Science, Technology & Innovation (STI) Policy Reform for Developing Countries at the Grassroots Levels

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Abstract

This review paper discusses Science, Technology and Innovation (STI) policy framework reform for developing countries by proposing three levels of policy integration process. In the last decade, there has been an increasing concern on the importance of STI for inclusive and sustainable economic growth. This paper aims to provide comprehensive understanding of the interdependence between governance processes and other stakeholders for leveraging STI policy at the grassroots levels. The attainment of national development goals requires realistic and context based policy development process based on relevant strategic approach at the grassroots. However, in many developing countries, there is a gap between policy and development priorities as most of them are not integrated into the grassroots. Based on the review of literature on STI policies, the analysis indicated that there is a need for a major policy reform for the third world countries’ STI polices in terms of policy agendas regarding to the sustainability dimensions. However, developing world still lacks the conceptualization of STI policy, which is tailored with their development goals. The prevalence of institutional and organizational fragmentation in developing countries is one major factor that constrained the technology transfer process from translation into the development of innovation initiative. The current body of research, however, is characterized by a narrow focus on the specific institutions like universities and research institutions but the bigger picture on STI policy interaction is largely ignored. The proposed framework STI policy ecosystem is organized around three different levels with multi actors ranging from global, regional and even national levels. The limitations of STI policies necessitate policy coordination, which opens significant challenges when it comes to the implementation endeavors. Lastly the paper brings out the establishment of institutional ecosystems at the grassroots in terms innovations and their subsequent absorptive technology capacities. And it is further argued that, this bottom-up approach of STI development is to pave the way towards achieving sustainable development goals. Therefore, this paper calls for more research on the context of STI framework reform, not only but particularly for the third world countries.

Keywords: STI, Grassroots, Sustainable Development, Ecosystem, Policy Formulation.

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1.0 INTRODUCTION

The world is moving fast into the knowledge and innovation economy. Countries worldwide have begun making preparation to embrace the shifting requirements posted by the new economy. Top on the agenda of requirements is the need to review and reform each country’s Science, Technology and Innovation (STI) framework. As STI are key drivers of the knowledge economy, yet developing and underdeveloped countries need to adapt a generic framework based on their priorities that guide the whole policy formulation at the grassroots. Inputs at grassroots to STI policy agenda can be aimed at nurturing inclusive participatory process fostering in the
policy implementation as outputs from trajectory of multisector stakeholders. Civil society organizations, individual experts, small businesses and all the available local structures are considered the contributors of the policy development from the grassroots. Those inputs from the grassroots reflects smooth implementation due to the fact that, the policy is owned by the public and as an outcome aimed at providing services for marginalized groups, or even endeavor to produce structural change. Generally, bottom up policy formulation enables broad and diverse participation in shaping policy priorities that promote STI capacities at the national level. Over the years, countries like Europe adapted broad-based innovation strategies through establishing ecosystem incorporated into different clusters at the grassroots (Harmaakorpi, Melkas, & Uotila, 2017). In this regard, best practices of STI come through policy benchmarking at global level particularly during the implementation stage. The STI policy discussion has changed in recent years. Policy makers, scholars and analysts alike gradually focus on challenges stanching from policy intricacy. Policy matrices focus on interactions and interdependence between existing policies and affect the extent to which policy goals are achieved (Flanagan, Uyarra, & Laranja, 2011).

STI Policy implications cannot be automatically derived from the analyses of innovation issues as there is always a need for additional theoretical and conceptual or empirical knowledge. Existing policies of all kinds need reform and re-engineering in ways that contributing to the holistic development endeavors and should be based the best practices of policy formulation. As such, developing and underdeveloped world are straggling challenges posted by dynamics of STI and yet there have not been STI policy frameworks coined for them to achieve the trend of knowledge based economy (Madar, Subari, & Baqutayan, 2018). Knowledge, a product of science and scientific enterprise, is a significant resource central to achieving sustainable development. While the term “development” is a universal concept, which often means different things to different people, the fact still remains that it is often used to denote social, economic and political conditions of the populace (Siyanbola, Adeyeye, Olaopa, & Hassan, 2016).

This need has clearly been identified by the developed and the developing countries. STI are now fundamental tools for integrating potential industry and academic institutions at all levels. There is a huge gap between the industry and the academia as they present two different institutions that are frequently inconsistent with each other (Etzkowitz & Leydesdorff, 2000). Social policy and STI programmes in developing countries have attracted widespread international attention. The emergence, nature and effectiveness of recent social policy pathways are therefore of interest, to understand whether these represent substantive approaches to the social development challenges faced in low and middle income contexts (Plagerson, 2019). In the context of the developing and underdeveloped world this gap is on the increase as academia and industry are operating in such standalone approach and they are not properly integrated. Policy harmonization is an essential and neglected issue in STI policy that has traditionally been studied in the literature on institutional theory and public policy (Braun, Vincent, & Ball, 2008).

This review paper sheds light on the STI policy framework literature and explores its implications at the global, national and local levels. In particular policy implementation aim to address the multiple coordination modes and mechanisms that are required in a complex policy space, where multiple instruments from different domains and levels coexist and a large variety of actors operate at different layers (Magro, Navarro, & Zabala-Iturriagagoitia, 2014). The policy implementation for STI is one of the area’s most in need of an integrated policy approach. Getting this right is vital to countries’ sustainable development and hence their capability to deliver on other social and environmental policies. However, there is arguably less integration in this area than in many others and, so far, there has been little guidance on what integrated policies would consist of and how they might be delivered (Lyall & Tait, 2005). Prior literatures have discussed importance S&T policy implementation at sectoral levels. Various authors have used the concept of an innovation system to explain the mechanisms of knowledge creation and dissemination at the national, regional, and/or sectoral levels (Edquist, 2010).

In general, public policy is not used to tackling problems in an incorporated way and, in particular, policy frameworks for areas such as STI are usually compartmentalized in different departments and agencies that compete for power rather than co-operate to tackle policy issues (Cooke, Boekholt, & Tödtling, 2000). This happens most in the third world countries, where institutions are very weak with overlapping roles. Despite current
and emerging socio-economic and political developments where policymakers in most industrialized countries are trying to reform traditional policy approaches, intra-departmental rather than overall co-ordination would still seem to be the preferred policy mechanism in developed countries like the UK (Kaiser & Prange, 2005). In contrast, within the context of the developing world, like Ghana STI adoption is the major concern. Furthermore, challenges toward STI implementation are often accompanied by multiple shifts in governments’ STI policy, yet there are growing concerns in developing countries (Amankwah-Amoah, 2016). In the world, the STI is not specifically addressed let alone for implementation process. As a result, the context of the world countries, any STI policy formulated is lacking relevance and there is no absorptive capacity in place that nurtures institutional ecosystems at the grassroots.

2.0 STI REVISED FRAMEWORK

Prior studies discussed an effective STI policy occurs in tandem with collaboration of key stakeholders such as public, private and academic institutions as well as other industries. STI policy is a cross-cutting issue that integrates potential sectors of the national development to form institutional ecosystem. Such collaborations are required not only in formulating policies but also to ensure implementations at the grassroots. Generally speaking, STI policy involves constant and progressive alteration aimed at enhancing absorptive capacities of both public institutions and the academia including the business sectors (Madar, Subari, Baqutayan, & Mohamed, 2016).

Furthermore, STI policy encompasses developing science and technological infrastructure to support the development and utilization of existing and new technologies, whereas, innovation policy focuses on actions by public organizations to help develop capabilities and capacity of firms to innovate (Amankwah-Amoah, 2016). Prior literatures have suggested that enhancing local firms’ capacity requires resources, training and development as well as effective policies that remove business and innovation obstacles. According to Amankwah, 2016, national STI policy framework is an incorporation of these three dimensions towards nurturing sustainable development and national competitiveness. It may evolve over time to reflect the needs of the country or changes in the political environment. The prevalence of institutional and organizational fragmentation in developing countries is one major factor that constrained the technology transfer process from translation into the development of innovation initiative (Bhutto, Rashdi, & Abro, 2012).

However, it is very often found that STI as any other public policy needs the participation of the different stakeholders including the wider public without compromising policy benchmarking at the global context. As such, it is paramount to address the role of local and global context in STI policy implementation. It would not be feasible if policies are designed and implemented by standalone governmental departments without any coordination with other stakeholders at local, regional and global levels. The following diagram demonstrates STI ecosystem at the grassroots with sectoral structures. In this broader sense, grassroots innovation groups can be regarded as initiators or advocates of alternative pathways of socio-technical development which sometimes engage with STI groups and development agencies in pursuit of technical assistance, funding or other kinds of institutional support; but also including symbolic legitimacy, policy design, supportive regulatory structures, etc. Interactions between professional bodies and formal institutions of R&D, policy and development arise through mutual interests that contain an uneasy mix of cooperation and competition for ideas and models of innovation for development.
Based on the above indication, technology foresight can be achieved through effective linkage of national STI framework, as illustrated in figure 1. The figure demonstrates a unified approach for government policy to help foster the development of local innovation and national competitiveness. Although government’s role is to set a comprehensive and decentralized STI policy it does not mean that the implementation goes to the government only. A progressive central role in STI policy much depends on funding scheme tailored to specific objective and criteria within the national framework. Indeed, the governance of science policy has also been characterized by the involvement of a range of semi-autonomous, scientific organizations, such as funding councils or advisory boards to oversee the funding of research (Perry & May, 2007). Likewise, the diagram implicitly states contributors to the STI formulation and implementation in a broad category that covers inputs and outputs of the grassroots. Subsequently, an output from one sector could be an input of another institution and the outcome STI policy would be achieved through collaborative efforts.

Diffusion of scientific outputs and technology interventions into social systems is a multi-layered and an iteration process to ensure the contributions from grassroots without compromising inputs from the authorities. Except for the mission-orientated strategic sectors, the delivery mechanism involves a large number of intermediaries both from the public and private sectors. This requires strengthening of linkages between the scientific and socio-economic sectors. The STI policy will leverage the R&D allocations of socio-economic ministries through a shared vision, mission-oriented approach and adoption of new delivery models with provisions for accountability. The state governments constitute important stakeholders. Measures will be taken to ensure that state-specific S&T vision and plans are informed and guided by the new STI policy towards which State S&T Councils/Boards will be strengthened. None Governmental Organizations will be accorded a pivotal role in the delivery of STI outputs, especially rural technologies, to the grassroots level (India, 2013).

National institution has the authority to lead the policy agenda but formulation and implementation is a collective effort of all stakeholders including industries, academia, research institutions and other professional bodies. In this regard, STI policy should communicate with the needs of the trajectory levels within context of the ecosystem and serves the interest of the wider community. At the global level, STI policy should adopt the best practices of implementation and learn lessons from the existing limitations. The global landscape of STI is changing and new hubs for STI are emerging. Therefore, developing countries need to respond to and integrate their STI ecosystems into the global context. STI policy agenda traditionally pursued to improve the conditions for research and innovation activities to flourish, at times the government can also become a barrier to development in these areas. In this study, we seek to illuminate our understanding of this issue by investigating the reform and revolution of STI for both the developing underdeveloped world.

The Implementation of STI policy framework needs very strong and relevant science communities that participate in policy formulation process at the grassroots. The interactions between multi-levels embodied in integrated ecosystems are very essential for STI implementation process (Koch, 2018). In light of the widespread development of a postindustrial or knowledge-based economy, the role of regions in STI policy now requires re-
evaluation. The challenges for STI policy in order to move towards inclusive implementation are really threefold as presented in the following table 1. First, what can be done at the international level to start and sustain learning networks and trajectories that can lead to effective STI policy implementation? Second, how can the overall linkages of all institutional ecosystems at national level are made more inclusive to ensure effective collaborations of all stakeholders within a policy framework? Third, what are the policies and other mechanism required to ensure investment on STI and seeking effective regional affiliations for venture funding schemes?

Table 1: Three Level Scheme of STI

| Global | ➢ Following global STI indicators and achieve global STI competitiveness through comprehensive policy benchmarking.  
       | ➢ Countries should be designed STI oriented economic strategies and policies in order to achieve sustainable global competitiveness and long run growth. |
| National | ➢ Within nationally-defined policy frameworks, national institutions are seen as facilitators with the help of the contributions from the grassroots.  
           | ➢ At the national level STI Policy may be organized and decentralized within regional units yet regional authorities or agencies are not seen as participants in that process but contributors and implementers. |
| Regional | ➢ Regional authorities and agencies have a role in the implementation of nationally-defined and funded policy initiatives. Regions provide not only stages for policy delivery but are also agents for delivery according to centrally conceived priorities and targets.  
           | ➢ Regional authorities and bodies are increasingly devoting their own finance and resources to funding regionally significant scientific investments or projects.  
           | ➢ The emergence of ‘regional STI policies’ may be characterized by independent agenda-setting, institutional creation and new governance arrangements, new mechanisms and policy tools or strategic intelligence and capacity building. |

Most importantly, this perspective highlights how national initiatives in STI policy are increasingly dependent on local action for their successful implementation. As evidence of this, Koch outlines how the traditionally centralized and national direction of STI policy has given way to the regionalization of policy initiatives in terms of cluster-based initiatives and new industry–STI relationships. STI policies can exist separately on their own in disconnected spaces but it’s integrations into the grassroots are paramount. But it is their integration that leads to new value creation. There is, therefore, the need to create the necessary framework for enabling this integration in identified priority areas by exploiting endogenous resources, strengths and capacities. The policy will drive both investment in science and investment of science-led technology and innovation in select areas of socio-economic importance. Emphasis will be to bridge the gaps between the STI system and socio-economic sectors by developing a symbiotic relationship with economic and other policies.

3.0 DISCUSSION

This article set out to analyze the role of stakeholders in the development of STI at grassroots using their inputs as empirical evidence. The STI framework has become an increasingly complex field that has been studied from a huge range of scholarly disciplines and approaches. However, developing world still lacks the conceptualization of STI policy tailed with their development goals. This review paper suggests that since there is no comprehensive and generic STI framework that suits to all countries, yet there is a need to reform and improve
the existing policies. Therefore, it is paramount and indispensable to address this gap within pivotal trajectory at the grassroots. The main cause for the failure to develop sound and achievable STI in developing countries are due to the lack of co-ordination between the stakeholders in the innovation system, which included: the government, universities, research institutions, extension services, support institutions and the user agencies i.e. industry, public institutions and service sector. This lack of co-ordination and linkage has also been responsible for the lack of absorptive capacity of within the institutional ecosystem (Magro & Wilson, 2013).

The proposed framework STI policy ecosystem is organized around different levels with multi actors that link local, national and global institutions and could be used during policy benchmarking. This calls for policy coordination, which opens significant challenges when it comes to the implementation endeavors. From a conceptual perspective, the paper provides an analytical framework for the analysis of the coordination modes and mechanisms of STI policies in complex and collaborative environments (Magro & Wilson, 2013). Policy integration across levels of ecosystem depends mainly on the ability to communicate effectively across system boundaries and the institutional structures determined by government policy-making at the highest levels have a major influence on the effectiveness of its implementations. The conceptual discussion on STI, emphasizing the importance of interaction between actors, institutions at all levels has been marked on issues of national, regional, global and sectorial systems. In this framework, administrative policy elements stand for supporting the implementation of the sectoral policies amid the STI policy which is responsive to ever-changing national, regional and global context. The national institutions herein are suggested to play a role in the coordination and put mechanism in place that encourages inputs from the grassroots.

At the present, enormous scholars indulge into connecting STI system scales which provide important intuition into more interdependence and collaborative approaches. The complex STI policy ecosystems described above are organized around three levels and with multi-actor dimensions at the grassroots levels (van Geene & Verhoosel, 2009). Currently, the proposed STP framework incorporates ingredients and flavors of the academia, industry, public institutions and other professional societies just to mention a few. As a result of this, the STI framework stands out by providing an environment in which the interaction between local, national, regional and global institutional ecosystem is encouraged. Then the paper outlines a policy framework that aims at appropriately linking tasks of innovation support at different spatial levels including the national, regional, and international dimensions.

5.0 CONCLUSION

This paper highlights that inputs to STI policy from the grassroots levels during formulation stage are equally important at the policy implementation phase. The main argument is that the three levels do not function independently from each other, but mutually rely on each other’s strengths and specific system qualities in order to productively interact. While collaborative efforts of STI tend to grow mainly on nationally established, or at least supported, infrastructure and institutional foundations, it needs successfully networked with private sector and at the global level (Magro & Wilson, 2018). We hope that the current review paper will serve as a point of departure to further our understanding the importance of the inputs from the grassroots in both policy formulation and implementation which the links between the institutions underpinning political stability, reform and the innovative capability of countries. Grassroots participation in the STI policy formulation is a significant approach for making implementable and outcome based public policy.

REFERENCES

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