

Article

Determinants of ICT Innovations: Lessons Learned from Sweden and Sri Lanka

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Abstract: Innovation is critical for enterprises and the country's economy, and it has resulted in an improvement in living standards. There may be appropriate lessons to learn from other countries, but their adoption must be assessed due to education and living standards variations. This paper aims to build an in-depth understanding of the stimulating factors for ICT innovations from Sweden, and examines their adoption in the context of a developing country, Sri Lanka. ICT innovations significantly impact development in other sectors, as they can ease doing business and other essential services. This study is based on seven interviews, including key people leading innovation activities in Sweden. Then, it critically analyses and presents the application of stimulating factors in Sweden to the context of a developing country, namely Sri Lanka. The results indicate that education and mindset, a risk-taking environment, embracing failures, digitalisation and collaboration are the critical determinants of ICT innovations in Sweden. This research is vital for educational policymakers in universities, technology transfer offices, and governmental policymakers.

Keywords: collaboration; determinants; developing country; innovation; Sri Lanka; Sweden



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1. Introduction

Innovations allow organisations to stay relevant in the competitive market while playing an essential role in the country's economic growth. The world market for technologically advanced products is growing 2.5 times faster than the world economy (Cherner and Alaudinova 2021). The ability to solve critical problems depends on radical innovations, and developing countries need this ability more than ever as the living standards are rising due to innovations (Dumpit and Fernandez 2017). Innovation was outlined by Baregheh et al. (2009) as "the multi-stage process whereby organisations transform ideas into new/improved products, services or processes, in order to advance, compete and differentiate themselves successfully in their marketplace". Many experiences have accumulated in innovations in developed/OECD countries, while this is challenging in developing countries (Aubert 2004). According to the OECD (2007), innovation for growth is strengthened by advances in new technologies and a greater focus on creating and using knowledge. Understanding how innovations arise and are adopted and which policies can support them is crucial for developing countries to overcome their growth barriers. The emergence of digitalisation and automation, which is rapidly altering the economies around the world, has catalysed the above need in developing countries (Cirera and Maloney 2017).

ICT can potentially help lower- and middle-income countries to tackle a wide range of health, social and economic problems. The advantage of ICT innovation is that it does not require large-scale infrastructure development or policy changes by the government. In addition, it is not very capital-intensive. However, a national policy for internet capacity and pricing is urgently required. Innovations in digital space require primarily skilful

minds and a set of computers connected to the Internet to get going. At the same time, ICT innovations typically generate a high magnitude of income for the country. In Sri Lanka, IT has also become the fourth largest export earner of the country. The export revenue of this sector grew from USD 166 million in 2006 to reach USD 968 million in 2017, with a workforce of over 85,000. With value addition of over 90% and high-paying jobs, it has significantly impacted the country's economic growth. This growth indicates that ICT innovations are ideal for a developing country to aid its financial development.

A comparison of stimulating factors for ICT innovations between Sweden and Sri Lanka is interesting for various reasons. Sweden is one of the most innovative countries, and Sri Lanka has a clear understanding that this is a sector of extreme necessity. The following section presents the background and the strengths of innovations in Sweden, followed by the experience of Sri Lanka and its potential for growth in the ICT sector due to innovation.

Sweden has a per capita GDP of USD 55,027.36, with a population of 10.28 million as of 2019 ([The World Bank 2021](#)). The country has a long history of innovation, and exports are a significant driving force for Sweden, as the domestic market is relatively small. Making schooling compulsory for 7–13-year-old children in 1842, Sweden started the game-changing journey from a poor agricultural nation to a prosperous innovation leader ([Swedish Institute 2021](#)). Today, Sweden has secured the second position in the Global Innovation Index published by World Intellectual Property Organization (WIPO) for the second consecutive year ([Cornell University, INSEAD, and WIPO 2020](#)). With its start-up-friendly business climate, Sweden has high levels of cultural tolerance and diversity, and a broadly popular social safety net facilitates entrepreneurial risk-taking. Sweden has established itself as a home to Europe's largest tech companies and a fertile incubator of up-and-coming entrepreneurs. Additionally, Stockholm produces the second-highest number of tech unicorns per capita, behind only Silicon Valley ([Raudabaugh et al. 2021](#)). Spotify, Klarna, Candy Crush, Minecraft, Skype, MySQL, Volvo, Ericsson, IKEA, Wrapp, Memeto, and Bloglovin are well-known start-ups from Sweden.

VINNOVA, the government agency under the Ministry of Enterprise and Innovation, plays a crucial role in building Sweden's innovation capacity, contributing to sustainable growth. The National Innovation Council (NIC) is another entity existing under the Ministry of Enterprise and Innovation and is chaired by the Prime Minister, i.e., the highest possible political level. Hence, the smooth and flexible transfer of advice from the NIC to politics and the policies in public agencies are taken place. The NIC and its political prominence have given innovation guidelines much more importance than before within the government and government agencies ([Edquist 2018](#)). By evaluating the NIC and adapting to local conditions, [Edquist \(2018\)](#) argued that the Sweden NIC can serve as a role model for other countries and regions to initiate and govern a holistic innovation policy.

In contrast, developing countries face barriers to innovation that are orders of magnitude more challenging than those found in the developed world. Low rates of technological adoption in developing countries, barriers to accumulating physical and human capital, low firm capabilities, and weak government capacity comprise the range of challenges they face ([Cirera and Maloney 2017](#)).

Sri Lanka is a lower-middle-income country with a GDP per capita of USD 3853.1 as of 2019 and a total population of 21.8 million ([The World Bank 2021](#)). Sri Lanka became independent in 1948 from the UK and faced a civil war for nearly thirty years, ending in 2009. The average literacy rate is 91.7%, while it is 98.8% in people between 15 and 24 years of age and 79.1% among those aged 65 and older. The government's expenditure on education in 2021 is 9.1% of the government's total expenditure, and it is 1.81% of the GDP. The number of researchers per million people is reported as 281.29, and the gross domestic expenditure on research and development is 0.10% of GDP as of the most recent statistics in 2017. [Table 1](#) shows the gross domestic expenditure on R&D, and there was a considerable increase in funds received from abroad for R&D activities in 2017, while the highest allocation was given to government and business enterprises. The highest science

percentage is in the agricultural sciences, valued at 35.76%, and the second-highest is in engineering and technology, 20.19% (UNESCO 2021).

Table 1. Gross Domestic Expenditure on R&D (GERD) in Sri Lanka.

GERD by Source of Funds (%)	2013	2014	2015	2016	2017	2018	2019
Business Enterprise	40.68	41.24	34.44	43.49	40.26	39.57	
Government	53.88	56.17	59.64	50.50	46.59	53.07	
Higher Education	0	0	0	0	0	0	
Private Non-Profit	0	0	2.33	0	0	0	
Funds from abroad	5.03	2.13	1.48	3.45	7.27	5.08	
Not Specified	0.41	0.46	2.11	2.56	5.87	2.28	

Author created using the Sources: (UNESCO 2021; National Science Foundation 2018).

Sri Lanka ranks 101 in the Global Innovation Index (Cornell University, INSEAD, and WIPO 2021), demonstrating its innovation system's weakness. However, other indicators show that there is potential for growing the economy through ICT innovations and start-ups. According to the Global Startup Ecosystem Report GSER 2020 (Startup Genome LLC 2020), Sri Lanka's start-up ecosystem's value has more than quadrupled from LKR 5.4 billion to LKR 21.8 billion in the past two years. The country ranks number one for affordable talent in the Asia-Pacific region. Sri Lanka is emerging as a global destination of choice for knowledge solutions. According to Raudabaugh et al. (2021), Sri Lanka ranked among the top 25 in its global location index for countries for digital hubs based on four major categories: financial attractiveness, people skills and availability, business environment, and the new digital resonance category.

Furthermore, the authors of the same report recommended increased government intervention to enable these locations to thrive as centres of advanced R&D, enabling them to reach the next level of innovation. E-commerce in Sri Lanka is supported by the low cost of data, as affordability is one of the top three factors affecting customers' decisions to get online and stay online. Sri Lanka is ranked 21 out of 181 countries for mobile broadband prices based on price in USD as a percentage of GNI per capita, which is one of the lowest prices in the world. Lower prices lead to greater adoption and use, supporting online business growth as more people use internet services (PwC 2019).

All these indicators show that there is a tendency to uplift ICT innovations in the country. However, implementation mechanisms should be carefully examined. It is difficult to develop one general theory, because states are highly heterogeneous in terms of size, income level, and degree of cultural homogeneity (Chaminade et al. 2018). With the above background, this study aims to examine the stimulating factors for ICT innovations in Sweden and propose recommendations for Sri Lanka within a feasible context to promote ICT innovations in the country, facilitating a change in living standards. The study attempts to answer the research question: what lessons can be learned from Sweden to escalate ICT innovations in Sri Lanka? To the best of our knowledge, this is the first paper examining the adaptability of innovation practices from a developed country that is higher ranked for innovations to a developing country with weaker innovation indicators.

2. Methodology

Learning about the innovation culture in another country where the researcher has less experience in its socio-economic factors requires an in-depth inquiry into the hindered areas in the study. There has not been much research conducted to understand the determinants of the Swedish ICT innovation ecosystem. Individuals and contributing institutions may have different opinions on the factors contributing to the ICT innovations in the country.

The search for interviewees from Sweden was performed through purposefully selected websites for innovation centres in universities, start-up companies, and government agencies in Sweden. Then, interview requests were sent to twenty purposefully selected individuals based on their involvement in the ICT innovation activities. Finally, seven

interviewees responded, expressing their willingness to participate in the interviews, and all respondents were high-ranking people handling a considerable amount of responsibility in their institutions. Among the interviewees, there were four chief executive officers (CE1, CE2, CE3, CE4) directly related to ICT innovation start-ups and an innovation agency. Two were innovation coaches (IC1, IC2) with many years of experience in innovation activities. Among these two, one respondent (IC1) had previously worked at Silicon Valley. He had two qualifications as a business development coach and innovation strategist. The other was a university professor (UP) researching and teaching innovation studies in a leading technological university in Stockholm. Six interviews were conducted as face-to-face interviews, while one interview (CE4) was performed using Skype. All interviews were conducted in Sweden from September 2019 to October 2019.

Concerning the sample size, [Guest et al. \(2006\)](#) demonstrated that saturation (i.e., the point at which no further information is gained by conducting more interviews) is reached rather rapidly. Beyond 12 interviews, saturation is generally at its maximum point, and seven interviews enable one to collect most of the critical information. According to [Dworkin \(2012\)](#), a massive number of articles, book chapters, and books provide guidance and suggest anywhere from 5 to 50 participants as being adequate for qualitative studies using in-depth interviews. [Young and Casey \(2019\)](#) claim that significant coverage of codes ranged from a minimum sample size of six to nine, and substantial theme completion necessitated sample sizes of 7–10 cases. Likewise, [Romney et al. \(1986\)](#) calculated that sample sizes as small as four enable capturing highly accurate information with a high confidence level (0.999). For this reason, it was initially decided that no less than four interviews would be conducted, as this would ensure a high level of capture of critical information ([Striukova and Rayna 2015](#)).

The duration of each interview was around one hour, and the questions were prepared with the basic understanding gained by reading previous studies. By spending a prolonged amount of time in the data collection process, the interviewer developed an in-depth understanding of the phenomenon and the people who lend credibility to the process ([Creswell 2014](#)). Before meeting interviewees, the author researched the interviewees' background and experience in the domain under study. This made it easy to build a close and trustful relationship. The greater the researcher's experience with the respondents, the more accurate or valid the findings will be—the time the interviewer spent learning about interviewees before the interview delivered some additional advantages. The interviewer was able to relate some questions to the interviewees' previous experiences and obtain more elaborative answers. The first interview provided a holistic view of the country's innovation ecosystem, and therefore some questions were altered after the first interview. Some interviewees provided valid printed documents and books and some online resources for referencing purposes. All of the interviews were conducted in a reasonably informal way to make the interviewees feel that they were participating in a discussion or conversation rather than a question-and-answer session. This semi-structured interview approach provided opportunities for both the interviewee and interviewer to discuss the topic in more detail. Using open-ended questions, the interviewer had the chance to probe the interviewee to elaborate on the original answer. This approach was helpful in the study, as the fundamental idea behind qualitative research is to learn about the problem or issue from the participants and address the questions to gain information.

Assuming that sensitive information may be revealed during interviews, the following actions were taken to safeguard informants' rights. (1) The objective and the nature of the research and how data will be used were articulated in the interview request letter and verbally communicated before the interview began. (2) Informants' acceptance for the interview with the articulated conditions was received as a reply to the email. (3) The informant was informed regarding the interview data recording, and the interviewer obtained their verbal consent before the voice recording began. Further, the researcher did not force any participant to sign the consent forms, and all the participants voluntarily participated.

Interviews were started by informing the interviewees that they could withdraw at any time from the interview without any unfavourable consequences.

3. Analysis

The recorded interviews were listened to until they became familiar and then transcribed. Information was treated confidentially at the time of transcribing. The transcripts were read with focused attention to generate codes systematically and rigorously to make them make sense. The textual data were evaluated line by line to discover relevant discrete events, situations, thoughts, actions, perceptions, and interactions that were coded as concepts. Once a basic set of concepts was established, these concepts were utilised to code the remaining data while seeking new concepts and improving old concepts. Following that, similar concepts are classified into higher-order categories, which are needed to reduce the number of concepts to build a big picture. The categorisation was performed in stages. The concepts were combined into subcategories, and then subcategories were combined into higher-order categories. Then, the candidate themes were developed from the analytic works from the earlier coding phase and tested with the research question. [Braun et al. \(2019\)](#) stated that good themes tell a coherent, insightful story about data concerning the research question. The themes were reviewed by compiling all coded data for each candidate theme, and the final themes were defined. The advantage of thematic analysis (TA) is that it provides a highly flexible approach that can be modified for the need of many studies providing rich and detailed data. [Braun and Clarke \(2006\)](#) argued that another advantage of TA is that it is easy to understand and grasp for a researcher who is not relatively familiar with qualitative methods. Thematic analysis is a valuable method for examining the perspectives of different interviewees, highlighting differences and similarities, and generating unanticipated insights. The advantage of having less technical complexity in the methods was the ability to grasp the essence of the insights provided by all informants and generate a reasonably good set of results. However, the high flexibility of thematic analysis can lead to inconsistency and a lack of coherence when developing themes from the research data ([Todres and Galvin 2005](#)).

4. Results

The results were generated reasonably, and we reported the full range of findings, including findings contrary to the themes. When identifying codes, researcher did not favour any of the informants or any of the informants' opinions.

All interviews were started with the entry-level question "how do you define innovation?". The common definition provided by all respondents for the question was that innovation is something new and valuable; it must meet a need in the market. However, one respondent (UP) extended his definition, claiming that,

"... novelty is a paradoxical pro concept because nothing can be completely new. It always comes from something that exists ..."

4.1. Education and Mindset

People's creative attitudes have a significant influence on their innovative performance. From diverse perspectives, several informants emphasised the importance of the innovative mentality.

One innovation coach (IC1) revealed that:

"... if you seriously want to create an open society an innovative society, everybody has to be educated. That means both boys and girls have to go to school. Some countries do not send girls to school. Why not? There. You are just disqualifying half of the population, half of the brain force, half of the workforce. So, if you truly want to compete globally, liberate your citizens, educate everyone, love them, support them. You know, and then it'll work".

One CEO (CE3) also revealed that a high level of education in Sweden is an influential factor for the current status of innovativeness. The government has started more and more universities during the last thirty years, and so the level of education is extremely high in the suite of the total population compared to other countries.

“... that I think has been very, really important because when people are educated, they start more to think on the road, they travel and see other things in the world and perhaps are not happy just being in a big company and doing a small piece of it. So, the education level has been essential, I think”.

CE3 explained the gradual change in the mindset of students as follows:

“It starts when you go to kindergarten, Sweden, promotes critical thinking and, asking questions and you are influenced and urged to do that already when you’re starting kindergarten. So, the ability to think independently and not listen to somebody else that you think is right. Ask questions, try to think on your own, come up with your answer on your own. That’s an extremely important factor behind innovation. You think that’s a really important factor in hierarchical societies with much upstairs and downstairs and all men’s structure. It doesn’t promote innovation in the same way. I think that’s really important”.

The importance of the nonhierarchical culture for innovation within the organisation was highlighted by another informant (CE1) as follows:

“To create an innovative organisation, you need to “leave your title at the door” Everyone must be encouraged to offer ideas, regardless of their rank or tenure. This allows for a diverse range of opinions, ideas, and perspectives. An intern may have a brilliant idea but may be scared to offer it due to rank differences. Leaving the titles empowers them to have confidence in their idea. (‘Leaving the titles’ is even a Swedish proverb)”.

Another point of view was given by IC1 relating to the equality among citizens and employees within the organisation as follows:

“... I honestly mean that they want to create an innovative society. They have to take the consequence, liberating their employees or their citizens, treating them all as equals, empowering them to follow their dreams, giving, supporting them in their attempts to enjoy the successes, taking care of the failures. But if you don’t care about your people, if you don’t care about your employees, then you’ll never be innovative”.

One CEO (CE1) revealed that mixed teams (if well managed) have better conditions for making more qualified decisions than homogenous teams. The most common obstacle is single-sex teams. Mixed teams are more creative, contain more diverse points of view, and show improved quality of decision-making. According to the opinion of another informant (CE3), the idea generated should be both new and valuable. The value should be societal or for businesses. Otherwise, it is not an invention.

Another two interviewees (IC1 and CE3) revealed that showing good examples and role models to students is another way to motivate them, and Sweden has a long history of strong innovators for this purpose. They need inspiration from other people, and at the same time, to be shown that their ambitions are possible to achieve. In this way, students are, in general, inspired to adopt innovative mindsets. They have venture competitions to generate business ideas in schools starting from eight to ten-year-olds, young entrepreneurship in schools and high schools, school projects starting a company, and trade shows. Business skills taught in schools together build up the mindset required to become innovative and entrepreneurial. CE1 also pointed out the facilities available for student support, giving the below examples:

“There are different student organisations that are promoting innovation capacity building. (*DRIVHUSET NORDEN* n.d.; *Om JA Worldwide* n.d. is for example)”.

4.2. Risk-Taking Environment

There are some unspoken notions, such as innovators being men and innovations being technological solutions, which mean that there is a risk of overlooking the innovation potential among large groups of individuals and entire sectors. However, Sweden has become a risk-free environment for innovators. IC2 revealed that:

“if you start entrepreneurship journey, start up a company, you don’t risk your children’s education. The education is free. You don’t risk your children’s health because the medicine and treatments are free. So you have something that’s basic support, and you’re not risking your entire future for your kids. And that’s, of course, something that we’ll take off the edge of risking everything for something”.

Sweden has a sound parent-led family system. Additionally, many parents typically take up to two years of their parental leave. Additionally, if they do not take it, they can save those days and take it later. During this period, people start thinking about their future, and many start-ups are initiated. Meanwhile, prolonging their holidays also enables people to be able to work on start-ups and innovations. These are soft things in society that help to enable innovation, and ultimately, all of these small factors mount up to something larger.

Sweden has a significant financial aid facility for business start-ups. While VINNOVA is a government agency for providing funds for innovators, Almi provides advice from experienced advisors knowledgeable about growth and operating a business. They provide loans to companies with growth potential and assist in their business potential. One interviewee (business coach) revealed that you do not have to pay this loan back if the company fails or the idea fails. The debt not forced upon you or your family, and thus the risk is low. Additionally, he further revealed that financing is much easier for digital space inventors.

4.3. Embracing Failure

The fear of failure in an innovation journey may cause anxiety and aversion regarding risk-taking. Failure, on the other hand, is something innovators should embrace rather than shun. By failing at something, people have the chance to recognise deficiencies that must be addressed in order to face future challenges. Almost all the interviewees revealed that failure is a part of innovation. One CEO of a technology transfer office (CE1) claimed that only about 15% of the nearly 300 projects they receive annually are successful, and further explained that:

“... it does not mean that 85% are failures ... but a lot of learning goes back to the individual ... ”

Sweden has a flat and very open system which is competitive, but, at the same time, technology transfer offices are willing to help each other, as it is possible to fail in Sweden. The legal system and social security network exist in such a way that nobody will lose their houses or their pension by failing in innovations; CE1 further revealed that:

“... because it is possible to fail in Sweden and you will not lose your house and your pension and all these things”.

4.4. Collaborations

The historical strength of Sweden’s collaborative society was revealed by an informant (CE3) as follows:

“Since hundred years ago, Sweden society is built very much upon collaboration. And it is vital to cooperate and collaborate extremely, and Swedish society is very flat and not hierarchical. There’s not much upstairs and downstairs”.

Then, in another instance, he further revealed,

“And from kindergarten, we are taught to cooperate and question things, which is a very, very good ground for coming up with complex innovations”.

The individuals' goal-oriented and effective collaboration was highlighted by the same respondent as follows:

“So if you take five Swedish engineers and lock them into a room and on a piece of paper, you'd say, okay, you're going to develop a system, and they're going to do this and this. And now you have two years come back. Okay. They would probably come up with something quite interesting. And, because we're pretty good at collaborating and organised sort of setting. In some other countries, perhaps it would not be the same, but because people are more used to that, well, I don't know what I'm going to do. Tell me I need a specification or something like that. So, that type of society is very important for companies”.

The university professor (UP) highlighted the importance of having a relevant network for collaborations, and student placement should be conducted with relevancy targeting with regard to what kind of innovation is targeted. For example, when a group of students is engaged with a very complex AI start-up, the student should collaborate with a company on that scale. He further revealed that:

“Then I think our support structure is very nice. I can go to Sting. I can go to KTH Innovation. I can go to a technology transfer office. But if I say I have something that will be useful for self-driving vehicles in the future. I am not sure that we know how to do that because that is basically a collaboration with Scania or Ericsson, a company developing self-driving cars. We need to know a lot of companies in controls systems. We need some AI companies. So that ecosystem, when it becomes that complex, I'm not sure that the university can play such an important role, which is interesting because we also think about the more knowledge content there is. The university's more important will be innovation because we're talking very much about knowledge-based innovations. And we think of the university because we are generating knowledge, we will have a more important role. I think that we will not necessarily have a more important role in the future unless we develop new ways of collaborating. And I do not see that at the moment. And this is, of course, if you look at Silicon Valley, they are good at these things because they have a lot of networking”.

Furthermore, the same respondent highlighted the importance of value creation in collaborations rather than just adding more and more numbers set in Key Performance Indicators (KPIs), and it was revealed that:

“... So, we have all of these KPIs, key performance indicators, or number of startups, number of ideas, number of patents, number of licenses. That is a measurement thing, and that does not necessarily value creation. I believe very much in closer collaboration with different types of companies. But today, we do not have the objectives to support that. We do not have the measurements to support that. And we do not even have the norms to support. And because it's not considered to be good to go out there and work with them”.

Another vital factor is joint research publications between university and industry.

“... we should publish right. Relevant stuff. And we should collaborate and do research together with companies in new ways”.

TTOs in universities are conducting collaboration activities with the industry in parallel to mainstream education. Some are organised by the TTO, such as “Demo Day”, for students to showcase start-ups. One informant (IC1) revealed that they conduct about 200 activities per year, which is huge. Student organisations organise some events, and these include “innovation week”, “entrepreneurship week”, and “Russia Forum”.

4.5. Digitalisation

Embracing technology in the early stage has elevated the level of innovation in the country to the next level of innovation. Digital innovations in the country are currently booming, including multi-billion businesses such as Spotify, Skype, and Klarna. One informant who is a CEO revealed that:

“The digitalisation in Sweden was very early with the political reform 30 years ago, and I think it was called the PC reform. So, it was a subsidised program 30 years ago, where everybody is weird and could buy a PC for a very low price, extremely low prices. So, in the eighties, Sweden was the country globally with the highest penetration of personal computers early out. So, the whole population got used to using computers very early. And then after that, the government also have decided to invest a lot in high band networks. I think 90% of the population today can imagine it’s 90% have access to fibre”.

Sweden adopted the national broadband plan in 2016, and the government’s vision is a “completely connected Sweden” by 2025 (Government Offices of Sweden 2017). Furthermore, Sweden has acknowledged the significance of the 5G rollout, and the Nordic prime ministers signed the declaration in May 2018 (European Commission 2021a).

A summary of the above results is presented in Table 2.

Table 2. Key findings of the study.

Theme	Knowledge Contribution
Education and Mindset	Education for all, critical thinking and asking questions are encouraged as early as kindergarten—a crucial component in the development of new ideas, organisations’ non-hierarchical culture for creativity, students are provided with good role models
Risk-Taking Environment	Risk-free environment for innovators, freely available health and education, financial aid facility for business start-ups
Embracing Failures	Technology transfer offices to support each other, as failure is conceivable in Sweden, the legal system and social security system are in place to ensure that no one loses their home or pension because of a failure to innovate, encouraging and educating students to consider failure as a learning for future challenges.
Collaboration	Relevant network for collaborations and student placement, good support structure for innovations (Sting, TTO, etc.), value creation in collaborations is more important than KPIs, collaboration activities with the industry in parallel to the mainstream of education
Digitalisation	Digital innovations are currently booming (Spotify, Skype, Klarna), PC reforms was a key factor, high accessibility to broadband

5. Discussion

This study covers essential determinants of the innovation process in Sweden, especially in the ICT domain. Developing countries struggle with financial difficulties regarding investing in research and development in many fields, such as product manufacturing. Hence, ICT innovation is a good alternative for developing countries, and it is more feasible with their financial capabilities. There are suitable lessons to learn from other countries where processes for innovation are well-established.

Innovations can be defined as new creations of economic significance. Following most of the literature on these matters, innovation is related to the emergence, combination, and diffusion of knowledge and its transformation into new products and new processes. Innovation is intrinsically related to knowledge, which can be either entirely new knowledge or old/existing knowledge combined and used in new ways. For this reason, the production of knowledge and its development is a fundamental activity of any innovation system, albeit certainly not the only one, or the most important one

Among the five themes identified, namely education and mindset, risk-taking environment, embracing failures, collaboration, and digitalization, all themes except for digitalisation are correlated with universities and other educational institutions. Hence, universities can act as trusted intermediaries to bring together multiple parties and allow them to collaborate in a trusted environment for improved innovations (Striukova and Rayna 2015). Therefore, in the discussion, the authors mainly focus on developing and finding ways to stimulate innovations in Sri Lanka through university–industry collaboration. The existing weak university–industry partnership in Sri Lanka (Wijesinghe et al. 2018; Weerasinghe and Dedunu 2021) can be strengthened by introducing these as value additions.

Sweden’s long-term focus on education and research has had a significant impact on the innovation capacity. Higher education in Sweden has had a three-cycle structure since 2007, mainly due to the Bologna process. According to the general regulations in the higher education framework, higher education institutions (universities and university colleges) are free to define their own goals and how the programs are organised (European Commission 2021b). Many previous studies (Lee et al. 2016; Castellacci and Natera 2013) showed that education is significantly influential for ICT innovations, since it provides human capital and knowledge for ICT innovations. The education level within a nation can shape its capability to absorb advanced foreign technologies (Castellacci and Natera 2013).

Furthermore, education helps to create a national pool of entrepreneurs who demand innovation and efficient production methods to gain competitiveness (Varsakelis 2006). According to Varsakelis (2006), education affects innovation productivity in four ways—producing a qualitative education system with a scientific orientation (Acs et al. 2002), creating a highly skilled workforce relatively fixed within the borders of a country, promoting the organisation of knowledge creation and learning within firms, and producing an innovation network including customers, as innovation is stimulated by the presence of a sophisticated, high-quality, sensitive local customer base (Furman et al. 2002).

The education system in Sri Lanka is still primarily a teacher-based education and exam-based evaluation system, which does not provide many avenues for thinking and self-initiating tasks. Students attending universities anticipate the same atmosphere and, as a result, do not develop into good thinkers or task initiators. Students want to pass their exams and get a job in a reputable, well-established firm or work for the government. People are not confident to accept changes. This situation hinders the growth of innovators in any society. The Presidential Task Force on Sri Lanka’s Education Affairs (2020a) has identified the importance of innovative citizens in its latest educational reforms under section three as

“Innovative Citizens: Instilling a culture of innovation within which citizens are trained to employ creative approaches, foresight, and new technologies in all aspects of work. Students of all ages must be encouraged to develop mindfulness, creativity, and an entrepreneurial mindset. That also calls for an emphasis on driving research and development across all sectors”.

In achieving this goal, providing knowledge inputs to the innovation process, providing R&D results, and, thus, creating new knowledge is an important support function for university students. Further, universities in Sri Lanka can introduce new ways and means to develop an innovative mindset among undergraduates. From the very beginning of their university studies. Curriculum and student activities can be adjusted. For example, undergraduate modules such as design science and knowledge management are rare or non-existent in the Sri Lankan university curriculum. However, we are driving our youth towards a knowledge-based society empowered with innovations. The report submitted to the Presidential Task Force on Sri Lanka’s Education Affairs (2020b) to education reforms in Sri Lanka has also identified the issues with the examination system and the lack of creativity and innovativeness among students. Hence, the authors believe that the evaluation of Sri Lankan education should focus on student-centred and collaborative learning.

Furthermore, education for all is another important factor highlighted by the respondents. Though this concept is mandatory in both countries, and despite studies indicating the importance of girls' education for development, gender gaps in education continue. In primary education, just 49% of nations have achieved gender parity. At the secondary level, the gender gap widens: 42% of nations have achieved gender parity in lower secondary education, while 24% have achieved gender parity in upper secondary education (Unicef n.d.). An estimated 130 million girls aged seven to seventeen are out of school (Owen 2021). All these facts indicate that there is a need in addressing barriers to providing education for all.

National and local governments worldwide are particularly interested in encouraging new businesses in frontier technology areas (UNCTAD 2021). Sri Lanka Association of Software and Service Companies (SLASSCOM) has fostered open collaboration, support, and a strong growth mindset among university students targeting one thousand start-ups by 2022 (PwC 2019). Universities and industries can establish partnerships in support services for innovating firms, incubation activities such as providing access to facilities, administrative support for innovating efforts, financing of innovation processes, and other activities that may facilitate commercialisation of knowledge and its adoption. This collaboration can also provide consultancy services relevant to innovation processes, e.g., technology transfer, commercial information, and legal advice.

While VINNOVA and Almi provide financial assistance for start-ups in Sweden, the Sri Lanka Export Development Board has initiated the "Enterprise Sri Lanka" program and provides subsidised loans for the youth to accelerate their business ventures. Another two initiatives from the ICT Agency of Sri Lanka (ICTA) named "Spiralation" and "Disrupt Asia" is funded by the government, providing opportunities for start-ups with exposure to investors, accelerators, and mentors. The Sri Lankan business community has embraced the idea that start-ups are a part of their network in the recent past. Wijesinghe et al. (2018) claim that industries are willing to provide financial support for university start-ups, but no proper mechanism is built to link universities and industries. These facts fuel the government and industries supporting the innovation ecosystem in Sri Lanka, but an adequate channel for communication is required.

Digitalisation will make an immense impact, as predicted by scientists and social commentators. The areas such as artificial intelligence, big data, the internet of things, and other technologies will demand new skills and competence to live and work in the digital world. Higher education institutions embrace these digital changes and have been accelerated by the COVID-19 pandemic situation around the world. This situation has created a rapid change in switching to digital learning and teaching. A big step forward has been taken, and European Commission (2020) predicts that the use of digital technologies will undoubtedly continue and intensify, even when a total return to normality is possible. However, higher education posits more than academic learning, and it requires social and civic skills and confidence in personality and identity. These social aspects in higher education are vitally necessary to develop a complete graduate, and cannot be fulfilled totally by digital systems. Digitalisation supports the innovation process. However, authors believe that new digital innovations should address the challenges in social developments due to rapid digitalisation.

As a part of digitalisation, digital sexism is a barrier and a myth that needs to be eradicated in Sri Lanka. According to the National IT-BPM survey (ICTA 2019), only 29.4% of the entire ICT workforce in Sri Lanka are women. Culturally, Sri Lankan women, especially in remote areas, are not motivated into technological usage. There is a parental influence that women are not meant for technology. However, this trend creates a void in ICT innovations, not identifying the needs of women accurately. Sri Lankan media can play a role in communicating and storytelling about women in IT, creating more female role models and motivating others to join in.

The study's limitation is that it does not cover a holistic policy framework, but it covers only the determinants of the ICT innovation process. Developing a holistic innovation

policy requires understanding the nature and dynamics of innovation processes in the socio-economic context of innovation systems. Equally important, holistic innovation policy also requires an understanding of the nature of the problems in the systems, including the unintended consequences of the policy itself. Enthusiastic research to examine and develop a national innovation policy for Sri Lanka can use this study for policy interventions.

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