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## A REVISIT OF NATIONAL SCIENCE & TECHNOLOGY POLICY FOR THE DEVELOPMENT OF SMALL AND MEDIUM ENTERPRISES IN SRI LANKA

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### ABSTRACT

*Small and Medium Enterprises (SMEs) played a crucial part in the Sri Lankan economy and acknowledged as the country's backbone for industrial growth. However, the recent studies in this sector exhibit that Sri Lanka has not achieved the desired level needed in the modern world compared with other countries, especially within the region. This study examined and reviewed extensive literature, gathering information from experts in the national economic development and science and technology innovation. That helped to identify the major challenges on the National Science & Technology Policy (NSTP) and development of Sri Lankan SMEs, including various contributions to the national economy, with the challenges faced and the initiatives and incentives offered by related authorities. There are several significant factors identified among challenges. They are; lower level of science-based technological innovation, limited skilled of human resources with less commitment, the absence of broad-based scientific knowledge, weak implementation of policies, weak commercialisation of research & indigenous knowledge, poor sustainability of natural resources, lack of expert knowledge, high-cost technology import and leverage of much technology, informal use of technology, the reluctance of rural people to integrate with new technology and hesitance to pay for the technology, lower levels of research & development facilities, a high level of international competition, a high level of private-sector interference with less government involvement, and weakness of national fund gathering and distribution. These lapses suggest that the existing policies are insufficient or may not be delivered effectively to overcome these challenges. This study makes an effort to identify the irregularities of NSTP as a positive step and propose a way forward in formulating a workable framework to upgrade SMEs in Sri Lanka that would be highly effective.*

**KEYWORDS:** *SMEs, National Science and Technology Policy, Sri Lankan economy, Industrial development in Sri Lanka, Science and Technology Innovation*

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## 1. INTRODUCTION

Small and Medium Enterprises (SMEs) play a significant role in economies, especially in developing countries (Pandya, 2012). They generate a vast amount of employment (Yogendrarajah *et al.*, 2017; Priyanath and Premaratne, 2014) while expanding the Gross Domestic Product (GDP) by stimulating different economic activities needed for the economic development of a country (Sakolnakorn, 2010; Chen and Rozelle, 1999). SMEs make up broad economic activities like agriculture, mining, production, construction, service sector industries, *etc.* (White Paper, 2002; Amaradiwakara and Gunatilake, 2016). Due to the scarcity of statistics in Sri Lanka, the total contribution of SMEs to the economic system is difficult to be assessed precisely. Recent publications represent that SMEs participate in the economy by fulfilling over 75% of the total enterprises and over 45% of total employment (Gunawardana, 2016) and making a 52% contribution to the GDP in Sri Lanka approximately (Gunawardana, 2020; Perera, 2018). There are almost 500,000 SMEs in Sri Lanka, with each employing three to five people on average (Perera, 2018). Furthermore, Sri Lanka has just over 3,000 SMEs (businesses with a turnover of but Rs.150 million) registered as exporters (Perera, 2018).

Since independence, having understood the reality, subsequent governments in Sri Lanka have taken varied steps to improve this important sector. Developing agro-based small and medium industries was one of the major concepts (Sinnathurai, 2013), and around 70% of the country's residents are in rural areas, where agriculture provides the livelihood of the majority of people (Wickremasinghe, 2011). Small industries such as the production of agro-based food products and agriculture are the sources of employment in rural areas. However, only a few studies have examined their current development and challenges and have proposed some prospects.

According to a few previous studies, the Sri Lankan export market still has low levels. For instance, Perera (2018) revealed that enterprises registered as exporters in Sri Lanka collectively contribute to less than 5% of Sri Lanka's exports. In China, for example, SMEs

contribute more than 40% of GDP, while the Asian average is around 30%. Weak business environment, inadequate infrastructure, inadequate access to finance, low technological capacities, lack of a mechanism for protection and nursing of SMEs, lack of drive for innovation, and lack of recognition have been identified as major drawbacks of SMEs (Perera, 2018; Nishantha, 2018; Perera, 2018). Moreover, Heenkenda *et al.* (2018) and Karunanithy *et al.* (2017) have reported various factors contributing to SME development under various perspectives in Sri Lanka. When reviewing these studies, it is clear that Sri Lanka has not gained the desired level needed in the modern world compared with other highly competitive developed and developing countries (China, Singapore, Thailand, Malaysia, and South Korea).

Considered East Asian countries are the latecomers to engage with industrialisation (Intarakumnerd and Goto, 2016). However, latecomer countries benefit from trailblazer countries' technological and institutional advancements (Gerschenkron, 1962). While competing in the global market, they faced several disadvantages. They lack R&D and engineering capabilities, poorly developed industrial and technological infrastructure operating in isolation from the world centres of science and innovation, dislocated from international markets, whose demands help stimulate technological advancements and innovation (Hobday, 1995; Morrison, 2019).

Numerous enterprises in East Asia were latecomer economies. China, South Korea, and Singapore could capitalize on their advantages and overcome disadvantages by improving their technological capabilities and building organisational structures.

This allowed them to enter and advance throughout the global value chain. This study intends to extract the core of policies to improve SMEs' technological and innovative capacities by examining the experiences of China, Singapore, Malaysia, Thailand, and South Korea. They were selected because their SMEs contribute significantly to the economies of these countries, and they are technologically successful. Their economy is dominated by enormous corporations as well as within these five economies, China,

Singapore, and South Korea are now high-income economies. At the same time, Malaysia and Thailand are still middle-income economies.

Furthermore, the present study aims to examine and analyse the current role of National Science and Technology Policy (NSTP) for SMEs' development and find a pathway to bridge the NSTP and SMEs' development by rectifying the issues about the NSTP. This study intends to identify and understand the need to start an SME by looking at all the factors affecting business success, reducing the risk of failure, and increasing the chances of success. That conforms to modern Science and Technology (S&T) main technical initiatives supplemented by reviewing innovation policies, research, and supportive reports in the above-selected countries to identify modern ideas that have influenced SMEs' business success. Finally, this study is aimed to propose amendments to the NSTP strengthening SMEs in Sri Lanka as a global competitor.

## **2. METHODOLOGY**

This study was conducted mainly through a literature survey and via personal communication. The publications used regarding SMEs and S&T policies in Sri Lanka, China, Singapore, Malaysia, Thailand, and South Korea contained in databases such as Google Scholar, Science Direct, PubMed, Wiley Online Library, and Springer. Keywords used in this study were “Small and Medium Enterprises,” “Small and Medium Industries,” “Science and Technology Policy,” “Science, Technology, and Innovation Policy,” “Science and Technology Innovation,” “Challenges and policy implications for SME development,” “SMEs innovation,” and “SME development” for all the selected countries respectively.

Besides, analysis of the current situations of the SMEs include secondary data from the latest industrial surveys of Sri Lanka. The Department of Census and Statistics conducted industrial surveys in 2013/14 (DCS, 2015) and Sri Lanka Labour Force Survey (Annual Report in 2019) (DCS, 2020). In addition to this, various other data sources such as annual reports of the Central bank of Sri Lanka, World Bank reports, OECD reports, other annual banking reports, and

NASTEC reports (NASTEC, 2008; 2018; 2019) are also used.

In addition, the literature survey was conducted with the help of books, official websites on the internet, online published newspaper articles, and the reports & national policy frameworks were published by government sectors (i.e. NASTEC, MoDSIT, MoIC, MoSTR-2018). The National Science and Technology Commission, Sri Lanka, provided detailed information on the NSTP and its activities to Sri Lankan small and medium-sized enterprises (SMEs). Also, rural entrepreneur development programmes and their implementations were gathered from professionals at the Institute for Agrotechnology and Rural Development, University of Colombo, Sri Lanka (UCIARS).

The search was restricted to English language articles. All studies found during the search were independently evaluated for competence and inclusion. After compliance with inclusion criteria, experimental research and data resources that evaluate the effect of the NSTP component and SME development were included in the current study to propose strategies to improve the NSTP in Sri Lanka towards SMEs development and well distribution by the R&D sector to commercialise the outcomes through the SMEs.

### **NSTP in Sri Lanka**

The history of S&T development in Sri Lanka has been a long one (NASTEC, 2008). As early as the 1950s and '60s, the Ceylon Association for the Advancement of Science lobbied activities on a major source of power. That resulted in assigning S&T to a Ministry. In 1994, this subject's greater opportunity helped establish a separate Ministry for Science and Technology. The National Science Council (NSC) initiated work on an NSTP, resulting in the first policy statement in 1978 (NASTEC, 2008). In 1991, a Presidential Task Force on Science and Technology Development drafted an expanded S&T Policy. The Science and Technology Development Act of 1994 led to the establishment of NASTEC (National Science and Technology Commission) in 1998, which serves as a policy advisory body for the government. NASTEC has continued the work to develop a complete and

comprehensive NSTP (NASTEC, 2008). The commission developed a complete and comprehensive NSTP, which the government approved in 2009 (Ratnasiri, 2016).

### **NSTP works on SMEs in Sri Lanka**

The development of SMEs is a key concept to bring up the economy in many developing countries because it is the backbone of the social economy (Pratheeba, 2014). The role of SMEs in the Sri Lankan economy should not be underestimated, as they account for 45% of domestic employment and 52% of Sri Lanka's GDP (Perera, 2018; Gunawardana, 2020). As a result, SMEs operating in agribusiness (agriculture, forestry, and fishing), industry, and the service sector account for about 8.36%, 26.25%, and 59.67% of GDP contribution in 2020, respectively (Statista, 2021) (Table 1.). However, when analysing the sector's current contribution to the national economy, it has still not gained the desired level to compete with other countries (Figure 1). Quantity and the quality of the SMEs is a challenge due to low levels of modern S&T integration and entrepreneurs without broad scientific capabilities with an integrated approach to S&T. On the other hand, the lack of capital to pay for technology (a constraint for 59% of Sri Lankan SMEs), the lack of know-how on business plan preparation, and the excessive amount of regulatory impediments will keep entrepreneurs from accessing global demand (Ramanayake, 2019). Fortunately, however, it appears that Sri Lanka has a significant opportunity to develop this sector and reap the benefits that come with it. The Government has already identified this sector as a thrust area that should be developed to uplift the people's living standards (Gunawardana, 2016). Hence, the country's NSTP can provide a greater opportunity to make well developed & elaborated SMEs sector incorporating the government and private sectors collaborating with modern technology and financial efficacy. This is accomplished by offering guidance for resolving potential conflicts and maintaining a positive working relationship between these two.

However, promoting SMEs was not a major part of the current NSTP in Sri Lanka. Formulating policies, programmes, and projects, monitoring, and evaluating

themes related to industry and commerce maintained under the purview of over 20 ministries have engaged with the business sector with over 90 departments/authorities/councils established under such ministries. "Ministry of Industry and Commerce, Ministry of Primary Industries, Ministry of Development Strategies and International Trade, Ministry of Tourism Development, Ministry of Fisheries and Aquatic Resources Development, Ministry of Plantation Industries, Ministry of Agriculture are a few of them.

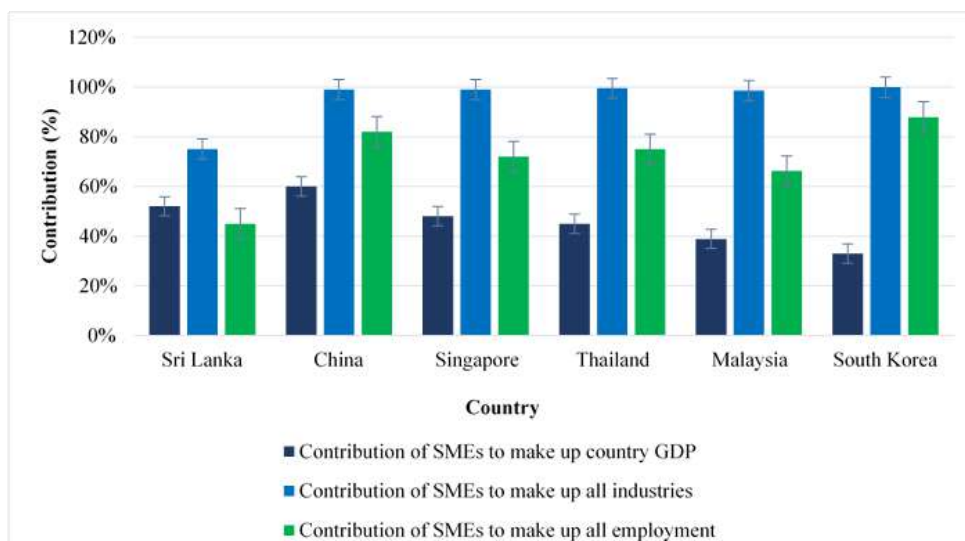
NSTP was originally developed by NASTEC, and implemented under the Ministry of Technology. Current NSTP leads to the development of S&T in the country and the application of S&T for national development. However, the NSTP must be included in the SME sector as the main stakeholder to execute the plan. For example, sunlight, the origin of all energies, was also taken for granted. If our S&T development had kept pace as in the past, we could be utilising sunlight, which we have in abundance, as our main source of energy instead of using petroleum, coal, *etc.* Billions of dollars used to import this fossil energy could have been saved and utilised for other necessities (Hirimburegama, 2020). Afterward, the R&D outcome got commercialised through SMEs in expecting a viable impact on the national economy. It will result in improved prospects for the young generation to develop technology-based enterprises and high-paying jobs.

Currently, NSTP focuses on S&T for social and economic development based on a few directions denoted as cultural innovation, national development, human resource, technology transfer & innovations, R&D, natural resources & the environment, indigenous knowledge, and intellectual property rights, quality improvement of S&T institutions, and human security (NASTEC, 2008). Under these directions, NSTP tries to provide equal and adequate opportunities for basic education related to S&T to foster novel technology and productivity to raise the efficiency of economic activities and promote S&T among the public, leading to a culture of innovation and entrepreneurship (STEPI, 2019). However, there is an urgent need to link NSTP directly with SMEs, an essential component of a progressive society in Sri Lanka.

**Table 1.** | Share of economic sectors in the gross domestic product (GDP) from 2015 to 2020 in Sri Lanka, China, Singapore, Thailand, and South Korea (Resource: Statista, 2021; Central Bank Annual Report, 2020).

Sector	Country	Share of economic sectors in the GDP					
		2015	2016	2017	2018	2019	2020
Agriculture	Sri Lanka	8.18%	7.43%	7.83%	8.02%	7.54%	8.36%
	China	8.40%	8.10%	7.50%	7%	7.10%	7.70%
	Singapore	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%
	Malaysia	8.29%	8.46%	8.60%	7.51%	7.26%	8.21%
	Thailand	8.87%	8.48%	8.41%	8.18%	8.14%	8.64%
	South Korea	2%	1.86%	1.85%	1.75%	1.62%	1.76%
Industry	Sri Lanka	26.20%	26.50%	26.80%	26.30%	26.40%	26.25%
	China	40.80%	39.60%	39.90%	39.70%	39%	37.80%
	Singapore	24.29%	23.30%	23.54%	25.50%	24.21%	24.37%
	Malaysia	38.45%	37.68%	38.11%	38.29%	37.40%	35.91%
	Thailand	36.18%	35.59%	35.02%	34.75%	33.60%	33.10%
	South Korea	34.15%	34.30%	34.77%	34.05%	32.83%	32.80%
Services	Sri Lanka	56.60%	56.70%	56.80%	57.50%	57.40%	59.67%
	China	50.80%	52.40%	52.70%	53.80%	53.90%	54.50%
	Singapore	69.95%	70.63%	70.33%	69.23%	70.67%	70.95%
	Malaysia	52.01%	52.53%	51.88%	52.99%	54.21%	54.78%
	Thailand	54.95%	55.94%	56.57%	57.07%	58.26%	58.25%
	South Korea	55.58%	55.36%	54.85%	55.69%	57.08%	57.02%

**Note** | These statistics show the share of economic sectors in the GDP in Sri Lanka, China, Singapore, Thailand, and South Korea from 2015 to 2020. In 2020, the share of agriculture in Sri Lanka's GDP was 8.36%, the industry contributed approximately 26.25%, and the services sector contributed about 59.67%. According to the data of the last six years, Thailand is the best country for the agricultural sector from among the selected countries. China is the best for the industrial sector contribution, and Singapore shows the best values for the services sector.



**Figure 1.** | Contribution of SMEs to make up the country economy, overall industries, and overall employment in Sri Lanka, China, Singapore, Thailand, and South Korea.

### **Lapses of NSTP in Sri Lanka**

The absence of broad-based scientific knowledge with an integrated approach to S&T has usually limited the growth of an innovation culture. There is a major issue when dealing with society in working with scientific and technology-based work/projects. Therefore, the implementation of NSTP is very important to give basic S&T knowledge to young people, especially including school children who would become future entrepreneurs. But the practical mission requires a capital cost and expertise knowledge with proper planning.

Sri Lanka is endowed with a vast repository of indigenous knowledge that has been developed and practiced throughout two and a half millennia. Therefore, NSTP linking SMEs could be implemented by appropriating indigenous technologies for the local SMEs through research.

According to the highly labour-intensive manufacturing and limited capital investment, labour-intensive industries or processes require large quantities of physical effort to complete necessary tasks. In labour-intensive industries, the costs associated with securing necessary personnel are more important than the capital costs regarding importance and volume. In contrast, many labour-intensive jobs require low levels of skill or education, and this is not true of all labour-intensive positions (Kenton, 2019). When making a capital investment for SMEs, people have to use their cash reserves or seek a loan from a bank. Industrial economics and strategic management theory are now developing a new viewpoint on companies with limited technology adoption and innovation capacity. A high-tech approach is necessary for Sri Lanka to modernise its industrial systems. The capability exists, but they need to be looked after, giving high priority to such scientists. Since Sri Lanka shares many of the same concerns as NSTP, NSTP must investigate the country's case studies to make changes to the NSTP. Priority needs to health, education, and science and technology (S&T). NSTP is not in a position to control private-sector abuses (specifically, unnecessary establishments and mining, *etc.*), coordinate and regionalise services, regulate equipment

and its use, and control charges, attempting to introduce prospective payment where possible. Furthermore, a great value addition would be, if the NSTP could focus on complications correlated with imposing import controls, and conservation of intellectual properties within Sri Lanka by providing short, medium, and long term solutions. Facilitating access to high throughput technologies for ongoing R&D projects, improving ongoing research through networking, and commercialising it through SMEs to obtain economic values, including patents, would be a solid initiative to protect intellectual properties within the mother country.

R&D can be the driving force of industrial innovations that accelerate economic development targets (Ratnasiri, 2007). NSTP may become a way of world-class facility provider for research in emerging S&Ts of national importance. Low R&D expenditures and low outputs, public R&D system misaligned with industry needs, low numbers of researchers and brain drain, low tech-transfer capacities are significant lapses of NSTP associated with R&D. Also, government universities and public research institutions pursuing to partner with industry or other organisations need a policy for effective intellectual property (IP) management and knowledge transfer. An IP policy provides structure, predictability, and a beneficial environment where enterprises and researchers can access and share knowledge, technology, and IP. A poor or insufficient IP policy for research commercialisation leads to a waste of intellectual property (WIPO, 2019). Therefore, NSTP has to add a new objective into its framework to develop a better IP policy linking public-private partnerships.

Laws pertaining on SMEs will also need to be updated to incorporate the possibility of arbitration in the event of a controversy. For this, identifying existing laws & regulations and identifying the gaps which need to be addressed relevant to the SME sector partnerships, designing, finalising & implementing the laws and regulations in line with the best international practices are highly required.

### **3. COMPREHENSIVE EVALUATION**

The establishment of new science-based technologies helps protect the environment, build safer homes, schools, and factories with cost-effective energy resources and develop energy-saving transport systems. Advances in medicine resulted in better health for all residents (NASTEC, 2008). In this scenario, it is important to advance our knowledge in areas that are particularly important to us with a solid knowledge base with comparative competitive advantages. Then continuing progress in biotechnology, nanotechnology, and ICT promises further improvements in living standards and economic performance. Moreover, establishing world-class research centers to carry out cutting-edge research in areas important for national development is a key strategy in this scenario (Agarwala and Chaudhary, 2019; Kim, 2007). In addition to strengthening existing R&D institutions, such as ACCIMT, NERD centre, and biotechnology at universities and ITI, establishing world-class new research centres with advanced facilities in emerging technologies of national importance, such as nanotechnology, radioactivity use to improve the export market will be good targets for the country's R&D effort. NSTP may become a world-class facility provider for research in emerging S&Ts of national importance.

Even though the technology is available in the country, the lapses associated with SMEs in Sri Lanka are inappropriate planning, looking only for financial gains – attitudinal issues and high cost involved. Therefore, a proper mechanism needs to make the authorities to provide better direction to overcome lapses. Therefore, the amendments in NSTP for the inclusion and sustainability of SMEs are important.

Another is to address the maximum possible value addition to local natural resources and develop appropriate strategies for sustainable utilisation of the country's limited resources (Hirimburegama, 2020). A significant development in the country with the new government has to identify potential areas and appoint separate State Ministers to each area. HE, the President keeping the Technology Ministry, is a significant decision. Since independence in India, the Prime

Minister served as the Minister of S&T, and a professional served as the Secretary.

NASTEC, the policy formulation commission is directly under HE the President is also an important decision.

With the approval of the Cabinet of Ministers, the State Ministry of Skills Development, Vocation Education, Research and Innovation formulated a National Policy (or current Ministry of Technology) on S&T in consultation with relevant stakeholders in Sri Lanka. The Policy reiterates the commitment of the Government, in partnership with the people, for the sustainable utilisation of the country's resources for the benefit of present and future generations. This Policy aims to ensure that the resources of the country are exploited to their optimal potential and subsequent appropriate value addition while ensuring sound environmental management within the sustainable development framework of Sri Lanka. This policy covers all SMEs' protocols within the jurisdiction of Sri Lanka. And is supported by other policies developed in relevant fields. Smooth implementation of this Policy will be ensured and managed by the line Ministry responsible for the subject of SMEs.

Sri Lanka is a country having rich biodiversity and natural resources, and also most of the SMEs are associated with rural areas. Hence, the availability of manpower is not a major issue, but lack of knowledge on S&T and proceeding industrial activities may become a severe challenge when entering the process. Thus, the NSTP might be revised to incorporate training for the workplace. Similar to the Singapore government, NSTP may include a bridge between universities and industries on technological collaboration, leading towards improved skills of graduates on persistence, networking, self-confidence, business planning, financial literacy, and managerial skills combined with positive attitudes & professional ethics (Lim, 2008). Thailand, Korea, China, and other Asian nations have already used this strategy (Park, 2019; Weerasinghe and Dedunu, 2020; Wong, 1999; Kim, 2007). Graduates from this programme would be well-prepared to assist the industry in developing new products and services, particularly small businesses

(OECD, 2018). The Government is also to give soft loans for beginners as done in South Korea.

For example, Sri Lankan universities have students with high education in every field. Enabling some of them to innovate technology and commercialise makes it possible to create many patent licenses for businesses. SME expansion is possible via adequate direction and strategy. At UCIARS, students can complete their degree programmes while developing small businesses in the fields they are interested in. With proper NSTP rules, Universities might be regarded as researchers and knowledge suppliers, leading to discoveries, innovations, and product commercialization. The developed nations have practiced it in that way. That converts the graduates as job creators rather than job seekers.

As part of the current NSTP, published in 2008, there are strategies for bridging universities and industries by developing and strengthening existing S&T institutions and universities to generate quality research and train scientists. That encourages industries, R&D institutions, and universities to emphasise innovations and technology transfer and commercialise research outcomes (NASTEC, 2008). These tactics currently exist at a very basic level. As an example, plant biotechnology research outputs are unlikely to get to the commercialisation stage by enhancing industrial reliability. They have only been able to publish the laboratory experience. Because of poor industrialisation and commercialisation, universities and research institutes have shied away from research-oriented university ideas. It only makes academically-oriented paths a reality. Comparatively, research may be expensive, but in the end, it yields little benefit or personal advantages that cannot significantly enhance the state of society).

The issue for Sri Lanka is its exceptionally low level of R&D investment since cross-national data plainly show that it falls behind even countries with lower per capita GDP. The Sri Lankan government had planned to expand R&D funding to 1.5% of GDP by 2016; however, this did not happen. Given such financial limits, it will be even more critical to identify key areas of S&T expenditure, which may need evaluating its

financing objectives across multiple areas for strategic emphasis. In particular, S&T-driven transition into a knowledge economy necessitates a far larger emphasis on engineering and technology than has hitherto been provided (STEPI, 2019).

Why is R&D investment in Sri Lanka so low? There may be other things to consider, such as political, economic, social, or cultural causes. Is it attributable to government budget limits, a stagnating economy, or a more basic economic structure? What about ordinary citizens? Are they less scientifically literate or less supportive of science and technology? Such considerations should guide us in formulating preparations. Compared to South Korea, cross-cultural data from Hofstede shows that Sri Lanka has a low degree of uncertainty avoidance and a weak long-term orientation (STEPI, 2019). Some in rural areas who wish to become entrepreneurs have to obtain their skills through learning. Positive attitudes need to be inculcated rather than waiting until the state does everything. As in China, Thailand, Singapore, Malaysia, and South Korea, low-interest loans through NSTP would encourage youth to be involved in SMEs while learning the technology. Youth, especially in rural areas, need to get benefits from the partnership to develop SMEs.

As in Singapore, NSTP needs to develop towards attracting foreign talents. Additionally, attracting foreign direct investment to enable knowledge transfer from foreign to domestic firms will be part of the investment-driven and catching-up paradigm (Liu *et al.*, 2017; Liu, 2008; Akhtar *et al.*, 2016). To supplement the native technology available, the government should adopt a liberal immigration policy to draw in overseas skills. NSTP could also play a vital role by preparing linkages among authorities. Women in rural areas of Sri Lanka, if empowered, would educate their children and look for their prosperity.

Like the Spark programme in China, Sri Lanka also could create a programme directed by NSTP that could be packaged with S&T to benefit the rural poor. It should be an amendment with specific consideration of the needs of rural women. It could be the potential to improve the status of rural women by increasing their



incomes and participation in rural enterprises (Campbell, 2013; Fletcher, 1998; Vidanapathirana *et al.*, 2012).

In Sri Lanka, the Tourism Development Authority is the government agency in charge of tourism and related industry planning, development, regulation, and policy execution (SLTDA, 2020). Tourism is a very attractive industry in a country like Sri Lanka. Added values needed for the development of the tourism industry are herbal therapy, archaeological tourism, eco-tourism, *etc.*, combined with modern technology (UNCTAD, 2021; Chung and yang, 2009; Prasanna *et al.*, 2019; UNESCO, 2020, Vitarana, 2010). Then, NSTP will encourage the SME industry to make a business-friendly regulatory environment for local entrepreneurs with a conserving nature.

As in other countries, we should focus on main research areas such as finding new energy sources, i.e., solar, hydro, wind current, *etc.* Solar energy would have contributed to industry development if our S&T development had kept pace as in the past (Hirimburgama, 2020). Besides, renewable energy sources economically developed in the country include wind, biomass, and hydro. Aside from these, there are other sources such as wave energy, ocean thermal energy, geothermal energy, *etc.* So far, resource potential evaluations on wave energy have been carried out as part of initiatives including these sources (SSEA, 2021). However, it still has requirements for potential studies and pilot projects on other emerging technologies. According to a new analysis, the cost of renewable technologies such as wind and solar is dropping dramatically. That fuels the ascent of renewables as the world's cheapest energy source. The cost of large-scale solar installations get reduced by up to 85% in a decade. Removing pricey coal plants would also save approximately several gigatonnes of CO<sub>2</sub> every year. According to a new estimate, renewables will drastically undercut fossil fuels as the world's cheapest source of energy (Masterson, 2021).

NSTP could lead to a better legal environment and IP protection to industries and provide a better business-friendly regulatory environment for local entrepreneurs in Sri Lanka. This will encourage the graduates to

support industrial innovation and stimulate the secondment of undergraduate and graduate students to innovation-oriented companies, in particular SMEs (OECD, 2018), giving systematic support for public-private innovation partnerships (Kulasinghe *et al.*, 2018). The Korean work-frame can be taken as an example where commercialisation activities would be the main outcome.

NSTP needs to take steps to stimulate the local pharmaceutical and medical equipment industries, including medicine, with efficient benefit-sharing processes to encourage local medicinal practitioners, *etc.* Developing mechanisms such as updating databases to retrieve, collate, and document indigenous knowledge and practices is important. Also, a well-developed traditional medicine system will be a good opportunity to improve tourist attraction towards the country. Sometimes, it will bring the best investments to the country.

Contemporary policies in S&T in Sri Lanka should focus on how SMEs are affected by the current COVID-19 pandemic. In the face of this uncertainty, many SMEs are already struggling with their financial instability. Financial aid should be made available to companies in Singapore to sustain their businesses and support employees affected by the ongoing pandemic. The sector-specific Industry Digital Plans can provide SMEs with a step-by-step guide on digital solutions to adopt and relevant training for their employees at different stages of their growth. Furthermore, during this situation, the government is responsible for coordinating between the private sector and the government sector. Introducing e-procurement programmes could be encouraged to further level the playing field for SMEs to compete for tenders with larger companies, direct investors, and domestic suppliers. Then policies and other government agencies need speedy modifications to prevent the breakdown of the supply chain and client relationships associated with small and medium industries. The Malaysian framework is a good example.

#### **4. CONCLUSION**

This study has examined and reviewed innovation policies, research & other supportive reports, and

personal communication regarding the development of Sri Lankan SMEs and NSTP, and their various contributions to the national economy. Also, the challenges faced and the initiatives and incentives offered by the government-related ministries and agencies. The review indicates that Sri Lankan SMEs account for over 75% of the total enterprises in the country, and it offers 45% of employment and contributes to 52% of the country's GDP. The evidence suggests that SMEs play a vital role in the development of the nation's economy. The key findings from this study are that NSTP in Sri Lanka should intervene to manipulate the domestic and global challenges faced by SMEs, which could hinder SMEs resilience and competitiveness such as:

1. Necessities such as power, water, and cutting-edge technology are too expensive for small businesses to purchase and might harm their survival ability. That is due to the lack of a one-stop shop from technology to commercialisation.
2. High-cost technology imports, maldistribution, and informal use of technology is a result of weak implementation of policies and the less-resourced economy of the country.
3. Most industries are associated with rural areas, and the village people supply the workforce. The rural communities need frequent on-the-job training. That avoids their reluctance to embrace new technology. Lack of knowledge and facilities to access modern technology, and ICT, hinders efficient and productive business operations among local SMEs.
4. Low R&D facilities with poor collaboration between universities, other research institutes, and SMEs lead to weak commercialisation of research & indigenous knowledge and poor sustainability of natural resources.
5. High level of international competition, high level of private-sector interference without government manipulation, and weakness of national fund gathering and distribution.

## **5. POLICY RECOMMENDATIONS**

When considering the status of selected countries (China, Singapore, Malaysia, Thailand, and South

Korea) for this study, Sri Lanka has a very weak status and is hard to compete with them. Therefore, developing and implementing an appropriate NSTP policy for upgrading SMEs in Sri Lanka is an urgent need. Having identified some of the challenges facing SMEs in Sri Lanka, some amendments/strategies are proposed to adopt the development of SMEs in Sri Lanka. The following amendments are to be included in the NSTP:

Entrepreneurs may get interest-free loans from the state banks for a period of one to two years to help them grow their small businesses. Interest rates may be set at 3 percent to 4 percent for another 1-2 years until the well-established sector. Those who plan to commence a business may need to follow a course to prepare a business plan, financial & legal aspects, S&T knowledge, supply chain with a positive attitude without waiting for the state to provide everything.

- That indicates the situation in all other countries.
- If indigenous knowledge/technology is available, start with it and gradually take up high technology for larger commercialisation.
- Improve the basic infrastructure (i.e. electricity, water) and be given at a low rate for three years until the business get established.
- Implementation of the National Science and Technology Policy (NSTP) under NASTEC to influence technical innovations within SMEs. Since promoting SMEs is not a mandate in the current NSTP, it is an urgent necessity as the mandate of NASTEC is finally to benefit people in the socio-economy.
- The NSTP can narrate towards the induction of S&T capabilities by increasing the number of projects offering consultancy and expertise knowledge to SMEs, such as ICT, financial planning, marketing planning, access to local and export markets, *etc.*
- Furthermore, the amendment of NSTP is necessary to develop SMEs to collaborate with the government and industries, universities, and research institutes to develop the R&D sector towards SME development.
- NSTP should be amended to establish new science-based technologies to protect the

environment, build safer homes, schools, and factories, develop energy-saving transport systems, advance in medicine, save lives and improve health standards throughout the country.

- The amendments would link NSTP with SME establishment and sustainability.

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