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What are the main differences?

Singapore is home to five million people inhabiting a small island of 700 sq km with a GDP of $250 billion. More than a quarter of Singapore's economy is powered by high tech manufacturing sector. Singapore is investing close to fifteen billion dollars on R&D during 2011-15. Environment & water technologies, biomedical sciences translational & clinical research, and interactive & digital media are pursued as strategic growth areas. Singapore is on its way to reaching the goal of gross expenditure on R&D (GERD) to 3.5% of GDP by 2015. Based on GERD percentage, Singapore is among the exclusive club of research intensive nations. However the absolute amount is small compared to the R&D expenditures by bigger nations such as USA, Japan, and Germany.

History of scientific research suggests that talented researchers are most creative when not directed and free to follow their passion (bottom-up approach). However, the significant amount of public funds involved in supporting research attracts active management by policy makers and public (top-down approach). Is there a merit to the view that larger nations have the natural bandwidth to pursue both bottom-up and top-down approaches whereas the smaller nations are constrained to lean towards top-down approach?

Can Europe keep path with the developmental dynamics of other parts of the world?

Increasing penetration of education and communication & information technologies supported by economic growth is changing the perspectives and competitiveness of higher proportion of humanity around the world. Europe is doing its best yet Europeans are uniquely placed to do even more to be an integral part of developmental dynamics of Asia and the world.

Which direction do scientific systems of other nations take?

There is growing evidence that economic and competitive factors are increasingly shaping the funding landscape of scientific research. Yet there must also be opportunities for talented researchers (preferably collaborating with peers in other nations) to pursue scientific research purely on intellectual basis. New knowledge out of such efforts will help to sustain and improve the quality of lives in all nations in unforeseen ways and means.

How can we strengthen the cooperation of several countries?

The research enterprise is far more wide spread globally than ever before in the history of human kind. The annual total global spending on research is over one trillion dollars. About fifteen per cent (about $150 billion) of it is appropriated by various governments for pre-competitive research in public sector. In many countries the public sector research is increasingly conducted at universities and various institutions of higher learning. Enablers of transformative research are now globally dispersed. It is timely to set up a **Global Research Foundation, GRF** to support researchers to work in teams internationally on pre-competitive transformative research. It is recommended that a collective pool of 10 billion dollars or higher is set aside annually (each nation to set a % point of their GDP) to support GRF. It is desirable for talented researchers to collaborate beyond their current boundaries set by their host institutions and national funding agencies. Moreover, the collaborations and deeper understanding among intellectuals promote stronger positive ties amongst nations, as most often these researchers are respected opinion leaders in respective nations. There is scope for believing that discovery of new knowledge is a win-win platform for everyone in the long run.

Reference: *Changing Face of Innovation***,** Seeram Ramakrishna *et al*, World Scientific Pub Co, 2011