vital for the development and stability in the country.

Advances in physics, electronics, and high-speed communications and transportation had a huge impact on the world during the twentieth century; however, information and communication technology (ICT), beside nano and bio technologies, are the main challenges for the twenty first century [1]. ICT is one of the prime technologies that have significantly affected

the world during the last two decades, as normal life may be impossible without ICT tools in some more developed countries. This paper will also discuss the application of ICT tools at the educational institutions in the developed world and will present an assessment of the present situation of educational institutions in Afghanistan. Based on international experience, recommendations will be made to the Afghan government and the international community to incorporate ICT within the education systems and hence to improve the infrastructure of educational institutions in Afghanistan [2] – [3]. Further recommendations will be made to improve the basic science, engineering and technology education, which could lead the Afghan people to the establishment of a prosperous and dynamic society that has been lacking for decades.

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Geospatial Science & Technology Policy of India in Global Context*

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Abstract

Geo-spatial Science & technology policy in India is evolving in phases and still in process of emergence. Though Science & Technology System in India includes various departments & ministries like (i) Department of Science & Technology; (ii) Department of Space; (iii) Department of Atomic Energy; (iv) Department of Biotechnology; (v) Department of Scientific & Industrial Research and (vi) Ministry of Earth Sciences, etc. , however, first two are the major players in relation to geospatial S&T. After Independence, the main science & technology policy instruments developed and adopted in India includes Scientific Policy Resolution (1958), Technology Policy Statement (1983) and Science & Technology Policy (2003). However, first time in 1991, measurers to make available geo-spatial data to users was elaborated in the Information Technology (IT) Policy and later on in 2005, a historic decision was taken by Indian government by announcing & adopting a full-fledged policy called, ''New National Map Policy (NNMP)' which had the potential to open a new door of opportunities for various sectors ranging from water management to development planning and infrastructure.

The NNMP (2005) was evolved by the Ministry of S & T, GOI, realising that global technological upheavals have rendered many features of the existing Map Policy of India redundant. The new policy envisages separating the sensitive, security-related maps from the ones which can be accessed, used and even modified by the public. Hence come out with two series of maps- (i) the Defence Series Maps (DSMs), for exclusive use for defence forces and authorized govt. departments, and (ii) the Open Series Maps (OSMs), for public use, which however have a different datum, projection, content and sheet numbers and derived from the National Digital Topographical Database (NDTB) of SOI. For their dissemination, in digital or analogue form, SOI may enter into an agreement with any agency for specific end users for developmental planning, infrastructure and research community, etc. In addition, the user agency can also make value addition to these maps and under SOI initiations, can share the information. All serial photographs after masking of Vulnerable Areas/ Points will be freely available for processing and project generation. Private agencies will also be permitted to carry out surveys in all parts of the country using Public Domain Datum. In this way, continuance of this policy tends to impede free flow of spatial information and engenders high opportunity costs for a developing economy like India.

Globalisation has led to the development of ontology of geo-spatial S&T, particularly in the fundamental ideas, geospatial data acquisition, visualization, storage, analysis, development of scenarios, modelling, DSS and dissemination, etc. Development in other science discipline includes spatial cognition, databases, statistics, data mining, computational geometry, vision, robotics & graphics, etc All these in fact intensified relations between different parts of the globe and also have highlighted the need for understanding and managing phenomena at a various levels. The availability of technologies & facilities like internet has powered to capture increasing quantities of information & communicating the same effectively over vast distances across land, sea, air and space globally. Consequently, in the past few

decades, an increasingly wide range of geo-technology tools, geospatial data and geospatial services have become available to a widening body of users including defence, civil governments, non-governmental organisations and multinational enterprises. Now a day, in fact, use of geospatial technology becomes mainstream, thus mandatory in most of the decision support systems.

Thus a dynamic policy framework for geospatial science & technologies is needed to be devised and adopted by all the nations, small or big, developed or developing, as per their requirements. Its role in a few specific areas like national security, counter terrorism, counter insurgency, disaster management, natural resource management, etc .made it more relevant & necessary for all the counties and regions. Policies which talk about a network-centric approach utilizing state-of-the-art of such technologies and also encourage open standards that apply to both the data exchange protocols and the data formats, etc. may be of much use in this context. Most revolutionary development happened in this field is, existence of the Open Geospatial Consortium (OGC), which came to existence in 1994 under the Chairmanship of David Schell. Schell as founding Chairman of the Board of Directors remains as one of the geospatial S&T leader & garnered both public and private sector support for "OpenGIS®" into a global standard and for interoperable geo-processing. In India, Dr. (Brig.) R. Siva Kumar is the CEO of National Spatial Data Infrastructure (NSDI) and also Head of the Natural Resources Data Management Systems (NRDMS), a division of DST that are spearheading NSDI development in India. In his role as Member Secretary of the Task Force on NSDI he bore primary responsibility for launching the NSDI movement in India.

The present paper discusses systematic account of the various developments and evolution process of Geospatial Science & Technology Policy of India. It also discusses the dissemination of Geospatial Technologies in a range of disciplines including studying their impact on the society.

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A Framework for the current state of understanding of Technology Entrepreneurship Capability

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Abstract

Technology entrepreneurship, a relatively new term is receiving increasing recognition from the scholars of various streams of business and science and technology disciplines, as well as from the industry players and business men. Technology entrepreneurship is indeed becoming vital in the current globalization and liberalization economy as it provides greater opportunities and enables effective optimization of resources to attain high profit margins. This paper presents theoretical framework for understanding technology entrepreneurship capability using Shane and Venkataraman (2003) definition of technology entrepreneurship and an improvised innovation capability audit tool as introduced by Bessant et al. (2000) and promoted by the World Bank. The improvised technology entrepreneurship capability framework is analysed through the lens of entrepreneurship and innovation, specifically according to eight key dimensions of technology entrepreneurship identified from the four technology entrepreneurship factors: awareness and search from the context factor; strategy and core competency from the firm factor; technology paradigm and linkages from the technology factor; and learning and leadership from the entrepreneur factor. This study believes that the proposed framework adds to the existing literature of entrepreneurship and innovation.

Keywords: Entrepreneurship, Technology, Innovation, Technology Entrepreneurship, Technology Entrepreneurship Capability

1. Introduction

Technology entrepreneurship is basically the merge of two words from two disciplines: technology from the innovation discipline and entrepreneurship from the business discipline. Technology entrepreneurship is thus understood in this study as the integration of technological and entrepreneurial realms. Technology entrepreneur then is described as individual who carries out entrepreneurial activities that are technology oriented. Hence, technology entrepreneurship capability is referred to the capabilities of a technology entrepreneur, specifically the knowledge and skills required by the entrepreneur to carry out technology based entrepreneurial activities successfully.

Having defined the relevant terms, this paper continues with a discussion on the different fields of study involved, or in another words, the two inter-related disciplines, namely entrepreneurship and innovation. A review on the pertinent literature covering the major issues emanating from the innovation discussion, notably technology and technology capability are presented. Consequently, the fourth part presents the framework for the emerging field of

technology entrepreneurship capability, followed by a brief summary in the final part of the paper.

2. Literature Review

This section provides a review of relevant literature that is pertinent to this study; the main themes include entrepreneurship and innovation.

2.1 Entrepreneurship

An enormous collection of literature exists in the field of entrepreneurship; it has been dealt with extensively by numerous scholars from various disciplines such as sociology, psychology, and economics. On the relation to personality traits, behavior, social and environmental influences, Weber (1930) is among the early authors who have discussed entrepreneurship in terms of behavior where a value system is regarded as essential to an entrepreneur's behavior.

McClelland (1961; 1971) explored psychology to explain an individual's need for achievement as the motivational factor that led entrepreneurs to perform better. Chandler and Redlick (1961) recognized skills and motivation as factors towards achieving entrepreneurial success. According to Johnson (2001) entrepreneurial behavior also refers to openness to new information and people, motivation, and making independent and self-directed decisions. A study by Filion (1997) associated entrepreneurs with environment; for instance, entrepreneurs are regarded as a reflection of the characteristics of a period and place that they are accommodated (McGuire, 1964, 1976; Toulouse, 1979; Newman, 1981; Gibb and Ritchie, 1981; Ellis, 1983; Filion, 1991; Julien and Marchesnay, 1996).

From the standpoint of economics, there are a number of authors who associate entrepreneurship with innovation. The pioneers in this field such as Cantillon (1755) and Say (1803) viewed entrepreneurship as a risk-taking activity. Subsequently, Schumpeter (1928) introduced a new notion to the field of entrepreneurship, namely "innovation". He viewed entrepreneurship as a dynamic process of creative destruction, in which he put forward the idea of innovation that changes the basic technological and demand parameters of the economy (Schumpeter, 1943).

2.2 Innovation

Innovation is defined by Schumpeter (1950) as the creation, development and introduction of new products, processes, systems and organizational forms. Schumpeter (1939) treats innovation activity as an internal factor in economic change. His theory of economic change on the role of innovation and the entrepreneur was outlined in the 'Theory of Economic Development (Schumpeter, 1934)'.

In this book, Schumpeter (1934) identified five ways of revolutionizing the pattern of production, that is, the introduction of a new product to the consumers, the introduction of a new production method, the exploitation of a new market, the utilization of a new source of supply of raw materials or partly manufactured goods, and the implementation of a new way of organization.

Thus, in undertaking an innovative endeavor, a great deal of information is needed on a variety of subjects such as the market situation, new technological developments, sources of technical assistance, government promotional measures, etc. (Rothwell and Zegveld, 1982). Among these various subjects, technology is regarded as one of the crucial components in an

innovation activity; technology has often been perceived as a function of innovation in creating new things and in matching it with market needs. Indeed, the focus on technology as a significant factor in Schumpeter's notion of innovation is also emphasized by other scholars (Freeman, 1998). Freeman recognized that innovation is developed from technology and an outcome of new scientific results.

2.2.1 Technology

Technology is defined as the ability to carry out productive transformation, and includes the ability to act, and a competence to perform; technology transforms materials, energy and information from one state to another value-added state (Metcalfe, 1995). Twiss and Goodridge (1989) viewed technology as a powerful resource in gaining competitive advantage. Schumpeter's theory of economic development reflects that technology is driven by entrepreneurs, and it is the entrepreneur who plays a major role in creating inventions through the appropriate implementation of technology (Schumpeter, 1912).

In addition, Dopfer (1992) defined technology as an engine of growth, and its application is seen in the branch of Neo-Schumpeterian research like Technological Paradigm (Dosi, 1988), "focusing devices" (Rosenberg, 1976), "Technological Trajectory" (Nelson and Winter, 1977), and others.

Technology has been considered as knowledge, as skills and as artifacts by Layton (1974). In this respect, technology is deemed to have its own specific framework of concepts, ideas and relationships within which it develops over time, and that this framework is reflected in a division of innovative expertise between the various institutions which support that technology (Constant, 1980; Laudan, 1984; Vincenti, 1990).

These studies clearly show that technology carries a comprehensive definition which is understood as 'a body of knowledge, tool and techniques, derived from both science and practical experience that is used in the development, design, production and application of products, processes, systems, and services' (Abetti, 1989). For the purpose of this study, technology is essentially viewed as the tool that enables the entrepreneurial activities to be carried out effectively.

2.2.2 Technology Capability

As technology has become increasingly important in this era of globalization, the concern then is on acquiring technological capability to achieve competitiveness. UNIDO (1986) looked at technological capability as the ability to train manpower, ability to carry out basic research, ability for testing basic facilities, ability to acquire and adapt technologies, and ability to provide information support and networking. The World Bank (1985) has categorized technological capability into three independent capabilities: production capability which consists of production management, production engineering, maintenance of capital equipment, and marketing of produced output; investment capability which consists of project management, project engineering, procurement capabilities, and manpower training; and innovation capability which creates and carries new technical possibilities for profit-making purpose.

Besides the definitions above, there is another study that categorized technological capability into six major areas: production capability, investment capability, minor change capability, marketing capability, linkage capability and major change capability (Ernst *et al.*, 1998). Lall (1990) defined technological capability as the required human skills such as

entrepreneurial, managerial and technical to set up and operate industries efficiently; there are two levels of technological capabilities identified: firm and national.

At firm level, Lall (1990) noted the requirement for three types of capabilities; namely entrepreneurial, managerial and technological capabilities. In terms of technological capabilities, he identified three elements: investment, production and linkages. Investment capabilities involve the skills required to utilize the invested resources effectively; production capabilities include all the necessary skills required to carry out the product, process and industrial engineering activities; and linkages capabilities is the skills necessary for transferring knowledge and technology infrastructure. Meanwhile, at national level, Lall (1990) referred to the incentives provided, supply of skills, and efforts to master, adapt and improve technologies, and institutions to support market functions.

Thus, it is hoped that the elucidation of various definitions and different classifications of technological capabilities as presented above provide valuable insights into the major theme of this study, and simultaneously pave the way for a better understanding of the significant terms applied in this study, namely technology entrepreneurship and technology entrepreneurship capability.

3. Methodology

In drawing the technology entrepreneurship capability framework, the Shane and Venkataraman definition of technology entrepreneurship and the World Bank framework was applied to this study. The framework introduced by Bessant *et al*. (2000) was improvised according to the research context in order to meet the objectives of this study. Eight key technology entrepreneurship activities were identified based on the four constituencies of technology entrepreneurship as highlighted by Shane and Venkataraman (2003) in their special issue on technology entrepreneurship, which includes industry, firm, technology and entrepreneur. However, the term 'industry' is replaced with 'context' as it is regarded more suitable in this study.

The 8 key dimensions of technology entrepreneurship are: awareness, search, strategy, core competency, technology paradigm, linkages, learning, and leadership. 'Awareness' is referred to the ability to recognize pertinent environmental changes, and the need to improve; 'search' is the ability to explore for opportunities and threat; strategy is the plan of action to achieve the envisioned goals that are significant for the economic growth of the firm; core competency is the economic strength of the firm that needs to be identified and built upon; technology paradigm is the ability to understand the existing platform of technology; linkages is any form of collaborative effort established by the firm; learning is the firm's effort to encourage acquisition of codified and tacit knowledge on continuous basis; and finally leadership is the ability of the entrepreneur to lead his firm to achieve competitive advantage and sustain it.

4. Technology Entrepreneurship Capability

This study is among the few studies to discuss the emerging discipline, notably the issue of technology entrepreneurship capability. Technology entrepreneurship capability is simply understood as the capabilities of the four factors of technology entrepreneurship that are: entrepreneur, firm, technology and context.

As in conventional entrepreneurship literature, the entrepreneur is of concern in this study as the person who navigates the direction of the firm. He should be equipped with adequate knowledge and apply it in his entrepreneurial endeavor. The entrepreneur should also have the

capability to implement the knowledge possessed appropriately, for instance, in problem-solving activity. The entrepreneur has to be agile which means that he should act quickly and smartly.

The generic term 'firm' is used in this research as applied in the Oslo Manual guidelines. Accordingly, "a firm can make many types of changes in its methods of work, its use of factors of production and its types of output which improve its productivity and, or commercial performance"(OECD, 2005). The firm factor includes all the firm's functions such as management, finance, and human resource. These functions need to be managed effectively for the success of the firm. As such, the entrepreneur should have the capability to develop strategies that can bind the firm's functions effectively so as to sustain high growth performance.

Technology is part of environment as suggested by Porter (1990) but in this study technology is regarded as an independent factor due to its significance in the technology entrepreneurship term. Furthermore, in the discussion on technology entrepreneurship termed by Shane and Venkataraman (2003), the technology element has been discussed extensively and not inclusively in the environment factor. This is basically due to its significance in innovation and related activities, which constitutes the driving force towards achieving sustainable competitive advantage. Therefore, it is essential for the entrepreneur to have the capability of applying the technology to exploit opportunities effectively in his industrial environment.

The context factor is of concern in order to know the industrial environment in which the entrepreneurial activity is carried out. Usually, environment that is conducive leads to the success of the firm; so, it is essential for the entrepreneur to have the ability to understand the industrial environment, and the changes that are taking place in order to take actions deemed appropriate. The four technology entrepreneurship factors: entrepreneur, firm, technology and context are inter-related and they complement each other.

Technology entrepreneurship capability is thus referred to the variety of capabilities that a technology entrepreneur requires to create competitive advantage, and to sustain firm performance that includes the capabilities to recognize environmental changes and market trend; continuously search for opportunities; effectively structure strategies; develop core competencies; establish strategic linkages; understands the technology paradigm of the industry; possess codified and tacit knowledge of particular technologies; and practice leadership quality to affect favorably and effectively the operation and management functions of a firm for sustainable performance motivation.

4. Conclusion

Technology entrepreneurship is a relatively new field of study; as such, there is relatively limited literature in this discipline, notably in Malaysia. Therefore, this study has made an attempt to explore this emerging topic to add to the limited literature in this relatively unexplored field of study. To facilitate a better understanding of this new discipline, relevant terms such as entrepreneurship, innovation and technology have been defined prior to explaining the main term in this study, technology entrepreneurship.

In traditional literature on entrepreneurship, the emphasis is on the entrepreneur, including his personality traits, behavior, and social and environmental influences, or rather the concentration of entrepreneurship literature then was 'person-centric'. It was Schumpeter (1928), who introduced a new idea in the entrepreneurship discipline, which is innovation. He added a new attribute to the term 'entrepreneur', and was able to change the basic parameters of entrepreneurship. Schumpeter's entrepreneur is one who has technical knowledge and is held responsible for applying it; the entrepreneur is not merely an inventor but one who is responsible

for bringing the innovation to the market to achieve competitive advantage. Following his notion, this study defines technology entrepreneur as one who has the capability to acquire knowledge and entrepreneurial skill and apply them for a firm's sustainable performance. Hence, technology entrepreneurship capability includes the capabilities of not only the entrepreneur, but also the firm, technology and context.

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Importance of Ambidexterity in Science & Technology Policy

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Abstract

In India, science and technology (S&T) have been accorded high importance over the years. Pioneering efforts have resulted in great scientific and technological advances of the highest international caliber. Policies for furthering the growth of S&T have been tuned over the years to meet the changing needs of the nation. The early policy resolutions emphasized self-reliance for sustainable and equitable development, resulting in a sound infrastructural base for S&T. With the changes brought about by globalization and the ensuing competitive environment, the current policy strives to ensure that S&T efforts have a beneficial impact on the lives of people, apart from enhancing the nation's global competitive capabilities. In recent times, sustained initiatives taken by several agencies have resulted in our country being well recognized for its competence in advanced areas of S&T. With the current emphasis on inclusive growth, the importance of generating ambidextrous solutions that can resolve the twin concerns of global competitiveness and enhanced reach of S&T benefits across the society has become more apparent. This paper attempts to identify major challenges involved in balancing these opposing needs and suggest some suitable policy interventions.

Keywords: S&T policy, Ambidexterity, policy interventions.

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Science and Technology in Afghanistan

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Abstract

Modern education (western style) started in Afghanistan with the establishment of the first secondary school in Kabul in 1903. The Faculty of Medicine was set up in 1932. The Afghan education developed significantly in the 1950s, 1960s and 1970s. Unfortunately, Afghanistan experienced serious conflicts during the last two decades of the twentieth century, which had a devastating effect on Afghan society, and its social and economic infrastructure, including education. At the end of the twentieth century, with an estimated population of 28 million, about 50 % of school age boys and only 5 % of girls were attending primary education. In 1995, there were a total of 10,700 students in institutions of higher education in Afghanistan.

Since 2002 efforts have been made to rehabilitate the education system. School education has been expanded significantly for boys and girls. The Ministry of Higher Education initiated a comprehensive programme of staff development, reconstruction of buildings and provision of laboratories, libraries, new technology etc. In 2003, 92 Faculties provided higher education in Afghanistan. Out of a total enrolment of 31,200 university students including 5963 female students, 14,973 male and 2,053 female students were enrolled in 43 scientific and technological faculties. A further 2,981 students including 594 female students were enrolled in 5 faculties of economics and 7 faculties of social sciences.

The new Constitution of Afghanistan, which was adopted in 2004, stipulates that nine years of basic education will be compulsory for all Afghan children between the ages of six and fifteen years old. Secondary, technical and vocational and higher education will also be expanded. Education in State schools and institutions will be free up to university level. The new Constitution also provides for the establishment of private universities and colleges of higher education. In 2009, 5000 students (8 % of higher education) were enrolled in private universities.

National Development Strategy

The Government of Afghanistan adopted a National Development Strategy in 2006, which focuses on security, governance, economic growth and poverty reduction. The priority sectors for economic development are: agriculture, labour-intensive manufacturing, telecommunication, transport, construction materials, mining, power and water. The government's goal, in the education sector, is to significantly improve the quality of, and promote equitable access to, education, skills development and other social services in order to re- invigorate Afghanistan's human capital, reduce poverty and facilitate economic growth.

In 2009 about 7 million children (37 % girls) were enrolled in schools. It is expected that 100,000 students will graduate from secondary schools. A total of 61790 students including

12957 female students were enrolled in 14 universities and 8 higher education institutes in Afghanistan. The updated education plan set the following targets for 2015: The enrolment in general education to 10 million pupils (achievement of universal compulsory education); enrolment in TVET to 150,000 students; enrolment in higher education to 135,000 including 15,000 students in private universities.

In view of the importance of science and technology for sustainable development, and the involvement of a number of ministries and government agencies as well as the private sector, studies were carried for a national mechanism to undertake policy formulation and elaboration of a strategic plan for capacity building in science and technology. The priorities for application of science and technology for development of Afghanistan will include the following:

- Science and technology for economic growth (agriculture, natural resources, industry and services);
- Contribution of science and technology to education, health and employment;
- Application of science and technology for environmental protection;
- Science and technology for promotion of culture and communication (daily living, leisure, media, popularization and public understanding of science).

Scientific Training and Research: Challenges

Faculty development – The majority of the faculty members in higher education do not possess advanced academic degrees which affect the quality of higher education and limits the development of graduate programme and research.

Modernization and efficiency - Efforts are made to modernize the curriculum and improve physical facilities including laboratories, workshops and libraries. There is a need for much greater resources and investment in science and technology, as well as increased interaction between university institutions, industry and the private sector.

Research and development – The university institutions and faculty members need to be encouraged to carry out research and development activities. Capability for research and development should be built in all relevant government departments and agencies as well as in the private sector. The professional associations such as the Association of Engineers, and the Association of Natural Science and Mathematics Educators should be supported to promote research activities.

National Infrastructure – Afghanistan needs a national mechanism for science and technology policy to coordinate and formulate appropriate policies and strategies for application of science and technology in social and economic development of the country.

International Cooperation – The ministries cooperate with a number of countries and international organizations for training and developmental programmes and projects. The reinforcement of international and regional cooperation, such as the Science Policy Forum of South Asia and South East Asia, will contribute to development of science and technology in Afghanistan.

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Lessons from the age of the post-war economic miracle in Japan

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Abstract

The Japanese post-war economic miracle started from 1955 and ended at 1991. In this period Japanese people enjoyed the marvelous economic growth of more than 9% on an average until the oil crisis of 1973, and thereafter lived in prosperity in the stable growth rate (4.2% on an average) until 1991.

But the Plaza Accord of G5 in 1985 chimed coming up to the end of economic miracle. The U.S. dollar depreciated sharply especially in relation to the Japanese yen by this agreement. The yen increased rapidly double from 1985 to 1987. Japan worried about the high yen recession changed the economic policy decisively from the export-led growth into the expansion of domestic demand. The Japanese government focused especially on the building of houses and the development for resorts in the local regions across the country. The real estate prices rose sharply by this stimulating policy as well as the low interest rate policy. The stock market showed extremely active. But on the other hand the consumer prices were stable due to the high yen. In this situation almost all Japanese people were so satisfied that they felt be in the middle-class. On the other hand U.S. export to Japan was not successful in spite of the dollar steep depreciation. But the Japanese economy collapsed unexpectedly in 1991, at the end of the cold war age.

Now let us look back on the factors of the Japanese post-war economic miracle.

(1) In terms of capital the saving consciousness of Japanese people was extremely strong and important. Japan enjoyed the long-term economic prosperity by this concept of national wealth.
(2) Labor forces were provided within Japan.
(3) As for technology, at first Japan learned much from USA and caught up and overtook US later.
(4) The domestic market of Japan was expanding rapidly as well as US gave immense market for the Japanese products.
(5) In terms of foreign exchange Japan utilized perfectly the fixed exchange rate regime till 1971 and overcame the difficulties of increasing yen rate by the rationalization of management and technological efficiency at the floating exchange rate regime.

Since bubble burst, Japanese economy is facing the long-term distress. Various and sophisticated factors should be considered to clarify the causes, but in the long run I think the shrinking local economy has one of the decisive difficulties for the Japanese economy, namely for the labor supply as well as the domestic market. In Japan the working forces were provided within the country to drive the rapid economic growth, while west Germany relied on the guest-workers (mainly Turkeys) to make up for shortage of labors since 1960's.

Tokyo, and Osaka were the main demand places for young and active people who came from the rural areas and fishing villages. There were the huge reservoirs of labor forces. They had many good merits guest-workers did not possess.

(1) There were scarcely the cultural conflicts on the job due to the same language and the racially homogeneous nation.
(2) They often identified the growth of company as theirs.
(3) As the prosperity of company was capable of raising wages, workers felt be in the middle-class and the domestic markets were expanding more and more.

What kind of policy did the Japanese government adopt for these very important reservoirs of labor forces?

(1) The government considered the rice embargo and rising rice price as the no.1 agricultural policy and guaranteed the rice farmers as much as the average wage of urban laborers.
(2) The government supported modernization of the rural community by the completing of infrastructure and farm mechanization.

But these protective policies were not successful. The population of rural communities is rapidly less and aging, therefore these communities can hardly supply enough young laborers. Japan has stepped into the age of population onus. Moreover Japan can not adopt the former protective policies since the collapse of bubble economy, because Japan has financially no room to assign to the rural districts as well as the worldwide competing market economy and the rapid growth of the emerging countries do not allow Japan to take the protective measures in the post cold war age. Thus the Japanese labor policy and agricultural policy come to a deadlock.
Japanese economy is now facing what to sacrifice for surviving.

Institutional Prerequisites of Innovative, Technological and Structural Dynamics (Russian case).

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Abstract

Keywords: *innovation, institutions, economic growth, forecast, social market economy.*

The economic crisis has uncovered three negative Russian tendencies that created institutional obstacles for market economy growth during the last decade: deepening of raw materials specialization, wear and tear of the equipment, gap in scientific and technical progress, and strengthening of the government. To stop these negative tendencies and overcome economic crisis it is necessary to reform developed institutes.

The major problem of the Russian economy is its low performance level. Overcoming development gap in comparison with developed countries will become possible only with the help of innovations. This means that process of generating and using Schumpeterian-type innovations should become the key factor of economic development. It is necessary to note that innovative activity of businessmen can be present in various forms. Depending on existing game rules business activity can get not only productive (J. A. Schumpeter's creative destruction), but also unproductive (rent seeking) orientation.

The "Concept 2020" analyses the global challenges which Russia faces in its development that amplify high level of social inequality and regional differentiation, preservation of barriers to conducting enterprise activity, weak interrelation of education, science and business, absence of necessary competition in various markets and low level of social capital development. Under these conditions, as A. Gerschenkron wrote, the government becomes the leading factor of economic modernization, and it is its representatives that try to shape the concept of long-term socio-economic development of the country.

It is supposed that gross national product growth will be provided, mainly, by means of priority development of labour productivity and large capital assets investments. Our calculations show they considerably advance growth of productivity and gross national product, and that will lead to increase in a capital intensity of production and falling yield on capital investment. The arising gap between export and import, according to authors of the Concept, will be covered by the accruing inflow of foreign capital.

However the main drawback is the mechanism of maintaining economic growth. Defining concrete aims of development is an important, but an insufficient condition. The institutional mechanism of private sector development stimulation is not developed at all.

Meanwhile, sharp increase of expenses on social sphere will raise the question about budget spending. It can be reached either by increase in taxes or by public sector expansion.

In the report it is critically considered not only the official point of view, but also Porter M., Ketels K. "Competitiveness at the Crossroads: Choosing the Future Direction of the Russian Economy", «The forecast of innovative, technological and structural dynamics of Russian economy till 2030», and RAND Corporation report "The Global Technology Revolution 2020: Trends, Drivers, Barriers, and Social Implications" devoted to tendencies of development of 16 technologies in 29 countries and other forecasts.

In this paper we analyze institutional preconditions and possibilities of application of the concept of social market economy in the 21st century Russia. Basic elements of social market economy are personal liberty, social justice, and economic efficiency.

Personal liberty assumes trust strengthening between agents, development of guarantees of private property, and regular economic policy promoting freedom.

With social justice present market economy promotes social development and strengthens middle class. Democracy will allow to break administrative barriers and to create public control. Social justice also includes address support of vulnerable regions of Russia.

Economic efficiency should be directed towards creation and maintenance of competitive order, strengthening of antimonopoly activity and improving fair entrepreneur's image. This will make Russia more attractive for workers from abroad and help it develop integrative relations with neighboring countries.

All these measures will raise economic efficiency while creating preconditions for a fast overcoming of the crisis and increasing the well-being and the acceleration of economic development of Russia.

Promoting access to medicines through global co-operation: A new strategy through North-South collaboration

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Abstract

India is considered a pharmaceutical super power in view of the generic industry and is considered a global pharmacy, especially drugs for HIV/AIDS. Indian pharmaceuticals companies have captured global markets for high quality generic medicines. Indian companies not only establish their businesses in America and Europe, but also sell many products to developing countries in Africa and South America. Ranbaxy, for instance, sells its products in more than 100 countries including Brazil, Russia, etc. In the past three years, almost 50% of Ranbaxy's sales revenue came from overseas market, and one-third from America. Due to uniqueness lies in the exceptional patent protection regulations in India Cipla, was able to supply AZT products at a price 1/5 of that of MNCs to support the poor HIV/AIDS patients in developing countries. Since then, Cipla developed a 'three in one' combined therapy for cocktail treatment, and further reduced the treatment cost to 1/12 and 1/20 of that charged by MNCs. With support and certification from the WHO, Cipla is now selling its products to more than 90 countries including Africa. More importantly, some Indian companies, such as Ranbaxy, Reddy's Laboratory, Cipla etc. are positioning themselves as a world-class enterprise with a real global vision. One major reason is that India has developed a global standards in quality and standard through appropriate internationally accepted regulatory standards and processes of registration besides skills in international marketing, overseas sales management and pipeline innovation. India exports 60% of the products it manufactures, and 15% of finished products are sold overseas underscoring its importance as global pharmacy. India has the largest number of FDA-certified manufacturers outside the USA (no). More than 100 products from India have been approved by the FDA. Additionally, Indian companies are pushing ahead in translating their generics-manufacturing-based experience into branded products innovation. Some Indian pioneer pharmaceutical companies like Dr. Reddy's, invested 15.5% of their revenue in R&D to identify and screen new molecules. The industry-friendly policy environment helped boost the pharmaceutical business. The Indian government provides incentives for exporting API, and waives, or exempts, export taxations to establish the international vision. The accumulated expertise in manufacturing and state-of-the-art facilities make today's India competitive and well-equipped with bench to bed potential in innovation that is being recognized. In view of the wide international reputation and demonstrated ability to manufacture and supply drugs as per global quality and standards, several multinational companies have started collaborating with the Indian pharma industries. Many multinational companies like GlaxoSmithKline, Pfizer, GSK Pharma, AstraZeneka etc. have established collaborative ventures with Indian companies like the Reddy's lab, Ranbaxy Laboratories (since taken over by Daichi), Nicholas Piramal, Sun Pharmaceuticals, Arabindo Pharma etc. The objective of the MNCs is to manufacture and supply

generics to the global market. There is a great potential to tap this collaboration towards providing affordable drugs for the poor through appropriate licensing strategies. This paper will present and discuss the legal and other frameworks to address the issues of access of medicines to the poor.

Genetic diversity in Indian populations and its health implications

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Abstract

India represents one of the largest human biodiversity pool in the world. There are 4,635 anthropologically well-defined populations with little or no gene flow between them. Out of these there are 532 tribes, 72 primitive tribes and 36 hunters and gatherers. Hence, study on Indian populations known for their cultural and genetic diversity, not only provides insight into their complex origin, history and relatedness, but also helps in understanding molecular pathology of genetic diseases. Therefore, our interest has been to study both population history and molecular mechanism of diseases in Indian populations.

To shed light on the genetic variability across the Indian subcontinent, 132 Indian samples from 25 groups were analyzed on an Affymetrix 6.0 array, yielding data for 587,753 SNPs after restricting to markers with good completeness. To span the widest range of ancestry in India, Tribal groups were sampled from 13 states and 6 language families (Indo-European, Dravidian, Austro-Asiatic, Tibeto-Burman, Great Andamanese and Jarawa-Onge). Some caste groups were sampled to permit comparison of traditionally "upper" and "lower" caste groups.

There is a strong evidence for two ancient and genetically divergent populations that are ancestral to most Indian groups today. The "Ancestral North Indians" (ANI), are genetically close to Middle Easterners, Central Asians, and Europeans, while the "Ancestral South Indians" (ASI), are not close to any group outside the subcontinent. By introducing methods that can estimate ancestry without accurate ancestral populations it was shown that ANI ancestry ranges from 39-71%, and is higher in traditionally upper caste groups and Indo-European speakers. Groups with only ASI ancestry may no longer exist in mainland India.

The finding that nearly all Indian groups descend from mixtures of two ancestral populations applies to traditional "tribes" as well as "castes". It is impossible to distinguish castes from tribes using the data. This supports the view that castes grew directly out of tribal-like organizations during the formation of Indian society. The one exception to the finding, that all Indian groups are mixed, is the indigenous people of the Andaman Islands, The Andamanese appear to be related exclusively to the Ancestral South Indian lineage and therefore lack Ancestral North Indian ancestry. In this sense, they are unique.

Many groups in modern India descend from a small number of founding individuals, and have since been genetically isolated from other groups for thousands of years. It has medical implications for Indian populations. Recessive hereditary diseases are likely to be common in populations descended from so few 'founder' individuals. This helps to explain why the incidence of genetic diseases among Indians is different from the rest of the world. For example, an ancient deletion of 25 bp in the cardiac myosin-binding proteins-C gene (MYBPC3) is associated with heritable cardiomyopathies as well as with an increased risk of heart failure. Its prevalence is high (~4%) in the general populations from the Indian subcontinent. However, this mutation is completely absent among the people from the rest of the world.

The finding that a large proportion of modern Indians descended from founder events means that India is genetically not a single large population; instead it is best described as many smaller isolated populations. It is important to carry out a systematic survey of Indian groups to identify which ones descend from the strongest founder events. Further studies of these groups should lead to the rapid discovery of genes that cause devastating diseases, and thus will help in the clinical care of individuals and their families who are at risk.

Social and Political Economy of Modern and Traditional Techonologies: Some Conceptual Perspectives*

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Abstract

Modern technologies have their roots in latest global developments in concept-based basic sciences and their practical laboratory based applications for economic and social neeeds. The global sociey's access to these applications is determined by their technical as well as their global economic and commercial viability. The institutions which influence these applications include the tastes and preferences of consumers, national and global input and output markets, globally networked scientific and R & D organisations, the industrial, service and agricultural organisations in the private and public sectors, and the national, international and multilateral S & T and economic policy-making bodies. Traditional and indigenous technologies, on the other hand, have their roots in the local markets, and expertise and experience accumulated and transmitted over generations of their practitioners. The society's access to these traditional technologies is determined by their technical viabilities, as well as by their local social and economic acceptability. The institutions which influence the society's access to traditional technologies are local consumer awareness and preferences, the networks promoting sustenance and development of traditional skills, and increasingly, due to the challenging convenience and economy of modern technologies, support from local, sub-regional and national public-governmental bodies. This paper conceptually explores the socio-economic, developmental and environmental implications of modern and traditional technologies, illustrating them through distinguishing characteristics in selected products and processes. It concludes by suggesting the need to consider a balance between modern and traditional technologies in the background of their socio-economic, politicaleconomic and environmental sustainability over the long run.

Paving Way for Global Knowledge Society - Towards Integration of Innovation and Development Policy Strategies

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Abstract

This paper is about the role of science and innovation and the stage of sustainable information society (SIS) in the socio-economic development of developing economies. The context for the article is in the structural change of economies from manufacturing phase towards knowledge-based intangible service economy, in ICT driven globalization, in requirements to solve grand global socio-economic challenges, and in the role of market driven approaches in improving welfare of majority of population worldwide (called Bottom of the Pyramid approach, BOP). The hypothesis of paper is that the strategy which integrates proactively and dynamically the context factors above, especially innovation and development strategies, has essential impact on the welfare of developing economies. The internationalization of R&D of transnational and other corporations is among key drivers of globalization and accordingly enterprises with their R&D and innovation have important role in the change. Moreover an important condition for policy-making is in ability to measure performance improvements with related indicators of SISs. In developed economies the changes above will challenge national R&D and innovation policies as well as development aid policies and their underlying theoretical approaches. Among consequent conclusions is the need to revise the rationales of these policy areas and improve coordination between these policy areas. Development aid policy shall be shifted towards the promotion of national innovation systems (NISs), and innovation policy shall play a more integrated role in development aid policies. The study is based on the recent literature in this research field. Empirical examples and aspects of these issues will be considered within a context of the EU policies from the perspective of one EU member country, Finland, a small open North-European economy.

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