

2016/17 Knowledge Sharing Program with PASET:

National HRD Strategy to Support the Social and Economic Transformation of PASET Member Countries with Focus on Senegal

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Ministry of Strategy
and Finance



Korea Development
Institute



Preface

Knowledge is a pivotal driver of growth and the fruit of all endeavors dedicated to socio-economic development. Accordingly, knowledge sharing has become an essential tool in strengthening nations' capacity to design and execute policies and programs. On the global front, the UN is making efforts through its Sustainable Development Goals (SDGs) to underscore the role of both knowledge and knowledge sharing in tackling sustainable development issues and in establishing and enhancing global partnerships.

Indeed, knowledge laid the foundations for Korea's remarkable transformation from a poor agro-based economy into an industrialized nation with an open and democratic society. And the process, though arduous, has enabled Korea to accumulate invaluable and practical lessons not found in conventional textbooks. Now, as a global economic leader, Korea is working with the international development community and partner countries to identify key development challenges and solutions by sharing its tangible know-how and experience.

The Knowledge Sharing Program (KSP) was initiated in 2004 by the Ministry of Strategy and Finance (MOSF) and is implemented by Korea Development Institute (KDI). The program plays a vital role in further expanding knowledge sharing as well as in strengthening government partnerships with low to high income economies. As of this year, 940 research studies have been conducted with 59 partner countries. And in 2016, KSP policy consultations and capacity building workshops were organized with 28 partner countries including new partner countries such as Jordan and the Sub-Saharan Africa Partnership for Skills in Applied Sciences, Engineering and Technology (PASET).

The 2016/17 KSP with PASET was undertaken by MOSF and PASET to support the formulation of the "National HRD Strategy to Support the Social and Economic Transformation of 3 PASET Member Countries with focus on Senegal." To that end, KSP and PASET engaged in a range of collaborative efforts including exchanging development experiences, conducting joint studies, and designing a policy action plan in line with the country's development targets.

It is with great optimism for the future of PASET member countries that the results of the 2016/17 KSP are presented. I firmly believe that KSP will serve as a stepping stone to further elevate the mutual learning and economic cooperation among our countries, and hope it will positively impact PASET member countries' attainment of its goals for sustainable development.

I wish to convey my sincere gratitude to Senior Advisor Dr. Byung Suk Jung, Principal Investigator Prof. Sung Joon Paik as well as project consultants Prof. Man-Gon Park and Dr. Sang Hyon Lee for their extensive contributions. I am also grateful to Executive Director Dr. Kwangeon Sul, Project Manager Dr. Song Chang Hong, Project Officer Ms. Bora Nam and all members of the Center for International Development (CID) for their hard work and dedication to this program. Lastly, I extend my warmest thanks to the PASET collaborates, Ministry of Higher Education, Research and Innovation of the Republic of Senegal, Ministry of Education of the Republic of Rwanda, Ministry of Education of the Federal Democratic Republic of Ethiopia, PASET Secretariat of World Bank Group and related agencies, project coordinators, and participants for their steadfast effort and support.

Joon-Kyung Kim
President
Korea Development Institute (KDI)



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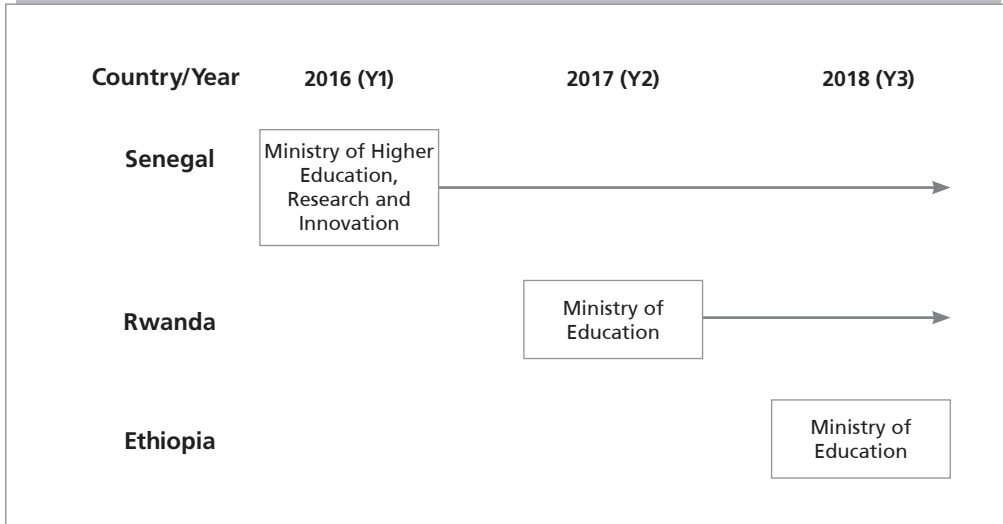
2016/17 KSP with PASET

Bora Nam (Project Officer, Korea Development Institute)

The Ministry of Strategy and Finance of the Republic of Korea (MOSF) has been operating a Knowledge Sharing Program (KSP) with partner countries in regards to their policy capacity building and sustainable development since 2004. The program was initiated by requests from ministries or public institutions of partner countries, which was followed by policy learning conducted by a research team of Korean experts, policy practitioners and local consultants from partner countries. The Korea Development Institute (KDI), the implementing organization for project management, is responsible for organizing research teams and facilitating all of the events.

KDI and PASET have started to establish a partnership through the World Bank-KDI joint regional conference on “Africa’s Transformation: Leveraging the Partnership with Korea” since July 2015. During the conference, KDI shared the outcomes of its country-specific consultations with KSP regarding economic transformation and the development of priority sectors. Thereafter, two visiting missions arose from the regional conference in September 2015 and February 2016 as the follow-up regional conference. Through the workshop, PASET countries have the opportunity to learn and deepen their knowledge of the Korean experience in Technical and Vocational Education and Training (TVET) and Science and Technology, and to discuss potential areas of collaboration between SSA countries and Korea. As a result of seeking its sustainable cooperation, KDI and PASET agreed to launch PASET KSP for three PASET Champion Countries (i.e., Senegal, Rwanda, and Ethiopia) from 2016 to 2018 as per the following schedule in [Figure 1].

[Figure 1] PASET KSP Project Plan



PASET Executive Committee submitted the Demand Survey document for 2016 PASET KSP (Year 1) to MOSF via the Korean Embassy in Senegal in April 2016. As a follow-up, PASET and KDI held a technical discussion on the details of the 30th September 2016 proposal in Seoul. After due consideration of the written demand survey form and the discussion with PASET partner country representatives, KDI, partner countries and the PASET secretariat agreed on a project plan and research topics under the main theme of “National HRD Strategy to Support the Social and Economic Transformation of 3 PASET Member Countries with a focus on Senegal.” This consisted of three sub-topics: 1) Strengthen National HRD System for Senegal’s Economic and Social Transformation; 2) Strategic Plan for Developing TVET Centers of Excellence; and 3) Strategic Plan on STI Governance System of PASET Champion Countries Located in Sub-Saharan Africa. Based on the research area above, a KSP research team was formed. The research team was composed of 1 Korean Expert, 1 Policy Practitioner, and 1 Local Consultant for each topic. <Table 1> provides an overview of the 2016/17 KSP with PASET’s research topics and team of researchers.

As the first step of 2016/17 PASET KSP (Year 1), a delegation of Korean experts visited Dakar, Senegal, from October 10th to 14th for the “High Level Demand Survey and Pilot Study” in order to identify project stakeholders’ policy priorities and to finalize the research scope. During the mission, a KSP Launching Seminar was held to mark the official launch of the 2016/17 KSP with PASET and inform partner institutions of the KSP implementation cycle and its components. Also, a research team consulted high-level officials representing partner ministries, including the Ministry of Higher Education, Research and Innovation of Senegal, to present the project proposal to high level policy makers and receive feedback in

order to gain a comprehensive understanding of the demands and needs on the given research topic. In the pilot study, the KSP team visited relevant institutions, such as the Ministry of Higher Education, Research and Innovation (MHERI), Ministry of Economic, Finance and Planning (MEFP), World Bank Dakar Office, Ministry of Vocational Education, Apprenticeship and Crafts (MFPAA), Ministry of Labor, Social Dialogue, Professional Organizations and Relations with Institutions (MOL), Ministry of Education (MOE), Chamber of Commerce, Industry and Agriculture of Dakar, University Cheikh Anta Diop (UCAD) of Dakar, Ecole Normale Superior Teaching Technical And Professional (ENSETP), Ecole Superior Polytechnic (ESP), Senegalese Institute of Agricultural Research (ISRA), Senegal National Academy of Science and Technology, Institut Pasteur de Dakar, the Ministry of Post and Telecommunication, and the Ministry of Youth & Employment.

⟨Table 1⟩ 2016/17 PASET KSP Consultation Team and Topics

National HRD Strategy to Support the Social and Economic Transformation of PASET Member Countries with Focus on Senegal				
No.	Consultation Topic	Name of Expert	Name of Senegalese Consultant	Name of Policy Practitioner
1	Strengthen National HRD System for Senegal's Economic and Social Transformation	Sung Joon Paik (KDI School)	Nouhou Diaby (Ministry of Higher Education, Research and Innovation)	Aminata Sall Diallo (Ministry of Higher Education, Research and Innovation)
2	Strategic Plan for Establishing TVET Centers of Excellence (CoEs)	Man Gon Park (Pukyong University)	Fadel Niang (Higher Institute of Vocational Education)	-
3	Strategic Plan on STI Governance System of PASET Champion Countries Located Sub-Saharan Africa	Sang Hyon Lee (Korea Institute of Science & Technology Evaluation and Planning)	Mamadou Sy (Ministry of Higher Education, Research and Innovation)	Abdou Sene (Gaston Berger University)

*Senior Advisor: Byungsuk Chung (Former Vice Minister of the Ministry of Labor of Korea)
 *Project Manager: Song Chang Hong (Director, CID, KDI)
 : Aminata Sall Diallo (Executive Director, PASET Executive Committee)
 *Project Officer: Bora Nam (Research Associate, CID, KDI)
 : Nobuyuki Tanaka (Economist, PASET Secretariat, WB)
 *Policy Practitioner from PASET partner countries:
 : Zerihun Kebede Wudie (Director General, Research and Academic Affairs, Ministry of Education of Ethiopia)
 : Marie Christine Gasingirwa (Director General, Science, Technology and Research, Ministry of Education of Rwanda)

The KSP team visited Senegal once again for the “Local Reporting Workshop and Additional Pilot Study” from 9th to 13th of January 2017 to present the progress of the research and discuss a future research plan. Korean experts conducted three activities: 1) a policy seminar for government officials to share overall Korean development history of HRD, TVET and STI sector, 2) a local reporting workshop with project participants to deliver Korean expert’s research progress and 3) an in-depth survey on research topics through discussions with relevant government officials by visiting MHERI, MEFP, ESP Dakar, MFCAA, ISRA, MOE, Minister of Youth, Civic Building and Promotion of Volunteering (MJECC), Higher Institute of Vocational Education (ISEP), Ecole Polytechnic of Thiès (EPT), and ENSETP.

For the next step, 10 PASET delegations (i.e., eight from Senegal, one from Ethiopia, and one from the PASET secretariat) headed by Malick Sow, Secretary-General of the Ministry of Higher Education, Research and Innovation, visited Korea from the 12th to 18th of February, 2017 to participate in the “Interim Reporting and Policy Practitioners Workshop.” At the Interim Reporting Workshop, Korean researchers presented interim research findings and all participants provided their feedback on the given research topic. Alongside a series of discussions on the KSP topics, a project coordination meeting was conducted to discuss the details of mutual cooperation and activities including the content of a Memorandum of Understanding (MOU) and Activity Arrangement (AA). As a result, an AA was signed between the KDI and PASET executive committee on cooperation and the implementation of the 2016/17 KSP with PASET. During the Policy Practitioners’ Workshop, the PASET delegation visited various Korean institutions related to each KSP topic, including the Incheon Electronic Meister High School, Korea Polytechnic Colleges, Korea Employment Information Service (KEIS), and Leaders in Industry-University Cooperation (LINC) at Sungkyunkwan University (SKKU) in order to gain first-hand experience and practical knowledge about the Korean case.

As the final stage of the project, the “Final Reporting Workshop and Senior Policy Dialogue” was held in Dakar from 30th May to 2nd June 2017. In the opening session of the Final Reporting Workshop, Dr. Byungsuk Chung, Senior Advisor of the 2016/17 PASET KSP, opened the event with welcoming remarks. And then congratulatory remarks were given by M. Malick Sow, Secretary of Ministry of Higher Education, Research and Innovation, and H.E. Hyo-eun Kim, Korea’s Ambassador to Senegal. During the presentation session, the final research findings of the policy study by Korean experts and Senegalese consultants were shared with approximately 50 participants from the government and related sector. Following the presentation, critical comments and a diverse range of questions were actively made among the participants on the research outcomes and their application to the situation in Senegal. Comments on the final outcomes extended to the Senior Policy Dialogue in which the Korean delegation held talks with the Secretary of Ministry

of Higher Education, Research and Innovation and the Minister of the Ministry of Vocational Education, Apprenticeship and Crafts (MFPAA). In the dialogue, the KSP team explained how to apply the recommended policies as well as emphasized the importance of policy implementation.

In addition, prior-discussion for the 2017/18 PASET KSP meeting was conducted with policy practitioners from the Ministry of Higher Education, Research and Innovation of Senegal and the Ministry of Education of Rwanda to discuss the project scope and to conduct a demand survey interview to explore how to organize future projects. After a series of meetings, interviews on the End of Project Evaluation providing feedback were conducted to evaluate the project.

Such efforts by both PASET and Korea enriched this 2016/17 policy consultation report. KDI is grateful for the kind cooperation and facilitation from the PASET Secretariat and heartfelt support from the Ministry of Higher Education, Research and Innovation of Senegal for its publication.

Executive Summary

Sung Joon Paik (KDI School of Public Policy and Management)

The Partnership for Skills in Applied Sciences, Engineering & Technology (PASET),¹⁾ in which over 20 sub-Saharan Africa countries participate, requested KSP policy consultation on science and technology manpower for the development of its member countries' industrialization. Upon receiving the request, the Korea Development Institute (KDI) selected three countries—Senegal, Ethiopia and Rwanda—through discussions with PASET and the World Bank and decided to provide policy consultation on three topics—human resource development, Technical and Vocational Education and Training (TVET), and STI—over the next three years (2016/17–2018/19) to support these countries' social and economic transformation into middle income countries. Senegal was selected for the first year of consultation.

Senegal has several problems, including high youth unemployment, low labor quality, and lack of STI support mechanisms. Although more than 60% of the population is under 25 years old, Senegal has not been able to successfully utilize its potential. A large proportion of the children do not have the opportunity to receive a basic education and consequently neither a secondary nor tertiary education, and many young people in Senegal start working too early without preparation. This creates unemployment among young people and low quality workers. Strengthening the human resource base through the provision of quality

1) PASET was launched in 2013 by African governments with facilitation by the World Bank, to address systemic gaps in skills and knowledge in priority fields in applied sciences, engineering and technology, and to build the capacity of African education and training.

basic education and TVET for young people is urgent. STI, a key element for increasing a country's production potential, also needs to be boosted through a systematic and stable governance system.

Three topics of this year's KSP for Senegal are closely related to the above problems: (1) strengthen the national HRD system for Senegal's economic and social transformation; (2) create strategic plans for establishing TVET Centers of Excellence (CoEs); and (3) create strategic plans for STI governance. Summaries of studies on these three topics are presented as follows:

1. Strengthen National HRD System for Senegal's Economic and Social Transformation

One critical policy issue for Senegal is how to tackle poverty; 34.1% of the population is estimated to be below the income poverty line and 51.9% experienced multiple deprivations in the same household in health, education, and living standards in 2014. Despite the relatively high rate of GDP growth in recent years, Senegal is struggling to solve the poverty problem due to the low level of education and TVET, lack of employment opportunities, and high rate of population growth.

This study adopts HRD as an effective strategic concept with which to approach this poverty problem. HRD in this study refers to activities that equip people with knowledge, skills, attitudes, and values that they can utilize for national development. HRD is integral for improving individuals' well-being, social integration, and national socioeconomic development.

With the aim of making policy recommendations to improve the performance of Senegal's HRD system, this study first analyzed the national HRD system and Senegal's strategies to identify the most critical issues and urgent needs in their national HRD system. Second, it analyzed the Korean cases that matched the issues and needs that were highlighted in the analysis of Senegal's HRD system. This study makes policy recommendations based on the results of these analyses.

Since 2012, Senegal has been working hard on promoting national economic growth with a strong and stable political leadership. Senegal is implementing a national socioeconomic development plan, the Plan Senegal Emergent (PSE), and an HRD plan, the Program for Improvement of the Quality, Equity, and Transparency in Education and Training (PAQUET). The Local Group of Partners operates to coordinate several HRD-related ministries. Collaboration with the private sector is further promoted by the government reorganization of the existing National Convention by involving employers, trade unions, and NGOs in 2016. Financially,

the government has allocated a large proportion of the budget to HRD and plans to increase its investment in TVET by fully utilizing levies. Young people's transition to the labor market is assisted by the government's provision of employment services through four employment centers and the National Agency for the Promotion of Youth Employment (ANPEJ). These all show that Senegal has made big progress in preparation for transforming into a middle-income country. However, it has also been pointed out that Senegal lacks quality basic education and literacy programs, investment in TVET, systematic linkages between national economic development plans and HRD plans, coordination among government ministries, analyses of labor market skill demands, and fundamental data for policymaking.

The Korean cases, which are selected in accordance with the problems identified in the analysis of Senegal's HRD system, including an adult literacy campaign, sequential educational expansion, vocational training system, Economic Planning Board, Inter-Ministerial Meetings on HRD, Sector HRD Councils, school-industry linkage policies, manpower projection system, and job information system, are reviewed to draw meaningful policy implications.

Based on the analyses of Senegal's HRD system and the Korean cases, this chapter recommends following policy measures:

- (1) Eradicate illiteracy and provide quality basic education to build strong bases for further HRD towards becoming a middle-income country;
- (2) Increase investment in TVET to provide a second chance to early school leavers, enhance worker productivity, and consequently promote social inclusion;
- (3) Make a national HRD plan that is closely linked to national economic development plans to effectively train and supply manpower for national economic development;
- (4) Establish and operate policy coordination mechanisms among ministries to improve horizontal and vertical linkages of HRD and macroeconomic policies;
- (5) Develop a national system for the analysis of labor market skill demands to make the curriculum more relevant to the skill demands;
- (6) Develop a national system for manpower forecasting to make HRD supportive of national economic development;
- (7) Develop a new curriculum for education and TVET according to the results of the analysis of labor market skill demands and manpower forecasting to enhance the HRD system's productivity;
- (8) Develop a national system for data collection, analysis, and management to make evidence-based HRD policies

In addition to the above recommendations, this chapter suggests that the

government of Senegal try two pilot projects as follows: (a) establish and operate exemplary vocational training institutes in line with pursuing (2) and (b) design and utilize a model for the analysis and forecast of labor market skill demands in line with (5). Both projects can be conducted with financial and technical assistance from donor countries and international organizations.

2. Strategic Plan for Establishing TVET Centers of Excellence (CoEs)

Regarding CoEs, Stephen Jenner at the Office of Government Commerce and Craig Kilford mentioned that a CoE is a team, shared facility, or entity that provides leadership, best practices, research, support and/or training for a focus area. It may also be called a competency center or capability center, and the term may also refer to a network of institutions that collaborate with each other to pursue excellence in a particular area. The key functions of TVET CoEs are summarized as coordination and collaboration, change initiatives, leadership, best practices, research, support, training, standards, revitalization, competency, and capabilities in TVET systems.

Most African governments work in collaboration and cooperation with international organizations and international cooperation agencies to expand TVET Projects and Programs and make every effort to develop TVET policies and strategies. PASET was launched in 2013 by Sub-Saharan African (SSA) governments and was facilitated by the World Bank; has built a strong relationship with Republic of Korea, and one of PASET's key regional initiatives is the establishment and operation of regional TVET CoEs. In these environments, PASET KSP is spearheading the development of a new strategy with which to revitalize TVET in PASET countries through the establishment of a PASET TVET CoEs Network in Senegal and other PASET countries.

Senegal's government is striving to strengthen TVET systems through the establishment of TVET CoEs in Senegal and other PASET countries to solve the pressing problems and hot issues of TVET systems under PAQUET as the detailed action plan of the Plan Senegal Emergent (PSE).

Under these visiting plans for relevant ministries, agencies, and institutions in Senegal, all members of the PASET KSP team visited most of the relevant ministries, agencies, and institutions as planned in actual surveys. It was necessary to readjust and confirm the scope of policy research for building TVET infrastructure while considering the surveyed results and research period for the Advisory and Evaluation Committee as follows.

(1) Choose and concentrate on some important demands of Senegal and other

- PASET countries when building TVET infrastructure (TVET CoEs).
- (2) Emphasize and adapt Korean experiences during the Korean industrial growth era with the development of skills and TVET systems through refocusing, restructuring, and readjustment.

With this advice, this paper synthesizes pressing problems and hot issues of TVET systems in Senegal as a PASET country with a survey of the necessary and emerging skills according to environmental changes of new technologies and labor markets, and we determine the current status of TVET systems of Senegal under PAQUET as the PSE's detailed action plan. Through this, we investigate the need to refocus, restructure, and readjust TVET systems in Senegal, and we would like to introduce overviews, lessons, and the implications of the Korean experience to solve the pressing problems that economic development faces through TVET systems by strategic points. These include choice and concentration strategies that use limited resources, local community-based skills, and TVET systems development, the capability building efforts of TVET-related government officials and teachers for maintaining the sustainability and effective utilization of overseas aid, and refocusing, restructuring, and readjustment through the establishment of TVET CoEs.

Finally, we propose approaches and methods for the establishment of PASET TVET CoEs and suggest and recommend some important strategic points and action steps for the establishment and utilization of PASET TVET CoEs to improve and reengineer skills and TVET systems through comparison with the Korean TVET experience and wisdom with the following strategies:

- Strategy 1: Choice and Concentration
- Strategy 2: Strengthening the Research Function
- Strategy 3: One Flow and One Frame Management
- Strategy 4: Standardized and Competent TVET Systems
- Strategy 5: Harmonized and Recognized TVET Systems in PASET Countries
- Strategy 6: Accreditation and Certification of TVET Systems by a Regional Accreditation Commission

3. Strategic Plan on STI Governance System of PASET Champion Countries Located Sub-Saharan Africa

The Senegalese government has demanded a diagnosis of the current state of the Senegalese STI system and its governance in consideration of major actors such as ministries, research institutions, and associated agencies as well as institutions such as laws, regulations, and the regulatory framework. This has also been

demanded by several countries located in sub-Saharan Africa that are in similar conditions to Senegal in terms of their social, economic, and human development, which are pursuing S&T promotion as a useful tool for national development.

The diagnosis revealed that Senegal has an unstable STI governance system, particularly for its research governance system, even though there is an administrative framework for S&T. MHER/DGR does not have the authority for budget allocation according to the S&T/R&D policies that they formulated themselves; they just maintain close communication with relevant ministries and organizations. These roles are based on presidential leadership rather than on laws or legislation. Therefore, the current governance of S&T/R&D for STI could not be continuously guaranteed. Thus, it is very difficult to get complete information of S&T/R&D-related affairs from relevant ministries and organizations; consequently, setting the priorities of S&T/R&D promotion areas and targets and coordinating the national budget in a top-down strategy to support PSE are difficult. However, there is no national body for S&T/R&D evaluation based on the monitoring of PSE enforcement status. Each institution evaluates its own research programs, so it is difficult to conduct a national-level diagnosis for a clear understanding of the state of S&T/R&D promotion programs or to decide budget modifications according to evaluation results while considering the phase goals of PSE. Another problem is the lack of S&T manpower with which to manage STI systems, and the eradication of illiteracy and vocational education remain key challenges in S&T promotion. This deficiency is a powerful cause of the unsatisfactory capacity of S&T/R&D planning and implementation for establishing efficient and effective STI systems in high-level STI governance systems.

Several practical lessons can be gleaned from the development history of the Korean STI governance system, including that the consolidation of STI systems is an essential engine for national development and innovations in society, culture, and the economy. Creating sophisticated mapping between national-level S&T promotion plans and the national economic development plan is the first priority to harden the basis of an STI governance system. Since the mapping was well matched, improvements to S&T legislation and the administration were directly followed that supported the implementation of S&T promotion both stably and continuously. The improvements could contribute to the coordination of S&T policies, R&D programs, and their budget allocations at the national level. This means that decision-making authority for S&T-related matters was centralized into one particular administrative system in terms of the STI governance system. In the implementation of S&T promotion, the roles of STI principal bodies, the government, GRIs, universities, and enterprise research institutes were clearly divided at the national level in response to changes of circumstance. When the R&D evaluation system was added at the national level, Korea's STI governance system was finally consolidated.

With the in-depth consideration of the current state of the STI governance system of Senegal and its main problems, and with practical discussions on the strengths and weaknesses of the Senegalese STI governance system and the practical lessons derived from the progress of building the Korean STI governance system, the Eliminate-Reduce-Raise-Create (ERRC) Action Framework was applied to develop the direction in which Senegal's STI governance system could be improved. In addition, the ERRC elements that could be offered as examples for a desirable STI governance system were proposed in the body text.

In conclusion, the policy recommendations for strategic plans are offered below.

- (1) A strategic roadmap should be defined between S&T policies and PSE. The sophisticated mapping between the national level S&T promotion plan and the national economic development plan is the first priority for hardening the foundation of the STI governance system.
- (2) The centralization of authority for decision making and budget allocation on S&T and research activities should be seriously considered. Authority centralization with open communication could make the coordination of S&T policies, research activities, and budget allocation at the national level both more efficient and effective. It could begin by allowing "A" (an authorized organization) to ask the funding agencies of research institutes to discuss the priority setting of national-level research subjects according to the S&T/R&D policies that are adjusted to PSE.
- (3) However, this authority centralization has to be performed in parallel with the implementation of proper legislation; if not it has the potential to cause arguments among STI principal bodies such as ministries, GRIs, universities, and enterprise research institutes. The legislation of S&T and research activities could both contribute to ensuring that the implementation of S&T promotion is both stable and continuous.
- (4) It is also strategically considered to form a national body for S&T/R&D evaluation at the national level with the S&T/R&D information reporting system. The evaluation system could significantly consolidate the STI governance system through the monitoring and modification of S&T policies and research activities with evaluative feedback and corrections. This national-level evaluation system could support increases in the definition of a strategic roadmap through its periodic readjustment.

Themes	#	Status of Senegal	Challenges	Korean Experience	Policy Recommendations
HRD	1	High illiteracy rate and low enrolment in secondary and higher education.	Lack of literacy programs, many national languages, and low quality basic education.	Six-year plan for achieving compulsory primary education (1954–59), Adult literacy campaign (1950s–60s).	Eradicate illiteracy by providing a literacy program in both French and national languages and provide a quality basic education.
	2	High youth unemployment	Lack of second chances for young people to be trained and employed.	National vocational training system (1967) and the Employment Insurance System (1995).	Increase TVET investment. Establish a national training system that covers both pre-employment training for the unemployed and recurrent training for workers.
	3	Lack of linkages between HRD and national economic development plans.	Weak coordination mechanisms among ministries.	Economic Planning Board (1960s–90s) and Inter-ministerial Meetings (2000s).	Make a HRD plan that is closely linked to national economic development plans. Establish and operate policy coordination mechanisms among ministries.
	4	Lack of labor market skill demand change analysis and manpower projections.	Lack of a national system for identifying skill demand changes by sector and projecting future manpower supply and demand.	The creation of a mid- and long-term manpower projection systems and job information systems.	Develop a national system for analyzing labor market skill demand changes and manpower forecasting. Develop a curriculum for education and TVET according to skill demand change analysis and manpower projection results.

Themes	#	Status of Senegal	Challenges	Korean Experience	Policy Recommendations
TVET	1	Education and training in Senegal is carried out by four ministries: MFFE, MESR, MEN, and MFCAA. The percentage of people who have received vocational training is 10.5% with 6.4% receiving formal training and 4.1% receiving only informal training.	Providing quality training opportunities for young and middle-aged people in the TVET system and Responding to the demands for necessary and emerging skills in the labor market.	The Korean government established various vocational training institutions and facilities under the Korea Vocational Training Management Agency to cultivate vocational trainers, introduce a technical qualification and examination system, foster skills competitions, carry out skills promotion projects, and accomplish related research and development projects to enable large-scale manpower cultivation and skill development national projects.	Under the leadership of CoEs, analyze and develop competencies and develop competency-based training programs while conducting job analyses and developing occupational skills standards for all occupations and skills in Senegal.
	2	In July 2013, four ministries (MESR, MFCAA, MEN, and MFFE) jointly established an action plan called PAQUET to resolve major issues in education and training. The distribution of individuals aged at least 6 years indicated that 89.5% of individuals had not received any vocational training and that women (92.5%) were generally more disadvantaged than men (86.3%) in vocational training services.	Reforming teaching and learning methodologies and tools, approaching competency-based education and training, and emphasizing dual work-learning systems; Mismatches between TVET institutions and industries' demands.	On November 12, 1981, the Korean government set up a plan of skilled workforce cultivation and vocational stability promotion by establishing the Korea vocational training management corporation to oversee and manage all tasks that were related to the training of skilled workers such as vocational training, qualifications, and testing.	Senegal's urgent objectives include refocusing, restructuring, and readjustment to national TVET systems that can be strengthened by establishing CoEs that can perform important roles and functions as in Korea's experience to carry out critical national projects through PAQUET under PSE.

Themes	#	Status of Senegal	Challenges	Korean Experience	Policy Recommendations
TVET	3	Recently, the Senegalese government has made efforts to extend more ISEP to schools nationwide through Presidential Decision No. 01 to refocus, restructure, and readjust the tertiary education system toward science, technology, and short-term vocational training.	Developing the labor market information system (LMIS) as an important tool for solving serious problems such as the inadequate responses of TVET institutions to the country's needs for a skilled workforce, lack of awareness with regard to industries' skills demands, and the unavailability of relevant information about job offers, job seekers, and required qualifications.	The Korean government drove (1) the expansion of the training period for the skilled workforce from one year to three years, (2) expanded companies to include in-house training with supportive taxation and financial benefits, (3) reform labor market information networks through the computerization of labor data, and (4) revise test criteria to emphasize the importance of practical skills above theory to rationalize the skills test. The government founded CoEs and established public training institutions under CoEs to train workers, while placing the obligation on employers to train and educate their employees. These initiatives gave strong backing to the national economy's fast growth. Under the Choice and Concentration strategy, TVET projects were significantly improved as efficient and effective financial and physical resource supports by considering the characteristics of the employment insurance system called the levy-grant system.	

Themes	#	Status of Senegal	Challenges	Korean Experience	Policy Recommendations
TVET	4	Recommendation No. 50 (to expand the ISEP network by establishing at least one ISEP school in each province in accordance with the future potential of higher education outlined in the recommendation of the National Advisory Committee).	Establishing a national vocational qualification (NVQ) framework for the harmonization of the issuance of TVET diplomas with qualifications awarded by professional branches. Contributing to the increase and improvement in labor productivity to create a more competitive and dynamic economy.	With the remarkable economic development in the early 1960s, the Korean qualification system created quantitative growth in line with the creation of various qualifications based on individual law. The enactment of the National Technical Qualification Act in 1973 meant that the criteria and titles of technical qualifications were standardized to lay a more trustworthy foundation for a national qualification system. With the enactment of the Basic Qualification Act in 1997, the qualification system categorized qualifications as either national or private, and the subjects of qualification systems became varied. The HRD Service of Korea is the main responsible agency.	Build CoE networks that will carry out the following key roles A Vocational Qualification and Certification Business Promotion Center TVET Teacher Training and Capability Building Management Center Workers' Lifelong Learning Support Center Occupational Skills Standards Development Center Career Guidance and Start-up Support Center Standard Curriculum Development Center Curriculum and Educational Content Development Support Center
STI	1	Virtually, each ministry independently implements related S&T promotion policies	Weak strategic mapping between S&T policies and PSE	The sophisticated mapping between national S&T promotion plans and national economic plans hardens the foundations of STI governance systems	Define a strategic roadmap between S&T policies and PSE

Themes	#	Status of Senegal	Challenges	Korean Experience	Policy Recommendations
STI	2	Administrative framework on S&T headed by MHER/DGR, which does not have the authority for practical coordination.	The weak governance of national-level coordination among S&T policy formulations, budget allocation, and implementation	The decision-making authority was centralized to coordinate S&T policies, R&D programs, and their budget allocations at the national level into one specific administrative system (Primary action ministry: Ministry of S&T in STI governance systems).	Centralize the authority for decision making and budget allocation in S&T and research activities.
	3	Presidential leadership on S&T policies and its budget allocation.	There is no legal framework for decision making and budget allocation for S&T and research activities.	Improved S&T legislation and administration directly followed the creation of a strategic roadmap between S&T and economic plans that made the implementation of S&T promotion both stable and continuous.	Legislate the centralization of decision making and budget allocation authority for S&T and research activities
	4	Each ministry and research institution should evaluate its own research programs.	There is no national body for S&T and R&D evaluation	The national S&T and R&D evaluation systems were improved so that the state of S&T and R&D promotion programs could be clearly understood and then how their budgets were coordinated could be decided.	Form a national body for S&T and R&D evaluation with its own information reporting system.

2016/17 Knowledge Sharing Program with PASET:
National HRD Strategy to Support the Social and
Economic Transformation of PASET Member Countries
with Focus on Senegal

Chapter 1

Strengthen National HRD System for Senegal's Economic and Social Transformation

1. Introduction
2. HRD System and Strategy of Senegal
3. Korea's HRD System and Strategy
4. Policy Recommendations

Strengthen National HRD System for Senegal's Economic and Social Transformation

Sung Joon Paik (KDI School of Public Policy and Management)

Summary

One of Senegal's current critical policy issues is how to tackle poverty. 34.1% of the population is estimated to be below the income poverty line and 51.9% experienced multiple deprivations in the same household with regard to health, education, and living standards in 2014. Despite the relatively high rate of GDP growth over recent years, Senegal has struggled to solve the poverty problem due to their low level of education and Technical Vocational Education and Training (TVET), lack of employment opportunities, and high population increase rate.

This chapter adopts HRD as an effective strategic concept with which to approach the poverty problem. HRD in this chapter refers to the activities that equip people with knowledge, skills, attitudes, and values and utilize them for national development. HRD is integral to improving individual well-being, social integration, and national socioeconomic development.

With the aim of making policy recommendations that can improve the performance of Senegal's HRD system, this chapter first analyzes Senegal's national HRD system and strategies to identify the most critical issues and urgent requirements in Senegal's national HRD system. Second, this chapter analyzes the Korean cases that match the issues and needs that are pointed to in the analysis of Senegal's HRD system. This chapter then makes policy recommendations based on the results of these analyses.

Senegal has been working hard on promoting national economic growth with strong and stable political leadership since 2012. Senegal is implementing a national socioeconomic development plan, the Plan Senegal Emergent (PSE), and an HRD plan, the Program for Improving the Quality, Equity, and Transparency of Education and Training (PAQUET). The Local Group of Partners coordinates several HRD-related ministries and further promotes collaboration with the private sector and the government reorganized the existing National Convention by involving employers, trade unions, and NGOs in 2016. Financially, the government has allocated a large proportion of the budget to HRD and plans to increase its investment in TVET by fully utilizing levies. Young people's transition to the labor market is assisted by the government, which provides employment services through four employment centers and the National Agency for the Promotion of Youth Employment (ANPEJ). All these show that Senegal has made great progress in preparation for a transformation into a middle-income country. Nevertheless, Senegal lacks quality basic education and literacy programs, investment in TVET, a systematic linkage between national economic development plans and HRD plans, coordination among government ministries, analysis of labor market skill demands, and basic data for policymaking.

Korean cases are selected according to the problems identified in the analysis of Senegal's HRD system, including adult literacy campaigns, sequential educational expansion, vocational training systems, Economic Planning Board, Inter-Ministerial Meeting on HRD, Sector HRD Councils, school-industry linkage policy, manpower projection systems, and job information systems, are reviewed to draw meaningful policy implications.

Based on the analyses of Senegal's HRD system and the Korean cases, this chapter recommends the following policy measures:

- (1) Eradicate illiteracy and provide quality basic education to make a strong foundation for further HRD toward becoming a middle-income country.
- (2) Increase investment in TVET to give a second chance to early school leavers, enhance worker's productivity, and consequently promote social inclusion.
- (3) Make a national HRD plan that is closely linked to the national economic development plan to effectively train and supply manpower for national economic development.
- (4) Establish and operate policy coordination mechanisms between ministries to improve both horizontal and vertical linkages for HRD and macroeconomic policies.

- (5) Develop a national system for analyzing labor market skill demands to make the curriculum more relevant to skill demands.
- (6) Develop a national system for manpower forecasting to make HRD more supportive of national economic development.
- (7) Develop new curricula for education and TVET according to the results of the analysis of labor market skill demands and manpower forecasting to enhance the HRD system's productivity.
- (8) Develop a national system for data collection, analysis, and management to make evidence-based HRD policies.

In addition to the above recommendations, this chapter suggests that the Senegalese government try two pilot projects: (a) establish and operate exemplary vocational training institutions in line with pursuing recommendation (2) and (b) design and utilize a model for analyzing labor market skill demands and forecasting labor demands in line with recommendation (5). Both projects can be conducted with financial and technical assistance from either donor countries or international organizations.

Themes	#	Status of Senegal	Challenges	Korean Experience	Policy Recommendations
HRD	1	High illiteracy rate and low enrolment in secondary and higher education	Lack of literacy programs, many national languages, and low quality basic education	Six-year plan for achieving compulsory primary education (1954–59), Adult literacy campaign (1950s–60s)	Eradicate illiteracy by providing a literacy program with in both French and national languages and provide a quality basic education
	2	High youth unemployment	Lack of second chances for young people to be trained and employed	National vocational training system (1967) and the Employment Insurance System (1995)	Increase TVET investment. Establish a national training system that covers both pre-employment training for the unemployed and recurrent training for workers

Themes	#	Status of Senegal	Challenges	Korean Experience	Policy Recommendations
HRD	3	Lack of linkages between HRD and national economic development plans	Weak coordination mechanisms among ministries	Economic Planning Board (1960s–90s) and Inter-ministerial Meetings (2000s)	Make a HRD plan that is closely linked to national economic development plans. Establish and operate policy coordination mechanisms among ministries
	4	Lack of labor market skill demand change analysis and manpower projections	Lack of a national system for identifying skill demand changes by sector and projecting future manpower supply and demand	The creation of mid- and long-term manpower projection systems and job information systems	Develop a national system for analyzing labor market skill demand changes and manpower forecasting Develop a curriculum for education and TVET according to skill demand change analysis and manpower projection results

1. Introduction

1.1. Policy Issues

PASET and the Korea Development Institute (KDI) decided to provide three PASET member countries—Senegal, Rwanda, and Ethiopia—with policy consultation services for Human Resource Development (HRD) for these countries’ socioeconomic transformation into middle-income countries during 2016/17–2018/19.

The most critical current policy issue that Sub-Saharan countries have in common is poverty reduction. The per capita GDP of the three countries targeted in this project—Senegal, Ethiopia, and Rwanda—are \$2,525 USD, \$1,869 USD, and \$1,784 USD (PPP), respectively. The majority of the population of each is employed in agricultural, fishery, and the marine industry sectors and the main sources of foreign currency include agricultural products such as coffee and tea and natural resources such as gold and phosphate.¹⁾ Although these countries have tried to

1) <https://www.cia.gov/library/publications/the-world-factbook/geos/>

increase their per capita GDP by implementing national development plans (e.g., “Plan Senegal Emergent” in Senegal, the “Growth and Transformation Plan” in Ethiopia, and the “Economic Development and Poverty Reduction Strategy 2” in Rwanda),²⁾ they still struggle to find solutions to their poverty problems.

How can these countries tackle the issue of poverty? Reducing the level of poverty requires that a country increases its income by enhancing the added value of its existing goods and services. For example, processing coffee beans to make them commercial products rather than simply exporting coffee beans is more profitable. To increase the benefit, Senegal must apply advanced knowledge and skills to the production process of goods and services, which indicates that equipping people with knowledge and skills is critical. Countries should prioritize providing a quality basic education to all school-age cohorts. Young adolescents who have core competencies can learn industry-specific or job-specific skills and knowledge through vocational education and training. In addition, countries must invest in research and development to create new knowledge and technologies that can contribute to the expansion of the country’s production capacity. In other words, people should be capable of acquiring and applying existing knowledge and skills and further generating new technologies.

What is the current situation of the target countries with respect to human resource development? Senegal’s high total fertility rate of 4.36 children per woman³⁾ means that they have a large proportion of young people that is still growing. As of 2016, 62.2% of Senegal’s population is under the age of 25,⁴⁾ as shown in [Figure 1-1], which implies great national development potential. However, Senegal has not been able to successfully utilize its human capital potential. As of 2015, the youth (15–24) literacy rate is 69.7% (male: 75.9%, female: 63.6%), while the literacy rate for adults (15 and over) is 55.6% (male: 68.5%, female: 43.8%). In 2014, the gross pre-primary school enrolment rate was 14.7% and the gross enrolment rate of primary education was 80.9% (86.4% in 2015), while the net enrolment rate was 71.1%. The primary school completion rate⁵⁾ was 59.0% in the same year. In 2015, the gross enrolment rate for secondary school education was 34.1%, the lower secondary school completion rate was 40.5%, and the gross enrolment rate for tertiary education was 10.4%.⁶⁾ These statistics indicate that a large proportion of children do not have a chance to obtain basic education and consequently fail to obtain secondary and tertiary education and that many young people in Senegal start working too early without appropriate preparation.

2) <http://worldbank.org/en/country/> and <http://www.minecofin.gov.rw/index.php?id=149>

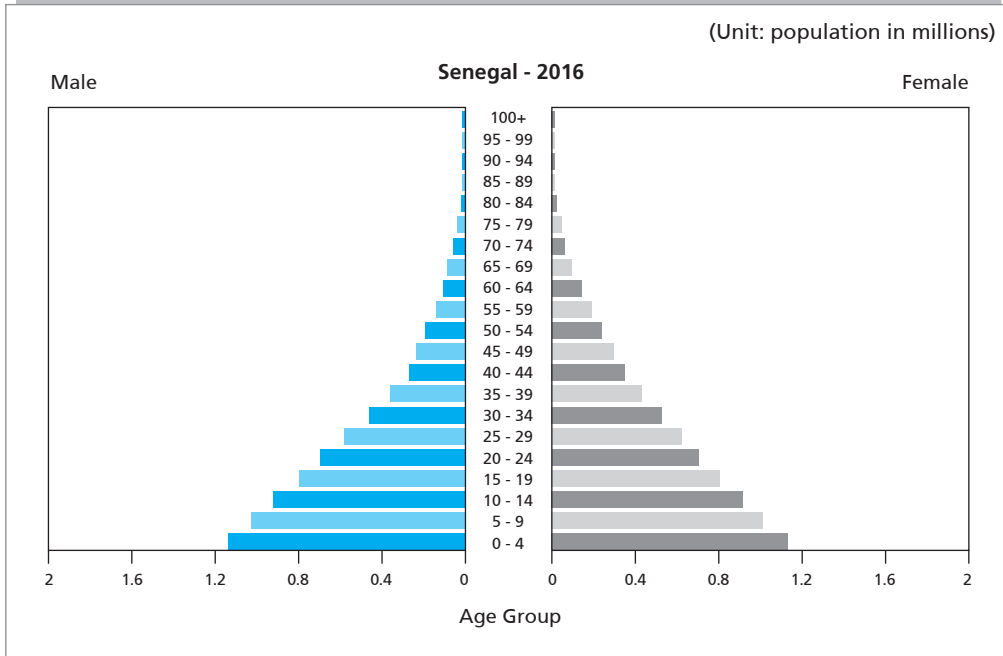
3) As of 2016. Birth rate is 34 births per 1,000 population(2016 estimation).

4) 0-14 years: 41.9%(male 3,011,233/female 2,981,128) and 15-24 years: 20.4%(male 1,452,415/female 1,462,989).

5) Percentage of relevant age group.

6) World Development Indicators, and <http://uis.unesco.org/country/sn>

[Figure 1-1] Senegal Population Pyramid



Source: <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html>.

The youth employment ratio (15–24 according to ILO estimation) was 57.6% and the youth labor force participation rate was 66.2% in 2014. The employment ratio for the population aged 15 and over was 69.0%, while the labor force participation rate was 76.6% in 2014. The youth (aged 15–24 years) unemployment rate (i.e., the percentage of the total labor force ages, modeled on ILO estimation) was estimated to be 9.3% for males and 18.6% for females as of 2014. The unemployment rate among the population was 10% in 2014.⁷⁾

As of 2013, only 13.9% of the population aged 25 and over (cumulative) was estimated to have completed at least a lower secondary education, while 8.2% had completed upper secondary education. Only 3.1% of the population aged 25 or over was estimated to have completed at least a Bachelor's course or equivalent, while 0.42% had completed doctoral or equivalent education.⁸⁾ These indicate that the overall education attainment level of people in Senegal was relatively too low to boost national economic development by adding value to goods and services.

The other two countries—Ethiopia and Rwanda—have similar characteristics that include rapid population growth with high fertility and birth rates, a large number

7) World Development Indicators.

8) *ibid.*

of young people (more than 60% of the population is under the age of 25), a low rate for primary school completion and consequently a low rate of secondary school enrolment, low literacy rate, etc. In these countries, it is urgent—from the HRD perspective that is an integral element of a nation’s socioeconomic development—to provide quality basic education and further expand both secondary and higher education opportunities.

1.2. Objective and Main Content of the Study

The main objective of the KSP/PASET project is to create policy suggestions to improve the national HRD system and strategies based on the diagnosis of current HRD systems and strategies and the analysis of the present and future policy environments of the three PASET member countries—Senegal, Ethiopia and Rwanda. Through discussions among KDI, PASET, and the World Bank, it is decided that the project should focus on Senegal in its first year.

HRD in this project includes all activities that are designed and conducted to equip people with the knowledge, skills, attitudes, and values and that utilize them for national development that are integral to the improvement of individual well-being, societal integration and inclusion, and the nation’s economic, social, and cultural development. HRD covers all major policy areas of human capital formation (e.g., basic education, science, engineering, and technology education, Technical and Vocational Education and Training (TVET), and professional education) and its utilization (e.g., employment through close linkage between HRD and national economic development). Through systematic coordination with economic and social development policies, HRD can significantly contribute to the achievement of national development goals. Thus, countries need comprehensive and integrated HRD systems and strategies. This is the main premise of this study, on the basis of which Senegal’s HRD system and strategy are analyzed.

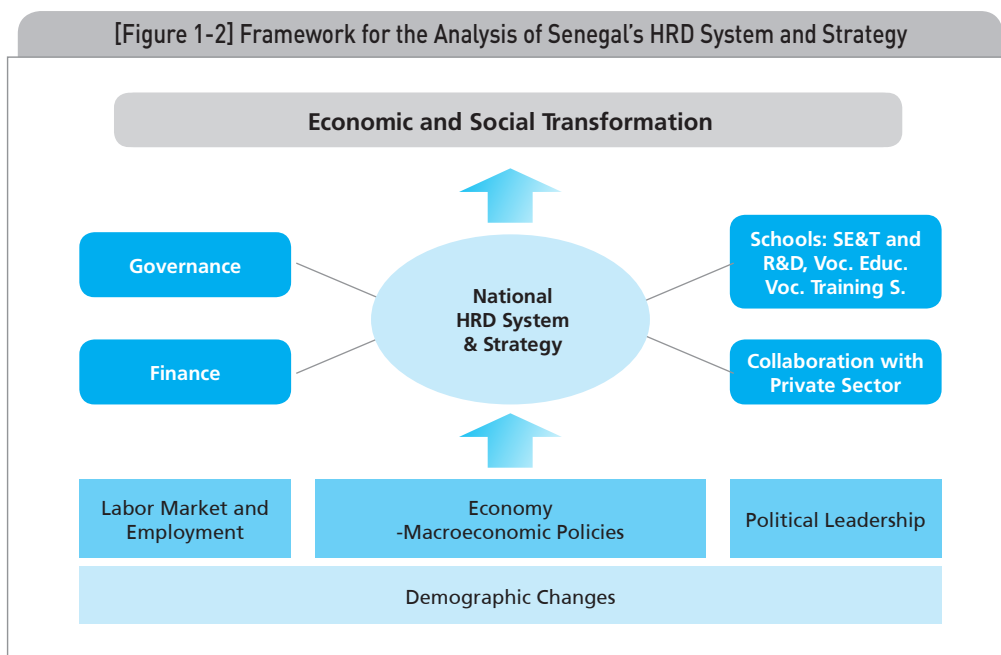
The brief discussion of Senegal’s current education and employment status in the previous section implies that Senegal needs a well-functioning HRD system and strategies that can produce the large quantity of well-educated manpower that would be required to implement national economic development plans. For this, Senegal needs long-term, comprehensive, and integrated HRD strategies and systems that are supported by systematic legal and financial frameworks. In that sense, it is necessary to diagnose the current HRD systems and strategies and how these are connected to the economy, and draw meaningful implications to improving national HRD systems and strategies.

With this reasoning, Section 2 first analyzes the overall policy context of HRD in Senegal and then Senegal’s national HRD system and strategy, including its

governance, finance, school system, and TVET. Section 3 reviews the Korean experience with focus on the major HRD systems and strategies that Korea has adopted to promote national economic development to derive meaningful insights and the key factors of success. Based on the results of Section 2 and 3, Section 4 suggests policy recommendations to improve Senegal’s HRD system and strategies along with specific projects that require urgent action.

1.3. Analytical Framework and Scope of Study

When designing a country’s new HRD system and strategies, it is crucial to analyze the major elements of national HRD policy contexts which include demographic changes, labor markets and employment, macroeconomic development plans, and political leadership. The analysis of these elements provides rational criteria for diagnosing and reviewing the current national HRD system and strategies such as governance, finance, and regular school systems that include science and technology education, vocational education and R&D, and vocational training systems. The review of the current HRD system and strategies based on the analysis of policy context will provide practical ideas for how to improve the national HRD system and strategies to transform Senegal into a middle-income country both economically and socially. The framework for the analysis of Senegal’s HRD system and strategy is described in [Figure 1-2].



This study focuses on the analysis of policy contexts regarding national HRD and the diagnosis of their current national HRD system and strategy. Thus, this study provides broad policy directions rather than specific action plans that can be practically applied to Senegal's HRD sites. However, the study suggests specific projects that Senegal's government can propose to international donor agencies such as the World Bank, the African Development Bank, or bilateral agencies to gain their technical and financial assistance.

2. HRD System and Strategy of Senegal⁹⁾

2.1. Policy Context

2.1.1. Demographic Change

As of 2016, Senegal's total population was estimated to be 14,799,859. As explained in the previous section, Senegal has experienced a very rapid increase in the youth population because of the high fertility rate (4.36 per woman) and birth rate (34 births per 1,000 population). The fertility rate has remained high due to the lack of family planning, early childbearing age, and preference toward larger families. Considering the youths' low educational attainment level, the dominance of the informal economic sector, and the large proportion of the population under the poverty line, it is expected that Senegal will struggle to provide jobs that pay decent wages to young people to utilize them as a crucial resource in national economic development.

Senegal's annual population growth rate is 2.7%. If this rate remains constant, the population is expected to double every 25 years.¹⁰⁾ The rapid increase in population hinders human resource development and the ability to improve living standards. Senegal needs to reduce its population growth rate and implement economic development policies while also investing in HRD.

Regarding migration, the economic crisis of Senegal in the 1970s resulted in mass emigration, and external migration was accelerated in the 1990s. Migrants headed for Libya and Mauritania, which were experiencing booming industries and becoming developed countries. Recently, Senegal has become a transit point for West Africans travelling to North Africa and Europe.¹¹⁾

9) This section is written based on (i) information and data collected from the government and organizations visited during the 2 times of business trips to Senegal, (ii) websites of international and related organizations, and (iii) country paper by Dr. Nouhou Diaby (local consultant).

10) Republic of Senegal(February 2014). Plan Senegal Emergent. p.76.

11) <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html> Dec. 19, 2016.

2.1.2. Economy

2.1.2.1. Overview

Senegal is a lower middle-income country. The estimated per capita GDP in 2016 was \$986 USD in nominal terms and \$2,525 USD in purchasing power parity. Senegal's economy is heavily dependent on international donor agencies' assistance, remittances, and FDI. Senegal achieved its highest economic growth rate (GDP growth rate) of 6.5% in 2015 for the first time in 12 years. This was in contrast to the many African countries that experienced economic downturns due to the world economy's recession in the 2000s. The private sector's high demand and the government's active investment policies contributed to this economic growth. The service sector contributed 33% to economic growth, while the chemical and construction industries and agriculture and horticulture contributed 23% and 34%, respectively. The future economic growth rates are expected to be maintained at a similar level, such as 6.0% in 2016 and 6.9% in 2020.¹²⁾

Despite the relatively high rate of GDP growth, Senegal is finding it difficult to tackle the poverty problem. According to the UNDP Human Development Report, 34.1% of the population is under the income poverty line,¹³⁾ and 51.9% of the population is multi-dimensionally poor with regard to health, education, and living standard.¹⁴⁾ Although the Gini coefficient (40.3) is lower than for other African countries, there is a huge discrepancy between urban and rural areas.¹⁵⁾

The informal sector economy is dynamic in Senegal. 40.5% of GDP was produced in the informal sector (13.3% from agriculture and 27.2% from non-farm informal activities) in 2014, as shown in <Table 1-1>. The primary sector's contribution to GDP mainly came from informal agriculture. Meanwhile, 31% of the secondary sector's contribution to GDP and 38% of the tertiary sector's contribution to GDP came from the informal sector.¹⁶⁾

12) <http://www.tradingeconomics.com/senegal/forecast> Jan. 2, 2017.

13) \$1.25 USD per day - http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/SEN.pdf Jan. 2, 2017. Now \$1.90 USD per day since 2015.

14) Briefing note for countries on the 2015 Human Development Report – Senegal http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/SEN.pdf

15) <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html>

16) Calculated with data from the Annual Economic Account (2000-2014) by the National Agency for Statistics and Demography.

⟨Table 1-1⟩ Contributions of the Informal Sector to GDP (2000–2014)

(Unit: billions of FCFA)				
	2000	2005	2010	2014
Primary Sector	561.8	671.1	978.9	1,017.9
- Informal Sector's contribution	545.8	656.3	961.5	1,009.1
Secondary Sector	681.8	943.8	1,309.5	1,601.7
- Informal Sector's contribution	273.1	371.3	418.8	508.1
Tertiary Sector	1,691.1	2,377.6	3,316.9	3,988.4
-Informal Sector's contribution	721.4	919.3	1,274.9	1,547.8
Taxes on Products	397.1	600.7	796.5	961.2
GDP (A)	3,331.8	4,593.1	6,401.8	7,569.2
Informal Sector's Contribution (B)	1,540.3	1,892.9	2,655.2	3,065.0
B/A (%)	46.2	41.2	41.5	40.5

Source: National Agency for Statistics and Demography.

The agricultural sector was estimated as contributing 17.1% of the GDP in 2015, indicating that the agricultural sector's productivity is low, considering that 46.1% of the labor force is working in the agricultural sector. The industry and service sectors respectively contributed 24.3% and 58.6% of the GDP in 2015.¹⁷⁾ Senegal's major industries include agriculture, fisheries, mining, construction, and tourism and Senegal's main export products are phosphate, fertilizer, agricultural products such as ground nuts and cotton, and fish. Senegal imports capital goods, fuels, food, and beverages.¹⁸⁾

2.1.2.2. Macroeconomic Development Plan

In 2012, Senegal suffered from the economic downturn due to its weak business environment, decreased agricultural production, and inefficiencies and decreases in public investment. In addition, the Ebola outbreak in neighboring countries impacted the regional economy.¹⁹⁾ Senegal sought to overcome these problems by deciding to adopt a new development model that would accelerate its progress toward emerging market status in 2014 under the leadership of President Macky Sall. This mid- and long-term national development plan, entitled the "Plan Senegal Emergent" (PSE), was made through the participation of government ministries, civil society, the private sector, technical partners, and local governments. This plan

17) <https://www.cia.gov/library/publications/the-world-factbook/sfbExt/>

18) *ibid.*

19) <http://news.adakar.com/42613.html> Economic situation of the country 3 years after the alternation: Macky can and must do better World Bank(2014). The Economic Impact of the 2014 Ebola Epidemic: Short- and Mid-Term Estimates for West Africa.

now constitutes a reference for medium- and long-term national economic and social development policies.

As a strategy to achieve the vision of “an Emerging Senegal in 2035 with social solidarity and the rule of law,” the PSE presents three pillars: (i) the structural transformation of the economy and growth, (ii) human capital, social protection, and sustainable development, and (iii) governance, institutions, peace, and safety.²⁰⁾ As the president provides guidelines for each pillar, action plans are designed by the Ministry of Economy, Finance, and Planning through which PSE can be effectively implemented.

For the PSE’s first phase, the Ministry of Economy, Finance, and Planning made the PSE Priority Action Plan (2014–2018), in consideration of the coherence of the strategic pillars, sectoral objectives, and action lines within a budgetary framework over 2014–2018. In determining priorities, a line of actions was assessed based on their likely contribution, mainly to economic growth and sustainable human development.²¹⁾

The PSE implementation process and results are monitored and evaluated by the newly created “Ministry in charge of Monitoring the PSE” under the President. In this ministry, according to Decree No. 2015-685 of 27 May 2015, an Operational Office for the Follow-up of the Emerging Senegal Plan (BOS) was set up to monitor—alongside the other ministries and organizations that were concerned—the execution of PSE projects and reforms, assess the status of their progress periodically, provide technical support to execution organizations, and submit proposals for decisions to the President of the Republic.²²⁾

The implementation of the PSE began in 2015, and public investment policy was aligned with the PSE Priority Action Plan (PAP) in the first year. The state's expenses for the plan were estimated to be 993 billion FCFA²³⁾ (approximately \$1.62 billion USD) in 2015. Approximately 60% of the budget was appropriated by internal resources (government budget) and the other 40% was appropriated by partners and donors. Sixty-five percent of the budget was spent on pillar 1, 25% on pillar

20) Republic of Senegal(February 2014). *Plan Senegal Emergent*.

21) Ministry of Economy, Finance, and Planning (2014) *Priority action plan for Emerging Senegal Plan*.

22) The Operational Office for the Follow-up of the Emerging Senegal Plan is managed by a Director General (under the Minister in charge of Monitoring the PSE) together with a Strategic Orientation Committee (COS) that consists of Prime Minister, Director of the Office of the President of the Republic, General Secretary of the Presidency of the Republic, Minister in charge of Monitoring the Emerging Senegal Plan, Minister of the Economy, Finance and Planning, and any member of the Government and representative of the presidential services concerned with the agenda of the meetings. The COS may also invite to its meetings any natural or legal person whose participation is deemed useful.

23) Financial Community of Africa

2, and the remaining 10% on pillar 3.²⁴⁾ The PSE aims to implement 27 key projects and 17 key flagship reforms²⁵⁾ to set Senegal on the path toward emergence.

After two years of implementation, 17 of the 27 key projects were launched: (i) 12 projects were in the implementation phase: Habitat, Agriculture, Aquaculture, Electricity Recovery Plan, Cereals Corridors, Dakar Regional Campus, Regional Air Hub, Universal Energy Service, Industrial Park, Integrated Tourist Zones, Logistics Hub Integrated, Dakar Medical City; (ii) four projects were in the study phase: Mining hub, Micro-tourism, Digital Economy, Falémé Iron Mine; and (iii) one mining project was in operation: The accelerated zircon operation in Diogo. Similarly, eight of the 17 planned flagship reforms have been launched; six of which were already in the implementation phase and two of which were in the start-up phase.²⁶⁾

2.1.2.3. Employment

Similar to other developing countries, Senegal's informal sector represents a significant portion of the economy. According to a 2011 survey of the informal sector, approximately 80.5% of workers (2,216,719 people) were estimated as being employed in the informal sector.²⁷⁾ The informal sector produced 39.8% of GDP (FCFA 4,336 billion) and 57.7% of non-agricultural value added. The total payroll paid to staff amounted to 600 billion FCFA, with an average monthly salary of 42,150 FCFA, and the amount of taxes paid to the State amounted to 111 billion FCFA.²⁸⁾ Since the formal economy sector's employment capacity is limited, the majority of youths are employed in the informal sector. Agriculture is the primary source of employment in rural areas.

1) Unemployment Rate

The employment ratio among the population aged 15 and over was 69.0%, while the labor force participation rate was 76.6% in 2014. The employment ratio among youths (15–24, by ILO estimation) was 57.6%, while the labor force participation rate among youths was 66.2% in 2014. The youth unemployment rate (i.e., the percentage of the total labor force that age, modeled ILO estimate) was estimated as 9.3% for males and 18.6% for females in 2014.²⁹⁾

24) Republic of Senegal (2016). Joint Annual Review of Economic and Social Policy. p.9.

25) For the lists of 27 key projects and 17 key flagship reforms, refer to Appendices 1 and 2.

26) Operational Office for the Follow-up of Emerging Senegal plan (2016). Status of flagship projects and reforms.

27) National Census 2013 and National Agency for Statistics and Demography (2013). National Survey on the Informal Sector in Senegal.

28) National Agency for Statistic and Demography (2013). National Survey on the Informal Sector in Senegal, p.9 and 44.

29) World Development Indicators.

The unemployment rate was estimated to be 15.7% in 2015 among the population aged 15 years and older. The unemployment rate was higher for women (22.6%) than for men (9.8%). Regarding the place of residence, the unemployment rate was higher in Dakar (16.7%) and other urban areas (19.7%) than in rural areas (12.3%). People without a diploma accounted for 39.9% of the unemployed.³⁰⁾

2) Distribution of the Employed by Education

According to the 2013 national census, 61.0% of the employed were estimated to have attended school, while 38.0% had not attended, as <Table 1-2> shows. The proportion of the population employed with school attendance experience in urban areas was higher than in rural areas. These observations indicate the low quality of labor and the labor quality discrepancy between urban and rural areas. A similar pattern is found in the case of the employed with and without vocational training. Over three-quarters (78.6%) of the employed responded that they did not receive any vocational training, and the proportion was higher in rural areas (91.0%).

<Table 1-2> Proportion of the Population Employed according to School Attendance by Place of Residence and Gender (2013)

School Attendance	Urban			Rural			National		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Never attended	23.9	32.4	26.5	47.5	65.0	51.7	35.3	45.1	38.0
Attended	75.1	66.3	72.4	51.4	34.0	47.3	63.7	53.7	61.0
Currently attending	1.0	1.3	1.1	1.1	1.0	1.1	1.0	1.2	1.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: National Agency for Statistics and Demography.

With respect to the proportion of those employed according to their educational attainment level, the majority (81.6%) of respondents had a diploma equivalent to or below the Brevet de fin d'études moyennes (BFEM) i.e., an ISCED 2—a lower secondary diploma. Of these, 57.1% had no diploma. Among those employed, those with professional degrees such as Certificate of professional skills (CAP),

30) National Agency for Statistics and Demography (2016). National Survey on Employment

Certificate of vocational education (BEP), Brevet professionnel (BP), and Technician certificate (BT) represented barely 1.4%. An urban–rural difference existed; 76.1% of graduates resided in urban areas.

3) Employment in the Informal Sector

According to the 2011 national survey on the informal sector (ENSIS, 2011), 19.1% of workers were self-employed, 33.3% were employees, 37.2% were apprentices, 6.4% were live-in caregivers, and 4.2% were associates. The average age of workers was estimated to be 35 years (34 for men and 36 for women) and more than half of those employed (55.3%) were working with a direct agreement from their employers, which is not an official contract protected by law.

With respect to the distribution of workers by sector, as <Table 1-3> shows, services (39.8%) and trade (30.8%) are distinguished, followed by buildings and public works (construction) (11.3%), food industries (8.5%) and non-food industries (8.4%). The remaining (7.0%) includes transport (3.8%), hotels, bars, and restaurants (2.1%), mining (0.8%), and ice making (0.3%).³¹⁾

<Table 1-3> Employment in the Informal Sector by Gender in 2011

Sectors and Industries	Male		Female		Total	
	Number	%	Number	%	Number	%
1. Industries and BPW	538,381	29.5	112,697	28.6	651,078	29.4
Mining and quarrying	16,112	0.9	2,712	0.7	18,824	0.8
Food industries	104,478	5.7	84,814	21.5	189,292	8.5
Other Industries	167,455	9.2	24,975	6.3	192,430	8.7
Buildings and public works (BPW)	250,336	13.7	196	0.0	250,532	11.3
2. Trade	558,151	30.6	125,174	31.8	683,325	30.8
3. Services	726,258	39.8	156,058	39.6	882,316	39.8
Restaurants and hotels	17,460	1.0	28,749	7.3	46,209	2.1
Transport	80,464	4.4	3,074	0.8	83,538	3.8
Other services	628,334	34.5	124,235	31.5	752,569	33.9
Total (1 + 2 + 3)	1,822,790	100.0	393,929	100.0	2,216,719	100.0

Source: National Survey on Informal Sector (ENSIS 2011).

31) National Agency for Statistics and Demography (2013). National survey on the informal sector in Senegal. p.27.

4) Future Employment Prospects – Manpower Forecasting

The BOS made a projection for the human resource needs of the economy according to the sector and the level of studies by 2023, using data from the National Agency for Statistics and Demography. According to the projection results, Senegal needs approximately 1,600,000 workers for priority sectors³²⁾ between 2014 and 2023, including 850,000 technicians, 500,000 senior technicians, or baccalaureates (secondary school diploma), 200,000 higher technicians, and 50,000 engineers mainly for trade, transport, handcraft, agriculture, fishery, manufacturing, logistics, business, and management.³³⁾ Although the projection does not provide detailed information for each year, it clearly shows that implementing the PSE requires a supply of quality technicians, engineers, and managers, which will mandate a thorough review of the current HRD system.

Moreover, in the framework of the PSE flagship reform “Alignment of Higher Education Training with the Needs of the Economy,” a directory of prospective needs in skills for the economy according to the sector is expected to be finalized in 2017. In addition, a survey on the needs of the private sector (private companies) was conducted, the results of which will be known in 2017. These recent efforts—BOS’s projection, the directory of prospective needs by the Ministry of Higher Education, Research and Innovation and the private sector survey—indicate that Senegal recognizes the importance of manpower projections and must have a comprehensive national system for manpower projection.

2.1.2.4. The Fourth Industrial Revolution

The fourth industrial revolution is expected to bring about fundamental changes in the industrial and occupational structure, and thus employment. From the pessimistic perspective, it is highly probable that routine clerical and administrative jobs and production works in the manufacturing sector will be substituted by Artificial Intelligence (AI) or robots, thus threatening employment security. However, from an optimistic perspective, productivity increases by AI or robots will increase demand for human labor to complement the work of AI or robot. In general, it is well understood that the fourth industrial revolution will enhance the economy’s productivity and efficiency tremendously, and the gap between countries that can invest in the fourth industrial revolution and those that cannot will widen.³⁴⁾ This implies that developing countries are losing the comparative

32) Agriculture, trade, energy, transport, craft, habitat, industry, logistics, mining, services, health, financing services, IT, and tourism.

33) Operational Office for the Follow-up of Emerging Senegal plan (2016) , Consolidated vision of 10-year skill needs.

34) Klaus Schwab (2016). The Fourth Industrial Revolution.

advantage of low labor costs and that they need to take certain actions to maintain their countries' sustainable development. For example, they can increase access to ICT and connectivity among networks by investing in their network infrastructure. Schools need to teach ICT, AI, and software to keep pace with the fourth industrial revolution's progress.³⁵⁾ In that sense, the recent policy initiative of the robot competition (i.e., the Pan Africa Robot Competition) is quite impressive.³⁶⁾

2.1.3. Political Context

Senegal, which is located in west Sahel, is one of the most politically stable countries in Africa since it gained independence from France in 1960, and has considerably strengthened its democratic institutions. Although Senegal has history in the break-up of the Mali Federation (1960), the Confederation of Senegambia (1989), the separatist insurgency in southern Senegal that has existed since the 1980s, and President Abdoulaye Wade's attempt to run for a third term in 2012, Senegal has had three peaceful political transitions with four presidents.³⁷⁾ On March 20, 2016, Senegal held a constitutional referendum to strengthen its political system by reducing the presidential term from seven to five years with a limit of two consecutive terms,³⁸⁾ created a new consultative assembly to allow independent candidate status for all elections, and enhanced the official status of the opposition party leader. The next presidential election is expected in 2019, while legislative elections are planned in 2017. President Macky Sall, who was elected in 2012, made an ambitious national economic development plan, the Plan Senegal Emergent, in 2014 and has tried to implement economic reforms and investment policies while tackling and overcoming both the government's bureaucratic inefficiencies and the challenging business environment.

2.1.4. The Plan Senegal Emergent

The second pillar of the PSE—human capital, social protection, and sustainable development—includes the following seven topics: population and sustainable human development, education and training, health and nutrition, social protection, drinking water and remediation, habitat and life framework, and prevention and risk management. Among them, the national policy for education and training is established based on PAQUET (2013–2025) with following objectives:

35) http://m.kisdi.re.kr/mobile/colm/pro_view.m?seq=31687&category=P&selectPage=1 Jonghwa Lee (2016.8). The Fourth Industrial Revolution and ODA.

36) The Ministry of Higher Education and Research launched 'Pan Africa Robot Competition' that provides students with 4-day program to learn how to make robots and think how to apply robotics to agriculture in 2016, and has expanded the program.

37) Leopold Sedar Senghor(1960-1980), Abdou Diouf(1981-2000), Abdoulaye Wade(2000-2012), and Macky Sall(2012 March – present).

38) <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html> Dec. 19, 2016.

(i) set up a 10-year basic education cycle, (ii) improve the quality of teaching and learning, (iii) eradicate illiteracy and promote the use of national languages,³⁹⁾ (iv) integrate apprenticeship training into general learning, (v) promote employment-oriented vocational education, (vi) diversify higher education and improve its quality, (vii) strengthen the use of ICT in higher education, (viii) create a “virtual university with open digital space,” (ix) enhance the utilization of the results of R&D and technology in strategic industry areas, and (x) develop efficient, effective and inclusive education governance systems.⁴⁰⁾ The Ministry of National Education, the Ministry of Higher Education, Research and Innovation and the Ministry of Vocational Training, Apprenticeship and Crafts all play major roles in implementing the above policy tasks. The Ministry of Youth, Employment and Citizenship Building and the Ministry of Women, Family and Childhood also participate in the policy process in related topics.

2.1.5. National Plan for HRD – PAQUET⁴¹⁾

2.1.5.1. Purpose and Strategic Areas of the PAQUET

The Ministry of National Education, the Ministry of Higher Education, Research and Innovation the Ministry of Vocational Training, Apprenticeship and Crafts, and the Ministry of Women, Children and Female Entrepreneurship made PAQUET (2013–2025) as a mid- and long-term national plan for education and training in Senegal in 2013. PAQUET was adopted as the framework for the operationalization of the Letter of General Policy (2013–2025)⁴²⁾ after the implementation of the 10-year Education and Training Program (PDEF 2000–2011). The main purpose of making the PAQUET was to build a system of education and training that was fair, efficient, and effective in line with the social and economic development requirements based on inclusive governance and greater accountability of local communities and grassroots actors. In the PAQUET, the Senegalese government identified six strategic areas in relation to the second pillar of the PSE: (i) integrated early childhood development, (ii) basic education, (iii) general secondary education, (iv) basic education for youths and adults, (v) vocational and technical training, and (vi) higher education and scientific research. PAQUET is planned to be implemented through three stages: the first stage is for 2013–2015, the second is for 2016–2020, and the third is for 2021–2025.⁴³⁾

39) In Senegal, there are 26 national languages. The Ministry of National Education tries to provide the adult literacy program for each of these languages.

40) Republic of Senegal(February 2014). Plan Senegal Emergent. pp.77-78.

41) Program for Improving the Quality, Equity, and Transparency of the Education and Training Sectors (2013-2025).

42) Letter of General Policy, prepared by all ministries in charge of education and training, is the policy document of the education and training sector that reflects the Government's vision, priorities and broad guidelines for basic education, secondary education, technical and vocational training, and higher education.

Implementing specific action plans of the PAQUET programs requires that public officials of the four ministries mentioned above discuss and collaborate through coordination by the Ministry of National Education. The general coordination of the Program for Improving the Quality, Equity and Transparency-Education and Training (PAQUET-EF) has been ensured by the Directorate of Education Planning and Reform (DPRE), under the authority of the Minister of National Education since the program began. An annual review of the program was carried out in 2016 by the Local Partners Group⁴⁴, which was composed of the technical committee⁴⁵, development partners, civil society, local authorities, and the teacher unions. The results have not yet been released.

Currently, the government is planning the second stage of the PAQUET (2016–2020) based on the results of evaluating the first stage (2013–2015). In the second stage, the government intends to make a linkage with Sustainable Development Goal 4⁴⁶ with action plans to improve access to and quality of education as well as promote gender equality, equity, inclusion, and lifelong learning.

2.1.5.2. Relevance of the PAQUET to the PSE and other Policies

As indicated in Section 2.2.1, the PAQUET is closely linked to the PSE's second pillar in that the ultimate purpose of the PAQUET is to educate, train, and supply competent human resources for Senegal's sustainable development. The main content of the PSE's second pillar were developed based on the PAQUET. Finally, the governance part of the PAQUET is reflected in the third pillar of the PSE.

Even if the main contents of the PAQUET are consistent with the PSE, however, it is necessary to update the main contents of the PAQUET and rearrange the priorities of them according to changes occurred during the first stage of the PAQUET implementation like new policy focus set out in other crucial government documents, acts and international organizations' strategies including (i) a national consultation on the future of higher education that resulted in 11 presidential decisions in 2013,⁴⁷ (ii) a consultation on education with 11 presidential decisions and 45 directives in 2014,⁴⁸ (iii) a new law on the orientation of TVET and its national strategy in relation to the PSE in 2015,⁴⁹ (iv) a new act on

43) Republic of Senegal(July 2013). Program for Improving the Quality, Equity and Transparency (PAQUET) of the Education and Training Sectors(2013-2025).

44) List of Local partner Group invited for PAQUET evaluation.

45) Ministry of National Education (2016). Decree establishing the technical committee for the evaluation and updating of the PAQUET.

46) "Ensure universal access to quality education on an equal footing and promote opportunities for lifelong learning".

47) Ministry of Higher Education and Research (2013). Presidential Decisions on research and higher education.

48) <http://www.gouv.sn/Conseil-presidentiel-sur-les,1898.html> – 02 Jan 2017.

49) Republic of Senegal (2015). Vocational and Technical Training Law.

decentralization,⁵⁰⁾ (v) a new Global Partnership for the 2016–2020 Strategic Education Plan,⁵¹⁾ (vi) the adoption of the 2016/2030 Education Agenda,⁵²⁾ (vii) The adoption of the United Nations’ Sustainable Development Goals, (viii) strategic environment assessment of the PAQEEB,⁵³⁾ and (ix) the 2013 general population census of Senegal.⁵⁴⁾

It is important to take into account that these national and international documents related to education were adopted after 2012, when PAQUET was designed after the OEDF evaluation (2000–2010). The new administration of President Macky Sall sought to improve education and training by organizing national consultations for higher education (2013) and for national education (2014), which resulted in presidential decisions in the sector. The Plan Senegal Emergent was designed in 2014 (two years after PAQUET) and brought new guidelines for economic and social development. Other international documents such as SDGs have engaged Senegal as a member of the international community. After four years of implementation, the PAQUET evaluation and revision has to take into account the new guidelines and objectives to see whether they are aligned and perform necessary modifications.

2.1.6. The Link between National Economic Development Plans and HRD Policies

As explained above, Senegal is currently implementing the Plan Senegal Emergent (2014–2035) under the leadership of President Macky Sall. However, the lack of systematic linkage between the first and second pillars is a key problem. The Ministry of Economy, Finance, and Planning makes specific plans for national economic development without carefully considering the labor supply and demand discrepancy. Each HRD-related ministry—The Ministry of National Education, the Ministry of Higher Education, Research and Innovation the Ministry of Vocational Training, Apprenticeship and Crafts, the Ministry of Youth and Employment, and the Ministry of Women, Child and Female Entrepreneurship—requests a budget and makes and implements policies based on its own estimations of demand. It is integral that the government first projects the labor demands required to implement national economic development plans, estimates the difference

50) Republic of Senegal (2013). General Code of Local Government Law.

51) Global Partnership for Education (2016). GPE Strategic Plan “Improving Learning and Equity through Stronger Education Systems”.

52) UNESCO (2015). Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4.

53) Ministry of National Education (2013). Framework for Environmental and Social Management (CGES) of the Project to Improve Quality and Equity in Basic Education(PAQEEB).

54) National Agency for Statistic and Demography (2013). General Census of Population, Habitat, Agriculture and Livestock.

between demand and supply by reviewing the country's current HRD capacity, and makes specific HRD policies to close the gap through the coordination and collaboration among related ministries, all to maximize the effect of government budget investment. The government of Senegal currently lacks this functionality. Thus, a mechanism in which the national economic development plan and HRD policies are closely connected⁵⁵⁾ in terms of labor demand and supply must be set up immediately.⁵⁶⁾

2.2. National HRD System

2.2.1. Education

2.2.1.1. Regular School Education System

Regular school system in Senegal, as described in <Table 1-4>, consists of (i) three years of pre-school education (3–5 year old students, administrated by the Ministry of Women, Children and Female Entrepreneurship), (ii) six years of primary education (6–11 year old students, administrated by the Ministry of National Education), (iii) four years of lower secondary education (12–15 year students, administrated by the Ministry of National Education), (iv) three years of upper secondary education (16–18 year old students, administrated by the Ministry of National Education), and (v) three years of higher education (19 year old and above students, administrated by the Ministry of Higher Education, Research and Innovation). In addition, vocational education is provided for students aged 15 years and older by the Ministry of Vocational Training, Apprenticeship, and Crafts. The basic education is free for children aged 6–15,⁵⁷⁾ while higher education students pay approximately \$50 USD per annum for a Bachelor's course, \$100 USD per annum for a Master's course, and \$150 USD per annum for a Ph.D. course.

Senegal has been trying to increase people's educational attainment level; the gross pre-school enrolment rate rose slightly from 16.4% in 2014 to 16.8% in 2015. For primary education, the gross enrolment rate has steadily decreased from 93.9% in 2012 to 86.4% in 2015, despite the government's efforts to broaden and diversify their education provision; this is due to the application of new census data that

55) The National Council on Education and Economy, which consists of representatives from the Ministry of National Education, the Ministry of Higher Education and Research, the Ministry of Vocational Training, Apprenticeship, and Crafts, and the Ministry of Economy, Finance, and Planning, is going to be established in 2017; this council can perform this function of HRD policy coordination.

56) Recently, the government has tried to align higher education with the economic needs by launching the Senegalese Program for Youth Entrepreneurship (www.psej.net) and the professionalization of the higher education courses (PROFsup-PSE) as a flagship reform of the PSE. Senegal's government needs to extend this effort to all industry sectors and all levels of schooling.

57) <http://www.epdc.org/country/Senegal> Dec. 5, 2016.

was collected in 2013. The government has tried to increase the enrolment rate by establishing more schools throughout the country while also recruiting teachers and building school cafeterias. The number of primary schools has increased from 8,984 in 2013 to 9,828 in 2015 (by 9.4%) and the number of students has also increased from 1,805,170 to 1,929,030 over the same period (by 6.7%).⁵⁸⁾

〈Table 1-4〉 School System in Senegal

Sub-sector		Target age groups	Ministry	
Integrated Early Childhood Development (Pre-primary)		3–5	Women, Childhood and Female Entrepreneurship	
Basic Education	Elementary Education	6–11	National Education	
	Lower Secondary Education	12–15		
	EBJA	Basic Community Schools		9–14
		Adolescents and Adults not literate		15+
		Modern Daaras		3–18
Secondary Education		16–18		
Technical Education and Vocational Training		15+	Vocational Training, Apprenticeship and Crafts	
Higher Education		18+	Higher Education and Research	

Source: National Account for Education (2016).

Over the same period, the gross enrolment rate for lower secondary school increased from 56.4% to 59.9%, although this is still below the target of 63.5%.⁵⁹⁾ As of 2015, the GER of female students in lower secondary school (63.3%) is higher than that of males (56.7%). The GER of upper secondary school increased from 25.8% in 2012 to 34.1% in 2015, which is higher than the targets of 2015 (27.1%) and 2017 (28.5%).⁶⁰⁾ The increase in the GER of upper secondary school is mainly due to the construction of high schools. The establishment of new high schools needs to continue and even accelerate in border areas where students have to travel a long distance to pursue an education. The number of graduates

58) Ministry of National Education (2016). Annual report of Education 2015. p.67.

59) Enrolment targets are set in each ministries' budget documents.

60) Ministry of National Education (2016). Annual Performance Report 2015. p.45.

from high schools increased from 39,638 in 2014 to 45,355 in 2015 and to 54,571 in 2016.⁶¹⁾ The number of higher education students is also estimated to increase rapidly from 122,970 in 2012 to 143,136 in 2015. Public universities have difficulty absorbing students, although private higher education institutions accommodate almost 30% of students.

2.2.1.2. Traditional School - Daara

Senegal's education authority now faces the serious issue that certain Muslim religious groups resist the modern French-style school education, because of religious and cultural differences; they have established their own Muslim schools called "Daaras" that teaches the Muslim religion in Arabic. Many parents living in disadvantaged areas send their children to a Daara, in which the number of students is not counted in the official statistics. A key problem with Daaras is that most of them do not provide education programs for acquiring basic competencies, but instead force the children to beg on the streets. The government has recognized the urgency of enhancing the education quality in Daaras and transforming Daaras into regular modern schools. However, it was difficult to change the various types of Daara into modern French-style schools; the government struggled to take the necessary steps because this might have created very serious conflicts with religious groups.⁶²⁾ The Ministry of National Education has reached an agreement with Daaras to modernize them, in which French and Arabic are used as teaching languages. Currently, there are 66 modern Daaras under construction.

2.2.1.3. Science and Technology Education

Science and technology education is mainly provided from the secondary school level onwards. For example, at the upper secondary school that provides two education tracks of literature and science, mathematics, physics and life and earth science courses are taught. Compared to the literature track, the science track provides more teaching hours of these three science subjects.⁶³⁾ However, there are too few students engaged in science. For instance, there is a science sub-track called S3 that also teaches mechanics, general technology, the theory of automation and manufacturing analysis that only a few students (i.e., 65 out of 153,462 baccalaureate (secondary degree) candidates in 2016) took.⁶⁴⁾ At the

61) www.officedubac.sn

62) The World Bank is planning to provide technical and financial support to the Daaras selected through competition process.

63) National Steering Committee for Science and Technology Education Development in Senegal (2010), Study on "Development of Teaching of Science and Technology, from Preschool to Higher Education. p.14.

64) www.officedubac.sn

higher education level, all Senegal public universities have faculties or colleges in science and technology that teach diverse courses such as chemistry, physics, math, biology, geology, ecology, and agriculture. Besides public universities, there are two polytechnic colleges that provide various engineering courses such as mechanical, civil, electrical, chemical, and biological engineering and other courses such as renewable energies and aeronautics.⁶⁵⁾ However, Senegal has to contend with the low quality of available science education and a lack of science teachers.⁶⁶⁾

According to the PSE, the government of Senegal has emphasized science education in every stage of schooling from secondary to higher education.⁶⁷⁾ The first presidential decision with regard to education consultation (2014) was to "reorient the education system toward science, mathematics, digital technology and entrepreneurship." This decision was implemented through curriculum changes to increase the teaching hours of scientific disciplines, the creation of science high school, and the construction of scientific and technical sites for practical training. A new decree no. 2014-632 (May 07, 2014) was taken to increase the weekly credit for lower secondary-level science disciplines. Physical science courses start in the third year of lower secondary school. A Scientific High School of Excellence was created by decree no. 2016-1226 (August 19, 2016), with a residential system and student recruitment exclusively through competition.⁶⁸⁾

The list of initiatives and innovations to promote the teaching of these sciences included the obligation for institutions to have scientific projects in their performance contracts. Since 2015, 200 lower secondary schools across the country have had school projects centered on Mathematics and the Sciences, financed up to approximately \$2 million USD. Roughly \$300,000 USD was also mobilized for the training of 7,763 teachers of Mathematics and Sciences. To create the conditions for success in initiatives and innovations, the Ministry of National Education developed a program to provide institutions with scientific equipment. Approximately \$6 million USD was spent on equipment and laboratory products between 2012 and 2016 to equip 48 upper secondary schools and 32 lower secondary schools.⁶⁹⁾

65) National Steering Committee for Science and Technology Education Development in Senegal (2010). Study on "Development of Teaching of Science and Technology, from Preschool to Higher Education. p.15.

66) Republic of Senegal (July 2013). Program for Improving the Quality, Equity and Transparency (PAQUET) in the Education and Training Sectors (2013-2025) p.18.

67) Republic of Senegal(February 2014). Plan Senegal Emergent p.78.

68) Ministry of National Education (2016). Senegalese Education System: Reforms, Initiatives and Innovation 2012-2016 p.61.

69) *ibid*, p.62.

Until 2013, there was a lack of any clear vision for science and technology education in universities. After the national consultation on the future of higher education (2013), the authorities committed to developing science in higher education. The first decision from the Presidential Council on Higher Education and Research was to "reorient the system to Science, Technology, Engineering and Math (STEM) and short vocational training." The implementation of this decision began with upgrading the technical setup of university laboratories in an emergency procurement program that ran from 2014 to 2016, followed by an extensive construction and equipment program for 100 training laboratories in Senegal's public universities and engineer schools. Since higher education is the top priority of the education system, the Ministry of Higher Education, Research and Innovation promotes scientific culture at all levels, especially for all students from pre-school to university to increase the scientific literacy of high school graduates; the directorate in charge of scientific culture promotion was created in 2014 for this. At the Knowledge City, the Ministry is building a media library and "Maison de la Science" with an aquarium, scientific demonstration areas, and a planetarium to offer children a space to explore science. In addition, an annual robotics competition is organized between colleges and high schools across the country to arouse students' interest in science.⁷⁰⁾

2.2.1.4. Higher Education

1) Higher Education Institutions

There are three types of higher education institution in Senegal: universities, polytechnics, and junior colleges, as described in <Table 1-5>. There are six national universities including the University Cheikh Anta Diop of Dakar (UCAD) and more than 200 private universities. UCAD is the second largest university in Africa and accommodates 80,000 students. From its inception in 1957 until 1990, UCAD was Senegal's only university. Gaston Berger University was established in 1990 with a greater focus on professionalization. As primary and secondary schools have expanded, the government has decided to create three new universities—Alioune Diop de Bambey University (UADB), Thies University (UT), and Assane Seck University of Ziguinchor (UASZ).

Since 2013, with national consultations and advice from the Presidential Council on Higher Education and Research, Senegal's government has been reforming their higher education system. Reform measures include the expansion of the university map with the construction of new universities and higher education institutes for vocational training, the promotion of STEM, arranging new governance of

70) <http://www.mesr.gouv.sn/?p=5961> Feb. 5, 2017.

universities involving the private sector on the boards, improvement in the use of ICT, and new impetus for research. A Development Plan for Higher Education and Research (PDESAR) was designed to support reform implementation and the government committed to investing more than \$600 million USD.

The government began to renovate and expand all of its existing universities and constructed new higher education institutions: Two universities of 30,000 students, one of which was entirely dedicated to agriculture, two delocalized university centers (out of four), five higher institutes of vocational education (for the target of 14 in the country's 14 administrative regions), and 19 open digital spaces (distance learning centers), which will be located in 45 of Senegal's administrative departments (out of 50).

(Table 1-5) Higher Education Structure and 2015 Statistics (public institutions)

Types	Level of Education	Entry Requirement	Duration	Number of Students	
Universities	Doctorate	Master's degree	Three years	Doctorate 3	1,815
				Doctorate 2	2,173
				Doctorate 1	2,006
	Master	Bachelor's degree	Two years	Master's 2	10,134
				Master's 1	8,521
	Bachelor	Secondary school degree	Three years	Bachelor's 3	16,272
				Bachelor's 2	23,120
				Bachelor's 1	50,134
	Polytechnics schools	Diploma	Secondary school degree	Five years	Doctorate 1
DIC 3					1,211
DIC 2					1,031
DIC 1					1,254
TC2					483
TC1					600
Junior College (ISEP)	Tertiary Vocational Training Diploma (DISEP)	Secondary school degree	Two years	year 2	98
				year 1	116

Note: (1) Students who complete 2 years at bachelor level in other faculties or schools can join this polytechnic level via a competition;

(2) TC = Tronc commun (common program before specialization); and

(3) DIC = Diplôme d'Ingénieur de Conception (Design Engineer Diploma).

Source: Ministry of Higher Education, Research and Innovation.

2) Research

Regarding science, technology, and innovation, Senegal lacks the research infrastructure, professional researchers, and financial resources. The main research centers are currently public universities and research institutes such as the Senegalese Agricultural Research Institute (ISRA), the Institute of Food Technology (ITA), the Dakar PASTEUR Institute, the Fundamental Institute of Black Africa (IFAN), the National Institute of Pedology (INP), and the Ecological Monitoring Center (CSE).

The government is currently building a Knowledge City in which they plan to establish a science and technology research complex. In the field of higher education, the knowledge city will host a higher Institute of Vocational Education (ISEP) with a focus on the automotive and ICT professions (financed by KOICA), the headquarters of the Virtual University of Senegal, an open digital space, the African Institute of Mathematical Sciences (AIMS), and the Francophonie Institute for Training.

Shared infrastructures will be built for the research, including heavy equipment, with the establishment of a Research and Innovation Technical Support Platform for Emergence (PATRIE) to host shared laboratories in (i) life sciences (basic biology, biotechnology, agriculture, livestock, health, pharmacy, etc.); (ii) basic and applied sciences (mathematical modeling, numerical simulation, computing, telecommunications, robotics, embedded technology, contactless technology, space, peaceful use of nuclear energy, materials physics, motors, sensors, sensors); and (iii) nuclear medicine and particle physics.

Overall, Senegal's higher education facilities are confronted with the following problems: (i) lack of physical capacity to accommodate students (i.e., overload of UCAD, lack of universities in other areas than Dakar), (ii) low proportion of students who have mastered the basic cognitive skills required for higher education, and (iii) mismatch between the curricula and the labor market skill demands in terms of both quality and quantity. These problems have led to Senegal's higher education institutions continuing to produce graduates without marketable competencies and the quality of their education has remained low.⁷¹⁾ Since 2013, Senegal has been implementing higher education reforms to overcome these problems.

71) Republic of Senegal (July 2013). Program for Improving the Quality, Equity and Transparency (PAQUET) in the Education and Training Sectors (2013–2025). p.16.

2.2.2. Technical and Vocational Education and Training (TVET)

2.2.2.1. Vocational Education

Vocational education has not drawn much attention in the past. However, its current importance is highly emphasized from a national development perspective. At present, approximately 4% of the education budget is allocated to vocational education. The government intends to increase this proportion up to 25%. In addition, the government plans to increase the proportion of the levy⁷²⁾ allocated to vocational training to 100% by 2018, indicating that the size of the budget for TVET will expand considerably in the near future.

Vocational education in the regular school system is provided from high school. There are three types of high school: general academic high schools, technical high schools, and combined high schools that provide both academic and technical education, as shown in <Table 1-6>. There are also vocational and technical training centers. The Ministry of Vocational Training, Apprenticeship, and Crafts is responsible for managing vocational education. For the third type of high school, the budget for general academic education is provided by the Ministry of National Education, while that for vocational education is provided by the Ministry of Vocational Training, Apprenticeship, and Crafts.

At the post-secondary level, polytechnic colleges (ESP, IPSL, and EPT) and junior colleges (ISEP) provide vocational education.⁷³⁾ Although TVET in higher education is not particularly well developed in Senegal, the government has taken several initiatives since the 1960s: the Vocational Training Institute for Applied Economics (ENEA) in 1963, the Polytechnic Vocational Training School (ESP) in 1964, the National Institute for Rural Executives Training (ISFAR) in 1965, the Polytechnic School of Thies (EPT) in 1973, the National Institute for Agriculture (ENSA) in 1981, the Institute of Earth Sciences (IST) in 1981, and a two-year vocational training diploma (BTS) in the early 1990s. In addition, as a result of national consultations in 2013, the government opted to promote TVET and distance learning. The concept of the Higher Institute for Vocational Training (ISEP) was developed, and five ISEPs are under construction. For distance learning, the Virtual University of Senegal (UVS) was opened in 2014. UVS' training programs are roughly equivalent to those of the more classical Senegalese universities.

72) For a detailed explanation of the levy, refer to Section 2.3.3.2.

73) Refer to Chapter 3 for details of vocational education and training.

<Table 1-6> Composition Ratio of High Schools and Students by Type of High School and Training Centers

	2013		2014		2015	
	Number	Students	Number	Students	Number	Students
General High Schools	604	248,509	774	277,045	763	302,826
Combined Technical and General High Schools	1	48,116	1	51,965	1	54,318
Technical High Schools	9		10		10	
Vocational and Technical Training Centers	300		377		377	

Note: The number of students in technical education is included in the total number of TVET students for Combined High Schools. The number for general education is included in general high schools.

Sources: (1) National Education Report 2015. p.101 and 105; and

(2) National Report on the Status of Vocational and Technical Training 2015. p.8, 12, and 19).

As of 2016, there are three polytechnic colleges (Ecole Supérieure Polytechnique in UCAD [ESP], Ecole Polytechnique de Thiès; and Institut Polytechnique de Saint-Louis [IPSL] in UGB). ESP in UCAD has six departments: chemical engineering and applied biology, civil engineering, electric engineering, information engineering (e.g., computer science, software), mechanical engineering, and management (e.g., finance, marketing). ESP provides diverse diploma and qualification programs such as BAC (general certificate of secondary education) + a two-year diploma program, BAC + a three-year license program, BAC + a four-year engineer program, and BAC + five-year Master's program. The number of ESP students increased from 4,071 in 2010 to 4,317 in 2016, while the proportion of female students increased from 49.9% to 54.1%. The employment rate of graduates was approximately 75%.⁷⁴⁾ However, ESP does not conduct scientific analyses of the changes in skill demands.

The second polytechnic college is Ecole Polytechnique of Thiès (EPT)⁷⁵⁾, which is an engineering school with more than 40 years of expertise in the training of design engineers in civil engineering, electromechanical engineering, and computer and telecommunications engineering. The admission of first-year pupils is performed through a competition among scientific and technical baccalaureate holders. The five-year training program is divided into two parts: the common track (two

74) Ecole Polytechnic(2016.10). Formation of Catalog.

75) www.ept.sn

years) and the specialization (three years). Today, EPT delivers three engineering diplomas: civil engineering design, electromechanical engineering, and computer and telecommunications engineering.

The third polytechnic college is Polytechnic Institute of Saint-Louis (IPSL) which offers engineering and technical training to meet the needs of companies and the economy, notably in mechatronics and civil engineering.⁷⁶⁾

2.2.2.2. Vocational Training

The Ministry of Vocational Training, Apprenticeship, and Crafts is responsible for managing both initial and continuing vocational training. The ministry's main target groups include adolescents and adults 15 years and older. The ministry also deals with issues of gender discrimination and disability.

The ministry is currently implementing the Strategic Development Plan for TVET (2015–2019) that is linked to the PAQUET. The TVET Development Plan covers three policy areas: vocational training, apprenticeship, and handcraft. This plan, created through the participation of all stakeholders, takes two approaches: the sectoral approach and public–private-partnership (PPP). First, representative organizations of each industry sector analyze the skill demands; once these have been identified by sector, the government supports the budget for TVET and the private sector provides TVET through PPP. These two approaches are adopted to shift the TVET paradigm from theory-based and supply-oriented to skill competency-based and demand-oriented.

The new TVET strategy is inspired by the country's new policy documents such as the Plan Senegal Emergent, the PAQUET, decisions from consultation on education, and Decentralization Act 3. Considering the socioeconomic context, the Senegalese government aims to make vocational and technical training an important lever for improving economic competitiveness and creating wealth. For this, the main guidelines for technical vocational training are:

- (i) Promote vocational training oriented toward the labor market through the development of continuing education, training needs studies, work situation analysis, and curriculum development according to the “Approach by Skills” and the creation of conditions for their establishment, and support for the insertion of graduates;
- (ii) Integrate apprenticeships into the Vocational and Technical Training system through the training of workshop masters and implementation of

76) <http://www.ugb.sn/candidature-ipsl/public/>

- apprenticeship training schemes;
- (iii) Develop partnership governance and enhance PPP.

The vision defined in this strategic plan is articulated with that of the PSE. Four strategic pillars have been adopted to contribute to this objective: (i) the development of diversified and integrated vocational and technical training offers within the framework of a holistic vision; (ii) funding for appropriate Vocational and Technical Training and Crafts; (iii) the promotion of crafts; and (iv) strengthening the governance capacity of the vocational training and crafts sector.

In Higher Education, one of the reforms that resulted from the Presidential Council's first decision was the development of short vocational training. For this, the Ministry of Higher Education, Research and Innovation has carried out a study on 14 Senegalese administrative regions with a view of setting up a network of higher vocational institutes (ISEP) in various professions related to the economy's needs. Five ISEPs are already under construction and one has started training in 2014.

There is neither an accreditation system for TVET institutions and programs nor research institutes that specialize in TVET. The Ministry of Vocational Training, Apprenticeship, and Crafts can enact laws and acts related to the establishment of accreditation systems and research institutes and request budgets for their operations.

In the past, TVET has been regarded as second-class education in Senegal. Since TVET is a critical policy tool with which to promote a country's economic development, the government needs to let people know the positive effect of TVET and best practice cases. In addition, the government has been confronted with the problem of outdated facilities and equipment for TVET, which are both detrimental to their ability to provide effective TVET that is tailored to labor market skill demands. This implies the necessity of utilizing the private sector's facilities, equipment, and expertise. Currently, the government is investing in building new vocational training institutions that have world-class facilities.

2.2.3. HRD Budget

2.2.3.1. Education Budget

1) Central Government Budget

The central government budget is allocated to each ministry as follows: (i) The Ministry of Economy, Finance, and Planning decides the ceiling of the total budget amount for each ministry based on the national policy consultation process and the

president's guidelines, and announces the ceiling of the budgeted amounts to the ministries; (ii) each ministry makes specific budget plans within the ceiling amount using the budget template and sends this to the Ministry of Economy, Finance, and Planning and the Council of Ministers; and (iii) the Council of Ministers reviews this and then sends it to the congress. When international organizations provide the government with financial support, the Ministry of Economy, Finance, and Planning guarantees the lawful process of the budget plan and its management.

The central government budget increased from FCFA 1,316,552,473,500 (\$2,501,449,700 USD) in 2005 to FCFA 1,933,882,000,000 (\$3,867,764,000 USD) in 2010, then FCFA 2,906,689,000,000 (\$4,941,371,300 USD) in 2015.⁷⁷⁾ In 2015, the Ministry of National Education got the largest proportion of the budget (13.0%) except for the public debt (20.6%), followed by Common Expenditure (8.2%), the Ministry of Economy, Finance and Planning (6.0%), the Ministry of Agriculture and Rural Equipment (5.9%), the Ministry of Infrastructure, Land Transport and Opening Up (5.5%), the Ministry of the Armed Forces (5.1%), the Ministry of Higher Education, Research and Innovation (5.0%), the Ministry of Health and Social Action (4.7%) and the Ministry of Energy and Renewable Energy Development (3.2%). In 2015, 18.0% of the budget was allocated to primary, secondary, and higher education, which indicates that Senegal places a high emphasis on education.⁷⁸⁾ If the budgets of the Ministry of Higher Education, Research and Innovation, the Ministry of Health and Social Action, the Ministry of Vocational Training, Apprenticeship and Craft (1.0%), the Ministry of Youth Employment and Citizenship Building (0.4%), and the Ministry of Women, Childhood and Family (0.5%) are also counted, Senegal spent 24.6% of its budget on HRD.⁷⁹⁾

2) Education Funding

Education services are funded by two main sources—internal (i.e., government budget and private sector contributions) and external (i.e., donors). However, the budget approved by the national assembly only takes into account the share of the State and external resources from loans or grants signed by the Ministry of the Economy, Finance, and Planning. Some contributions are not systematically recorded in financial information systems, as they are directly provided to schools in different forms; this explains why actual expenditure on education exceeds the budgets approved by the national assembly. Moreover, besides the three ministries (the Ministry of National Education, the Ministry of Higher Education, Research and

77) Republic of Senegal, Amended Law of Finance 2005, 2010 and 2015.

78) Senegal does not have a mandatory requirement for the allocation of a certain percentage of the national budget on education or TVET.

79) Refer to Appendix 4 for further details.

Innovation and the Ministry of Vocational Training, Apprenticeship and Crafts), other ministries operate training and education institutions with their own budgets.

The proportion of education and TVET expenditure funded by external sources remained below 10% between 2009 and 2014 as shown in <Table 1-7>,⁸⁰⁾ which means that main source was internal. There is a general trend of funding increases for all levels, but predominantly for higher education and TVET, the budgets of which doubled. The primary school aspect decreased from 41.0% to 32.0% of the expenditure, while higher education and TVET increased from 22.6% to 28.7% and from 5.6% to 7.2%, respectively. This could be explained by the Higher Education and Research Development Plan that was adopted in 2013 and the 2014 decree of Lump Sum Contribution to the Employer's Expense (CFCE) levy distribution after the creation of the TVET Fund.

(Table 1-7) Changes in Expenditure on Education and TVET by Purpose, 2009-2014

	(Unit: USD)					
	2009	2010	2011	2012	2013	2014
Integrated Early Childhood Development (pre-primary)	8,992,806	12,589,928	12,589,928	21,582,734	30,575,540	30,575,540
Primary	302,158,273	311,151,079	291,366,906	312,949,640	345,323,741	354,316,547
Lower Secondary	86,330,935	109,712,230	124,100,719	129,496,403	174,460,432	160,071,942
Upper Secondary	34,172,662	44,964,029	48,561,151	57,553,957	75,539,568	86,330,935
Technical and Vocational Training	41,366,906	35,971,223	43,165,468	35,971,223	44,964,029	79,136,691
Teacher Training (MoNE and MoTVET)	19,784,173	14,388,489	8,992,806	7,194,245	5,395,683	5,395,683
Higher Education	167,266,187	190,647,482	197,841,727	206,834,532	332,733,813	316,546,763
Basic education for illiterate youths and adolescents	3,597,122	1,798,561	0	1,798,561	5,395,683	5,395,683

80) Republic of Senegal (2016). National Account for Education.

〈Table 1-7〉 Continued

	(Unit: USD)					
	2009	2010	2011	2012	2013	2014
Central Administration	57,553,957	66,546,763	53,956,835	64,748,201	48,561,151	52,158,273
Local Administration	19,784,173	14,388,489	17,985,612	12,589,928	12,589,928	14,388 489
Total domestic and foreign expenditure by level of education	741,007,194	802,158,273	798,561,151	850,719,424	1,075,539,568	1,104,316,547
Percentage of foreign funds	9.0	6.6	6.9	8.2	9.2	4.5

Source: National Accounts for Education.

2.2.3.2. Higher Education Budget

Budgets for higher education and research mainly come from the government and donors. In addition, budget surpluses are mobilized directly by higher education and research institutions through projects. The National Education Accounts estimated that the total expenditure on higher education in 2014 was \$329.8 million USD.⁸¹⁾ This includes those managed by the Ministry of Higher Education, Research and Innovation and other organizations. Nearly 30% of expenditure is allocated to scholarships, 22.6% to salaries (teachers and staff), and 18.8% to investment, while 78.4% of the expenditure goes to the public universities, 13.8% to centers for students' social affairs and 3.9% to higher education administration.⁸²⁾

2.2.3.3. TVET Budget

The TVET budget in Senegal is provided by four main sources: the government, trainees and students, international donor agencies, and private firms. Donors such as Canada, France, Luxemburg, Belgium, and the World Bank have made significant contributions to building training centers, improving training for trainers, and providing training to young people through multi-year projects.⁸³⁾

Private firms pay a certain percentage of their employees' total wages as a levy

81) Republic of Senegal (2016). National Account for Education. p.55.

82) Refer to Appendix 3 for details.

83) Refer to Appendix 5 for details.

(CFCE) to the Ministry of Economy, Finance, and Planning,⁸⁴⁾ which allocates part of that levy to the Ministry of Vocational Training, Apprenticeship and Crafts.

The levy rate is set to 3%. It is paid monthly and collected by the Directorate-General for Taxes and Domains. Until 2014, 95% was allocated to the public treasury and 5% to the National Office for Vocational Training (ONFP)⁸⁵⁾ under Ministry of Vocational Training, Apprenticeship, and Crafts. After creation of the TVET Fund by decree 2014-1264 (October 7, 2014) and TVET law 2015-01 (January 6, 2015), the government decided to allocate 5% to the TVET fund, 5% to ONFP, and 90% to the public treasury.

The TVET fund will be used to finance TVET.⁸⁶⁾ The fund performs several functions, including (i) mobilizing the resources needed to finance TVET; (ii) financing both initial and in-service training for company staff, jobseekers, and occupational integration project promoters; (iii) monitoring the use of the allocated funds; (iv) ensuring the effectiveness of the implemented TVET programs; (v) conducting forecasting on the economic development environment, employment, and vocational training; and (vi) assisting enterprises and both vocational and technical training institutions identify and formulate training programs. The fund's target groups include enterprises, TVET providers, and individuals.

As of 2016, 25% of the collected levy was planned to be invested in TVET and a decree was taken on July 2016 to allocate 15% more to the TVET fund. The government plans to increase the portion to 50% by 2017 and 100% by 2018, implying that the government's policy priorities are on TVET. <Table 1-8> shows the total amount of levy collected from 2014 to 2016.

According to the national education accounts,⁸⁷⁾ the total expenditures for TVET in 2014 amounted to approximately \$98 million USD, of which 71.5% went to salaries, 17.1% to other current expenses, and 3.6% to investment. Of this budget, 60.3% went on vocational training (VET, for vocational training centers), 19.5% on technical training (TET, for vocational high schools), 18.1% on management, and 2.2% on the re-training of trainers.⁸⁸⁾

84) Ministry of Economy, Finance, and Planning (2012), General tax Code, p.104 - The basis of the levy is constituted by the total amount of wages and salaries, including amounts paid as vacation pay, bonuses, allowances of any kind, excluding those representing reimbursements of expenses and family benefits, as well as all the cash or in-kind benefits that the worker has received.

85) Official Journal of Senegal (1986). Law no. 86-44 (August 11, 1986) - Creating the National Office of Vocational Training (ONFP).

86) Republic of Senegal (2014). Decree establishing the Fund for the financing of vocational and technical training.

87) Before 2014, it was very difficult to track all funding sources and expenditures. Senegal developed national education accounts for the first time in 2015, which identified education funding sources and expenditures at all levels from 2009 to 2014.

88) Republic of Senegal (2016). National Account for Education.

〈Table 1-8〉 Allocation of Levy Collected

(Unit: USD)			
Allocation	2014	2015	2016
STATE	36,771,318 (95%)	36,595,354 (90%)	34,372,087 (75%)
ONFP	1,950,202 (5%)	2,033,075 (5%)	2,259,085 (5%)
3FPT	-	2,033,075 (5%)	3,457,407 (5%)
3FPT	-	-	5,997,312 (15%)
Total	38,721,521 (100%)	40,661,504 (100%)	46,085,892 (100%)

Note: FTP = Fonds de Financement de la Formation Professionnelle et Technique
(i.e., Fund for Financing Vocational and Technical Training =TVET Fund)

Source: General Directorate for Tax and Domains.

〈Table 1-9〉 TVET Expenditure by Purpose (2014)

(Unit: USD)								
Expenditure by purpose in USD (average 1 USD = 556 FCFA)								
Expenditure for	Teacher salary	Non - Teaching staff salary	Training Materials / Supplies	Other current expenditure	Investment	Scholarships and Family Allowances	Other transfers paid	Total
Vocational training	52,556,103	2,602,093	557,848	2,434,985	654,740	214,320	17,511	59,037,600 (60.3%)
Technical training	12,330,805	1,812,172	343,620	2,741,590	1,684,389	107,329	104,406	19,124,311 (19.5%)
Teacher re-training	325,262	-	-	1,585,997	193,233	-	-	2,104,491 (2.2%)
Central administration (M of TVET)	-	278,796	85,991	9,951,799	1,013,102	-	6,142,054	17,471,741 (17.8%)
Locale administration (M of TVET)	-	167,277	5,826	72,046	-	-	-	245,150 (0.3%)
Total	65,212,169 (66.6%)	4,860,338 (5.0%)	993,285 (1.0%)	16,786,418 (17.1%)	3,545,463 (3.6%)	321,649 (0.3%)	6,263,971 (6.4%)	97,983,294 (100.0%)

Source: National Account for Education.

2.2.3.4. HRD Expenditure

<Table 1-10> shows that the total amount of the national budget for education and TVET was \$1.1 billion USD in 2014. Out of this, 57.7% was allocated to primary and secondary education, while 28.7% was for higher education. There was \$79 million USD allocated to TVET, which included both vocational education at secondary schools and vocational training for young people aged 15–35.

<Table 1-10> Education and TVET Expenditure in 2014 (Domestic and External)

(Unit: USD)		
Education Budget (Domestic and External) for 2014	Amount	%
National education	636,690,647	57.7
TVET	79,136,691	7.2
Teacher training for MoNE and MoTVET	5,395,683	0.5
Higher Education	316,546,763	28.7
Administration (for all ministries)	66,546,763	6.0
Total	1,104,316,547	100.0

Source: National Education Accounts.

2.2.4. HRD Governance

Overall, the government's works on HRD are divided into several ministries, including the Ministry of National Education, the Ministry of Higher Education, Research and Innovation and the Ministry of Vocational Training, Apprenticeship and Crafts. This indicates that the government needs a comprehensive and integrated framework with which to coordinate several ministries' policies in a systematic manner.

The implementation of PAQUET through coordination among related actors requires setting up a committee called the Local Group of Partners that was composed of representatives from the administration (Ministry of National Education, Ministry of Higher Education & Research, Ministry of Vocational Training, Apprenticeship, and Crafts, Ministry of Economy, Finance, and Planning etc.), representatives of civil society organizations, technical and financial partners representatives, representatives of local authorities, teachers' unions, parents, and the private sector. The committee facilitates coordination and collaboration among different actors to improve policy coordination and linkages between the government and other actors. This committee is responsible for directing,

supervising, and validating the documents that are produced as a part of the process of implementing and monitoring PAQUET.

However, there is a need for better and more systematic coordination between all ministries in charge of education and training, because it is necessary to establish an efficient administrative basis from which to coordinate and link ministries' policies and promote collaboration among ministries, local governments, the private sector, and other actors.

2.2.5. Link between Education/TVET and Employment

The Ministry of Youth, Employment, and Citizenship Building, whose target groups include the out-of-school adolescents and youths and adults unemployed, takes charge of youth-related policy, national employment policy, and civil education. Regarding the employment policy, the ministry implements employment programs in collaboration with the Ministry of Labor and employers' organizations, and manages four employment centers (one in Dakar for all citizens and three for youths). The ministry also provides financial support to the self-employed and start-ups by youths through the National Agency for the Promotion of Youth Employment (ANPEJ)⁸⁹. ANPEJ is responsible for (i) putting in place an integrated information and monitoring system for target groups in the labor market; (ii) facilitating access to employment for youths and other target groups; (iii) strengthening the employability of young people and other target groups; (iv) putting an effective labor market information system in place; (v) facilitating the access of young people and target groups to project funding; (vi) supporting young people in the design and implementation of projects; (vii) taking actions to promote the employment of young people; (viii) elaborating the program of the professional insertion of street vendors; and (ix) contributing to strengthening the technical capacities and level of civic awareness among street vendors.⁹⁰ The ministry's most urgent tasks include establishing a labor market skill demands information system, expanding the employment centers to cover the whole country, and strengthening employment services.

2.2.6. Collaboration with the Private Sector

The Senegal Chamber of Commerce and Industry (SCCI) established its own training institute in 1924 and has operated it ever since. This training institute provides two types of training: training for obtaining technical qualifications and training for acquiring and upgrading job competencies. Training programs cover logistics, accounting, banking, insurance, real estate, mechanics, and carpentry.

89) National Agency for the Promotion of Youth Employment.

90) <http://www.anpej.sn>

SCCI points out the lack of relevance of TVET curriculum to skill demands of industry sectors as a critical problem of the current TVET system. In 2014, SCCI conducted a survey of TVET providers and employers to identify specific skill demands. In the analysis of the survey results, SCCI reconfirmed the significant discrepancy between skill demands from industry sectors and the current curricula of TVET programs. Most young people prefer to get jobs in business services such as banking and insurance, while the national economy needs technicians who have received an additional two years of technical training after their high school education. The survey revealed that there is a notable demand for capacity building in industrial sectors such as production, conservation, storage, processing, and standardization; however, training programs for production, processing, and conservation were almost non-existent.⁹¹⁾ Youths who completed the technician training program had a higher chance of gaining employment. The technical qualifications awarded by SCCI tend to be well recognized and utilized in the labor market.

To enhance the job competency of young people, promote the self-employment, and boost income-generating activities, the government and employers' organizations established the National Convention of the State and Private Employers in 2000,⁹²⁾ the main objective of which is to improve the employability of young people and strengthen the relationship between TVET and employment in industry sectors. The National Convention achieved significant outcomes in the social and professional integration of young people into national enterprises. More than 20,000 young people were able to either become employed or start their own businesses. Nearly 400 partner companies participated in the National Convention.⁹³⁾ In 2016, a new National Convention was formed based on the wide consensus among the state, employers, trade unions, and NGOs. This will apply new innovations drawn from past experiences by involving more stakeholders.

The Convention operates four programs to promote employment: an internship and learning program, a solidarity contract program, a spin-off contract program, and a program for financing human resources for SMEs. The state provides enterprises with incentives by supporting monthly training or apprenticeship

91) Economic Observatory of the Dakar Chamber of Commerce and Industry (2014). *Training Needs of Enterprises*.

92) Ministry of Public Service, Labor, and Employment (2000). *National Convention and Private Employers for the Promotion of Youth Employment - The National Convention of the State and Private Employers (CNEE)* was signed in April 2000 between the State of Senegal, represented by the Minister of Economy and Finance, the Minister of National Education, the Minister of Public Service, Labor and Employment, and the private partners, represented by the President of the National Council of Employers (CNP) and the President of the National Confederation of Employers of Senegal (CNES).

93) Ministry of Youth, Employment and Citizenship Building (2016). *National Convention of the State and Employers for the Promotion of Youth Employment (CNEE)*.

allowances and the salaries of employees under the program to finance human resources for SMEs, reduce taxes on allowances and social security contributions to cover work accidents and professional diseases, and provide additional theoretical training.

2.2.7. Science, Technology and Innovation (STI) Manpower Development

STI professionals are mainly educated and trained at universities that have faculties, schools, and departments in science, technology, and innovation.⁹⁴⁾ More than 32,000 students and 1,300 permanent teachers are in STI departments such as engineering (chemistry, civics, electricity, computer, and mechanics), mathematics, medical sciences, biology, geology, earth science, and aquaculture. The minimum qualification for teachers is a Ph.D. and they are recruited as “teacher-and-researcher” (“enseignant-chercheur” in French). However, they have no research budget; they can apply to research projects for funding.

Research institutes also train researchers. For example, the Senegal Institute for Agriculture Research (ISRA)⁹⁵⁾ conducts research in four areas: crop production, livestock, fishery, and forestry. A candidate can become a permanent researcher if they have a doctoral degree and can pass the evaluation process (e.g., writing research papers and implementing research projects) during their probation period of six months to one year. The institute trains interns and research assistants.

The National Academy of Science and Technology (ANSTS) is an advisory organization that provides consultation and assistance to public and scientific authorities and is a center of excellence for the design and renewal of knowledge and thinking. ANSTS conducts studies in research topics to advise decision makers in four areas: agriculture, social sciences, health, and STI. The Academy reports its research results to both the government and the private sector. In addition, the Academy organizes science and mathematics competitions to promote awareness and interest in science and mathematics.

2.3. Implications

Overall, the analyses in previous sections indicate that Senegal has been working hard on developing its national economy and human resources with strong and stable political leadership. Senegal has implemented both a national socioeconomic development plan called the Plan Senegal Emergent, and HRD plans called PAQUET, the TVET Strategic Plan, and PDESR, which are well connected to each other with

94) For STI manpower development structure in public universities, refer to appendix 6.

95) Created by law no. 74-53 (Nov. 4, 1974).

respect to HRD.⁹⁶⁾ The Local Group of Partners, which consists of central and local government agents, the private sector, and civil society, operates to coordinate several HRD-related ministries.⁹⁷⁾ Collaboration with the private sector is further promoted by the government reorganization of the existing National Convention to involve both employers and trade unions/NGOs in 2016.⁹⁸⁾ Financially, the government has allocated a large proportion of the budget to HRD⁹⁹⁾ and plans to increase its investment in TVET by fully utilizing levies.¹⁰⁰⁾ To assist young people in their transition to the labor market, the government provides employment services through four employment centers and the National Agency for the Promotion of Youth Employment (ANPEJ).¹⁰¹⁾ These all show that Senegal has made great progress in preparation for transforming into a middle-income country.

Nevertheless, the analyses in this section point to several problems that need to be tackled:

Lack of quality basic education and a high illiteracy rate: The acquisition of basic competencies is a prerequisite for providing secondary and higher education, TVET programs, and achieving their expected results of higher productivity and employment. However, the illiteracy rate among people aged 15 and over in Senegal tends to be high. The completion rates for primary and secondary education are low, as is the advancement rate to higher levels of schooling. According to the results of school performance evaluation in 2010, slightly more than half of primary school students could prove that they possessed basic reading skills and the average math score among primary school students was less than 50%,¹⁰²⁾ which indicates a lack of the prerequisites for quality HRD. It is integral to place the first policy priority on the eradication of illiteracy and the enhancement of basic education quality.

Lack of investment in TVET: Since people have not recognized the importance of TVET, particularly in terms of giving early school leavers a second chance, investment in TVET was limited in Senegal. This resulted in outdated facilities and equipment for TVET, which is the main reason for the low quality of TVET and the shortage of quality labor. The budget for TVET should be secured through the full utilization of

96) Refer to Sections 2.1.2.2., 2.2.1, and 2.2.2.

97) Refer to Section 2.3.4.

98) Refer to Section 2.3.6.

99) Refer to Section 2.3.3.1.1; the proportion of the budget allocated to the Ministry of National Education, the Ministry of Higher Education and Research, and the Ministry of Vocational Training, Apprenticeship, and Crafts amounted to 19.0% in 2015.

100) Refer to Section 2.3.3.3.

101) Refer to Section 2.3.5.

102) The primary school completion rate was 66.2% in 2011 and the advancement rate from lower to upper secondary school was 55.1% in the Republic of Senegal (July 2013). Program for Improving the Quality, Equity and Transparency (PAQUET) in the Education and Training Sectors (2013–2025). pp.15–16.

the financial resources of the private sector and financial support from international organizations to overcome government budget constraints. With the budget mobilized, the government needs to expand vocational training systems for youths.

Lack of a systematic linkage between national economic development plans and HRD plans with respect to labor supply: In designing national economic development plans, it is pre-requisite to estimate the gap between labor demand needed to implement them and the current level of labor supply. Based on this estimation, the government needs to set up a comprehensive HRD plan to fill the gap through coordinating specific policies among several HRD-related ministries. Since Senegal's government now does not conduct manpower forecasting according to national economic development plans, each HRD-related ministry makes its own need assessments and HRD plans, which means a lack of coordination between national economic and HRD plans. Central government ministries including the Ministry of Economy, Finance, and Planning and HRD-related ministries should discuss this problem to find solutions.

Lack of coordination and linkages between the central government ministries related to HRD: Currently, Senegal's education and TVET are managed separately by several ministries without coordination, which creates the potential for risk of a lack of consistency and systematic linkages among HRD policies, and thus overall inefficiency in the national HRD system. It is integral to review the current institutions and organizations for the coordination among ministries' policies and revise them or set up new coordination mechanisms among HRD-related ministries to make and implement comprehensive and integrated HRD policies. This will require establishing a legal framework for administrative and financial support that promotes active collaboration among ministries.

Lack of labor market skill demand analysis and manpower forecasting: Senegal does not have an institution with which the government can identify changes in skill demands by sector and diagnose the level of matching between the curriculum and labor market skill demands, which is a prerequisite for improving the HRD system's efficiency. Collaboration with the private sector is integral for this. In addition, Senegal needs to conduct manpower projections covering all industry sectors and all levels and types of skills on a regular basis;¹⁰³⁾ this will require a national system for manpower projection. Given Senegal's current situation, fully establishing a national manpower forecasting system will take a long time. However, Senegal needs to start by building its capacity. The lack of labor market skill demand analysis and manpower projection limits the country's capacity to utilize the potential of available human resources and the HRD system, and the

103) Projection can be conducted according to national economic development plan period such as 5 years.

close coordination between national HRD plans and economic development plans. Thus, it is urgent to establish systems through which the government can diagnose the relevance of HRD programs to skill demands and forecast manpower required to implement national economic development plan in a scientific way.

Lack of basic data for policymaking and analysis: Like other developing countries, Senegal lacks the necessary basic data for analyzing policy problems, making policy measures, and evaluating the results of policy implementations in areas such as higher education, research, employment and the labor market because they lack data collection and analysis systems. The government needs to establish a systematic and comprehensive¹⁰⁴⁾ system for regularly collecting data and information in all major policy areas through government administrative organizations and surveys.

3. Korea's HRD System and Strategy¹⁰⁵⁾

3.1. Korea's HRD System

Korea's HRD system consists of two main parts: a regular school system managed by the Ministry of Education and a vocational training system managed by the Ministry of Employment and Labor (MoEL).

3.1.1. School System

Korea adopted a 6-3-3-4 school system¹⁰⁶⁾ in 1945 upon liberation from the Japanese colonial regime and gradually enhanced the capacity of their school system through sequential expansion strategies and policies to maintain the quality of education. As shown in [Figure 1-3], there are two education tracks—general academic and vocational—in high school. In addition to four-year university courses, two-year junior college courses are major higher education avenues.¹⁰⁷⁾

In the 1950s, Korea increased the primary school enrolment rate from 72.9% in 1953 to 96.4% in 1959 with the six-year plan for achieving compulsory primary education (1954–1959). The universalization of primary school education meant

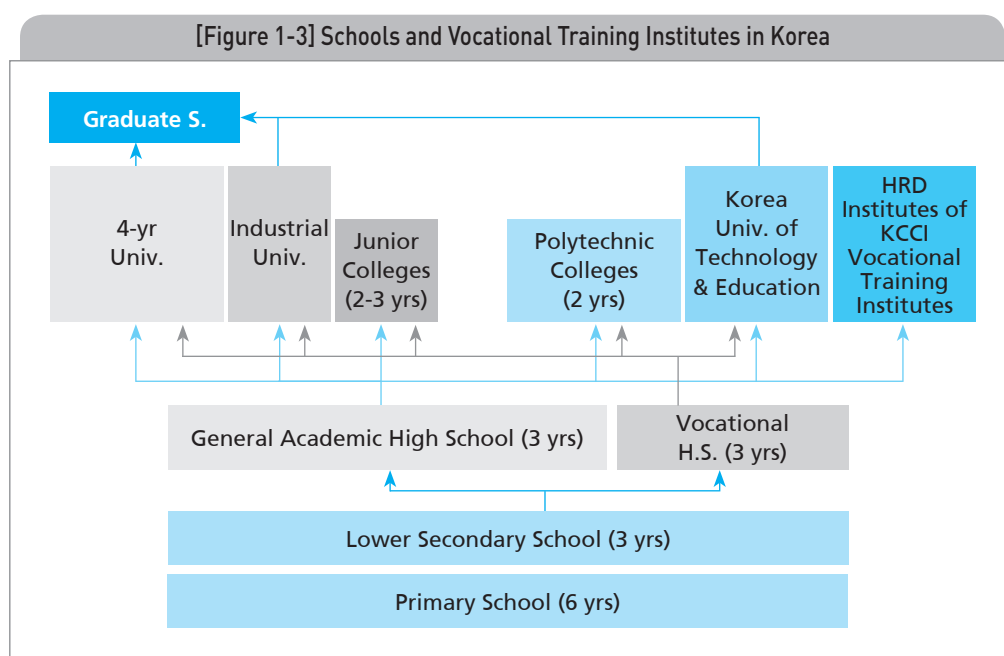
104) Data need to be collected and analyzed based on the logical sequence and hierarchy of the policy process (e.g., input-process-output-outcome) in major policy areas and in connection with other data in related policy areas to observe the whole picture in national policy issues.

105) This section analyzes the Korean cases that are selected according to the problems in Senegal's HRD system and strategies as pointed out in Section 2.4. to infer policy implications and solve problems.

106) Six years of elementary school, three years of lower secondary school (middle school), three years of upper secondary school (high school), and four years of university education.

107) Polytechnic colleges, the Korea University of Technology and Education, The HRD Institutes of the Korea Chamber of Commerce and Industry, and vocational training institutes, which are Korea's main vocational training institutes, are under the jurisdiction of the Ministry of Employment and Labor. Refer to Section 3.1.2.

that social demand for secondary education rose very rapidly in the 1960s, as did demand for labor with secondary education qualifications due to the successful implementation of a series of national economic development plans. Thus, the government decided to abolish middle school entrance exams and allocate all primary school graduates to middle schools near their residences via a lottery in 1968. The government introduced the high school equalization policy to accommodate the increased demand for high school education in 1974 for the same reason. Since the mid-1980s, the number of college and university students increased substantially with the failure of the graduation enrolment quota system (1980–1987)¹⁰⁸⁾ and the normative system (1996–2013).¹⁰⁹⁾

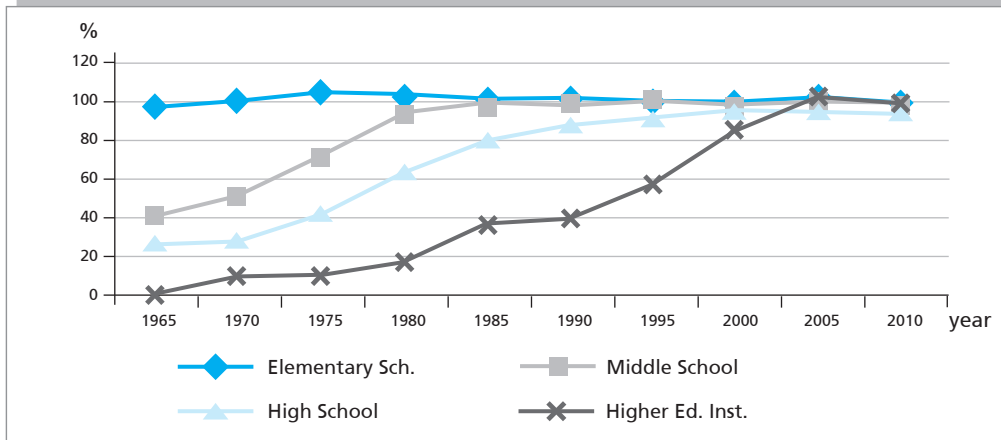


Note: Arrows describe students' flow.

108) In 1980, the new government increased the enrolment quotas of junior colleges and universities slightly, and allowed junior colleges and four-year universities to admit 15% and 30% more students respectively under the condition that they had to expel 15% and 30% of students prior to graduation based on students' GPAs. No college or university followed the government policy; thus, the number of college and university students increased drastically. The government abandoned the policy in 1987.

109) In 1995, the government applied the market mechanism to higher education. Any private school foundation that could meet the minimum conditions the government had set was allowed to establish and operate a private college or university. The underlying rationale was that colleges and universities would compete with each other and only the better ones would survive. However, no college or university disappeared in the market due to the excessive demand for higher education and the government called off this policy in 2013. Thus, as with the graduation enrolment quota policy in the 1980s, both the number of students the enrolment rate increased.

[Figure 1-4] Changes in Enrolment Rates according to Schooling



Note: Numbers in Y-axis are gross enrolment rate.

Source: (i) Ministry of Education and Korean Education Development Institute (each year). Statistical Yearbook of Education. (ii) <http://std.kedi.re.kr/index>

To financially support the 6-year plan for compulsory education, the government introduced education tax(1958-1961)¹¹⁰⁾ and national grant scheme(1958)¹¹¹⁾ and invested most of the Ministry of Education budget.¹¹²⁾ After achieving their enrolment goal (96.1%) in 1959, the government continued investing in primary education to improve school conditions for the first three five-year economic development plan periods (1962–1976).

This early commitment to universal primary education, along with the massive literacy campaign in the 1950s, made significant contributions to (i) improving communication between people, (ii) helping share a common set of knowledge and beliefs, (iii) supplying equal educational opportunities to both boys and girls and (iv) supplying a large number of quality manual workers for relatively low wages.¹¹³⁾ The universalization of primary education in the 1950s provided foundations for expanding secondary education in the 1960s and 1970s and successfully implementing the vocational training system that was introduced in 1967.¹¹⁴⁾

110) Surtax levied on property and house tax

111) 11.55% of internal tax revenue was set aside only for financing compulsory education.

112) In 1954 64.1% of the education ministry budget was spent on implementing the 6-year plan. The ratio increased to 80.4% in 1959.

113) Kim, Young Hwa (2015). Education and Economic Growth during the Industrialization Period of Korea. Education Science. pp.132-145.

114) Vocational training can achieve its objective when trainees have basic cognitive skills of reading, writing, and calculating. Owing to the universalization of primary education and subsequent expansion of secondary education, the Korean young people were able to read training manuals, write training reports, and take exams for certificates. For details of the vocational training system, refer to section 3.1.2.

Since the Japanese colonial regime prohibited Koreans from using the Korean language, the illiteracy rate was very high in 1945 when Korea was liberated (78.2%). The military government established a Committee for Adult Education in 1945, provided Korean language education programs, and trained adult education leaders. The adult illiteracy rate was estimated as having been reduced to 42% in 1948. After the Korean War (1950–1953), the government launched a massive adult literacy campaign (1954–1958) with which literacy programs were provided in schools, factories, military units, and prisons to equip people with (i) a reading comprehension capacity equivalent to a second grade elementary school student, (ii) the ability to perform arithmetic calculations needed in their normal lives, and (iii) civic virtues. The illiteracy rate had decreased to 4.1% in 1958.¹¹⁵⁾

After achieving the universalization of primary education in the 1950s, the government shifted its investment focus to secondary school education to respond to the increase in social and manpower demand. The new secondary school system, which was introduced through the abolition of the middle school entrance exam (1968) and the high school equalization policy (1974) contributed to improving equal access to secondary education, in that student placement was decided based on students' residence and a lottery rather than test scores that reflected parents' SES. When expanding secondary education, the government made policy efforts to provide more seats and make all schools comparable in terms of school infrastructure, expenditure, and teachers. In other words, the government tried to guarantee equal educational treatment for all.

Higher education in Korea began to expand rapidly in the 1980s due to the graduation enrolment quota system (1960–1987) and the normative system (1996–2013). The higher education enrolment rate increased from 16.0% in 1980 to 38.1% in 1990 and to 85.4% in 2000.

Similar sequential expansion patterns to that of education in Korea were also found in other advanced Asian economies including Japan, Singapore, and Taiwan.¹¹⁶⁾ When a country was at the beginning stages of economic development, it may need manual labor with a relatively low level of schooling. However, as a country's economy moves toward becoming more advanced, it needs more highly educated manpower. If a country needs more labor with a high school education but the enrolment rates for primary and lower secondary schools are low, then the economy's manpower demands cannot be supplied. In that sense, the sequential educational expansion strategies found in advanced Asian economies such as Korea

115) Kim, Chong-Chul(1989). *Education Policy Study in Korea*. Education Science. p.339.

116) Mundle, Sudipto (1995). *Financing Human Resources Development in Advanced Asian Countries: A Report* (paper presented in the ADB Conference on Financing Human Resource Development in Advanced Asian Countries, Manila).

have very crucial implications for other developing countries.

3.1.2. Vocational Training System

When making the first five-year economic development plan (1962–1966) in the early 1960s, the Korean government anticipated that a regular school system alone could not provide as many skilled workers and technicians as were required. For example, Korea needed 444,974 skilled workers in 1965, yet the total number of vocational high school students was only 172,436.¹¹⁷⁾ Korea suffered from constant labor shortages during the first five-year economic development plan period. The government could not expand its vocational education schools due to budgetary constraints; Korea needed a vocational training system with flexibility and efficiency in designing a curriculum, recruiting trainers, and selecting trainees, because the regular school system had the rigidity of the three-year of national curriculum, four-year teacher preparation, and only one student recruitment period per year. The government also thought that it was necessary to make more aggressive training policies that required that employers provide vocational training to new employees, because they were in the best position to know changes in skill demands and the primary beneficiaries of vocational training. Thus, the Korean government introduced a vocational training system in 1967.

In the 1970s, the Korean government continuously established public training institutes across the country with foreign assistance, as shown in <Table 1-11>. The government utilized financial aids from the U.S., Germany, Belgium, and Japan and international donor agencies such as the World Bank and the Asian Development Bank. The facilities of training institutes were technically advanced, unlike those of vocational high schools. Donor countries and agencies also provided professional advice. The costs of training materials and related expenses were appropriated by the government.

One of the most urgent tasks was training and supplying vocational training instructors. The Central Vocational Training Center, which was established in 1968, provided short-term license courses that were focused on helping experienced workers learn teaching methods and providing two-year regular courses to high school graduates and advanced courses to junior college graduates with a special focus on job-specific skills and theories. In addition, donor countries such as Germany and Japan provided financial aid to help establish training institutes and provided instructor training in their countries.¹¹⁸⁾

117) Suh, Sangsun (2002). *Vocational Training System in Korea*. Korea Chamber of Commerce and Industry. p.48.

118) Suh, Sangsun (2002). *Vocational Training System in Korea*. Korea Chamber of Commerce and Industry. pp.122–128.

〈Table 1-11〉 Public Vocational Training Centers (VTCs) established by Donor Grants in the 1960s–1970s

Name of Institutes	Number of Institutes	Year(s) of Establishment	Donors
Central VTC	1	1968	UNDP, ILO
Korea-Germany VTC	1	1970	Germany
Jung Soo VTC	1	1973	U.S.
Korea-Belgium VTC	1	1976	Belgium
Daejeon VTC	1	1976	Japan
Agricultural VTCs	9	1969–71, 1974–76	UNICEF, UNDP
Local VTCs	20	1974–80	ADB, IBRD

Sources: Suh, Sangsun (2002). Vocational Training System in Korea. KCCI. pp.117–156.

In the early stages of the vocational training system’s implementation, the government expected that employers would voluntarily provide training for their new employees; however, few employers actually did so, most preferred to poach experienced workers and technicians from other firms instead. In 1976, the government enacted “Basic Act for Vocational Training,” which mandated that private firms with 300 employees or more provide in-plant skill training. The targeted firms were expanded to those with 200 employees or more in 1989 and to firms with 150 or more in 1992. If employers did not provide training, they had to pay levies to the Vocational Training Promotion Fund, which were used to provide public vocational training services.¹¹⁹⁾ In other words, employers had two choices: provide training or pay levies. However, the levy required was smaller than the training cost and the government regulations for in-plant training were too difficult to follow, thus a large number of employers chose to pay levy. Therefore, the percentage of companies that provided training continually decreased until a new system called the “Employment Insurance System” was introduced in 1995, while the number of firms subject to the Act continued increasing.

As the Knowledge Economy progressed rapidly in the 1990s, the average lifespan of knowledge and skills began shortening and the structures of industry and occupation changed. The Korean economy needed a new comprehensive social insurance system that would provide financial support to maintain job security, promote vocational training, and guarantee a basic standard of life

119) The levy was estimated based on the monthly standard training cost per trainee and the proportion of trainees was decided by the labor ministry until 1986 and by a certain percentage of employees’ total wages since 1987.

for the unemployed. In 1995, the government introduced the Employment Insurance System (EIS) that is now the backbone of Korea’s vocational training system. In the EIS, all employers with one employee or more are required to pay employment insurance fees to the Employment Insurance Fund (EIF), which is used for the Employment Security Program, Unemployment Benefits, and the Vocational Competency Development Program.

The Vocational Competency Development Program (VCDP) is designed to provide financial support to three main target groups: employers for their employees’ training, individual employees, and the unemployed. As described in <Table 1-12>, the main objective of the VCDP is to promote continual training to upgrade the knowledge and skills of incumbent workers and the unemployed through market mechanisms. In the new system, employers, employees, and the unemployed can choose vocational training programs and institutes based on their own training needs. Training providers should provide higher quality programs to attract trainees; they cannot survive in the training market otherwise, because the EIF fund is paid directly to trainees (employers, employees and the unemployed).

<Table 1-12> The Paradigm Shift in Korea’s Vocational Training System

	Before 1995—Compulsory Training System (1977–1998)	Now (1995–present)—Vocational Competency Development Program
Law	Basic Act for Vocational Training (1976)	Employment Insurance Law (1995) Workers Vocational Competency Development Act (2004)
Financial Source	Training Levy	Employment Insurance Fee
Fund	Vocational Training Promotion Fund	Employment Insurance Fund
Operation Mode	Government-controlled ¹²⁰⁾ Supply-oriented ¹²¹⁾	Demand-driven/Market-oriented/ Incentive system
Training Market	Closed	Open to private training institutes
Target Industry	Manufacturing Sector focused	All industries and occupations
Main Training	Initial Training	Continuing Training
Target Groups	Youth without skills	Incumbent Workers/Unemployed

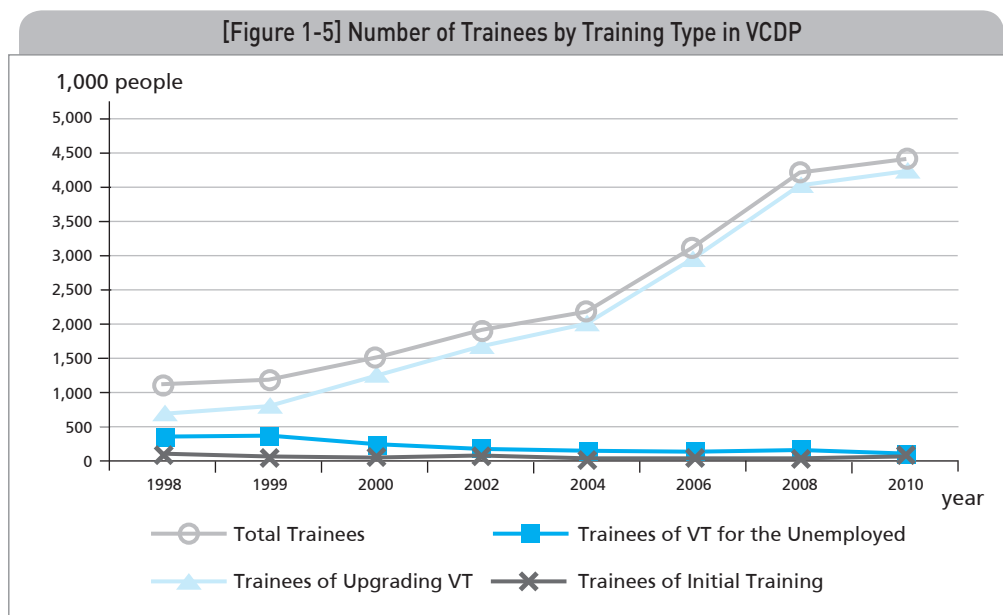
Source: Sung Joon Paik (2014). Human Resource Development: The Korean Experience (1950s–2000s). ppt file.

120) In the compulsory training system, the government decided the number of workers who would get training by sector annually, considering demand for skilled manpower.

121) Vocational training institutes decided training subjects and contents.

In VCDP, the three target groups make their own decisions about which training programs to take at which training institutes. After obtaining training services, they request refunds from the Ministry of Labor, which reimburses their training costs from the EIF. The government expected that adopting this demand-driven and market-oriented incentive system would improve the quality of vocational training programs and consequently improve the training system's efficiency.

VCDP has been effective in increasing the retraining of workers, as described in [Figure 1-5]. The successful operation of VCDP was enabled by (i) securing sufficient budget to provide financial assistance to three target groups through collecting insurance fees, (ii) increasing the number of training providers through opening the training market to private providers, and (iii) applying different rates of contribution (insurance fees) and reimbursements according to firm size.¹²²⁾



Source: Ministry of Employment and Labor (each year). Current Status of Vocational Competency Development Program.

Sections 3.1.1 and 3.1.2 indicate that the Korean school and vocational training systems have changed their structure, functions, and operational modes in accordance with the changes in labor demands for both quantity and quality as the national economy has developed. In the early stages of national economic development and during the period in which the manufacturing sector was fostered, the policy focus was on expanding vocational high schools and pre-

122) The larger the firm size, the higher the insurance fee rate, while the smaller the firm size the higher the refund rate.

employment vocational training for the manufacturing sector. As the Korean economy developed toward a more advanced level, the focus of vocational education shifted from high school to junior college level, while that of vocational training shifted from initial training for the manufacturing sector to continual training for all industry sectors. This implies that the national HRD system has to actively transform itself in accordance with the changes in the structure of industries and occupations to meet the manpower demand.

3.2. Korea's HRD Strategy and Policy

3.2.1. Close Linkage to National Economic Development Plans

HRD in Korea including education and vocational training has been regarded as a critical success factor that significantly contributed to the nation's social and economic development since Korea's liberation from Japan in 1945. Education in Korea was the most effective tool for the upward social mobility of individuals and a crucial policy instrument with which to secure the manpower needed for national economic development. Despite the lack of natural resources, Korea successfully achieved national development through training and supplying quality labor at the right time while effectively responding to individual and economic demands for education through investing its limited budget in HRD strategically. <Table 1-13> describes the linkage between education and national economic development.

<Table 1-13> Strategic Linkage between Education and National Economic Development

	Development Goals and Major Strategies	Educational Strategies and Major Policies
Until 1961	Build SOC and Industry Base	Universalize 6-yr Prim. Educ. Decrease Adult Illiteracy
1960s	Develop Labor-intensive Light Industry with Export-Promotion Strategy	Introduce Vocational H.S. Curriculum & Junior College Sys.
1970s	Build Self-reliant Growth Base Develop Heavy & Chemical Industry	Expand Secondary Schools and Junior Colleges
1980s	Develop Technology-intensive Industry	Expand Higher Education Promote R&D
1980s	Promote High-Technology Innovation Develop Information Industry	Expand Investment on R&D Develop Highly Skilled HR(IT,BT...) Develop Lifelong Learning System
2000s	Promote High-Value Added Technology Innovation	Restructure High School System Improve Quality of Higher Educ. Promote Lifelong Learning

Source: Sung Joon Paik (2014). Human Resource Development-Korean Experience. ppt file.

The universalization of primary education and the literacy campaign in the 1950s made it possible to supply the quality manual labor that was demanded from the labor-intensive manufacturing sector in the 1960s. The expansion of secondary education in the 1960–70s contributed to providing the skilled workers and technicians that were needed to promote heavy and chemical industries in the 1970s. The massification of higher education in the 1980s contributed to supplying the college-educated manpower required to upgrade the industry's structure to an advanced level. In other words, Korea was able to secure the necessary initial stock of human capital that was needed to start the national economic development plan and also continuously promote human capital growth in accordance with its national economic development.

The successful implementation of a series of national economic development plans provided sufficient employment opportunities to absorb graduates from regular schools and vocational training institutes, which led to increases in their labor earnings and a more equal distribution of labor earnings among people. The virtuous circle of HRD and national economic development resulted in inclusive growth.

The Korean case implies that national plans for HRD should be implemented through systematic coordination with national economic development plans. HRD is a prerequisite to realizing national economic development plans. Without a sufficient number of quality workers, a nation cannot pursue economic development, and without national economic capacity large enough to absorb the quality labor supplied, a nation will face social and economic instability. Thus, the government should establish a legal framework and institutional infrastructure that can link and coordinate HRD and national economic development plans in a systematic and integrated manner.

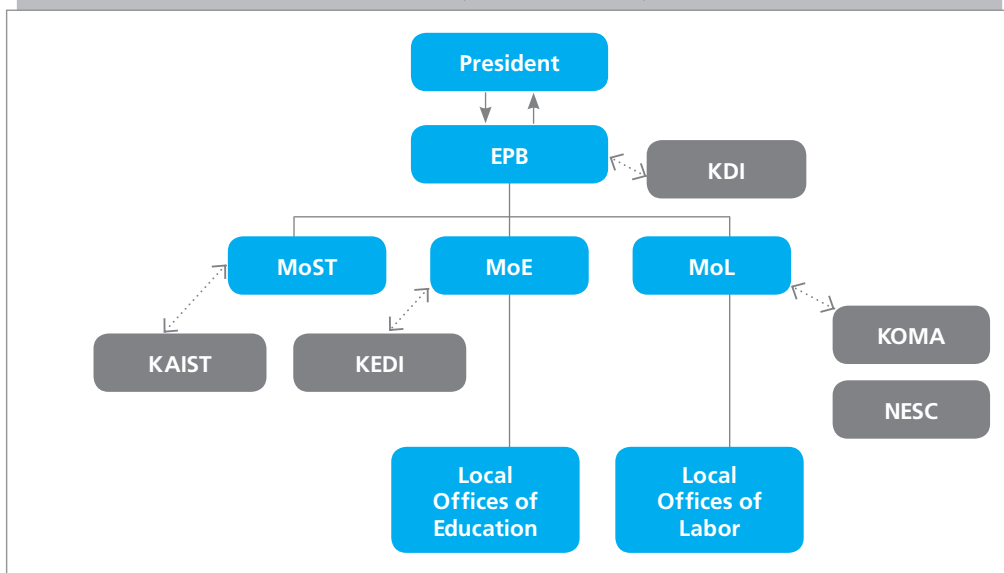
3.2.2. Coordination and Collaboration among Stakeholders

3.2.2.1. Economic Planning Board

During the 1960s and the mid-1990s, the Economic Planning Board (EPB), which was a super ministry headed by the deputy prime minister, made and implemented a series of five-year national economic development plans in collaboration with other ministries. The EPB implemented national economic development plans by playing a critical role in linking and coordinating the policies of other ministries with the national economic development plans. The EPB presided over the vice-ministers' meeting of the economy-related ministries such as the Ministry of Labor and Ministry of Trade, before having meetings among ministers. There were also meetings of director-generals and directors among related ministries before the

vice-ministers' meeting. All of these stepwise coordination mechanisms were intended to discuss critical issues that might cause problems such as duplication, disputes, or conflicts in advance, coordinate policies among related ministries, reach agreements, and promote collaboration between ministries.¹²³⁾ Regarding HRD, EPB worked with the Ministry of Education, the Ministry of Labor, and the Ministry of Science and Technology. In other words, EPB used its budget appropriation power to play a key role in discussing and coordinating HRD-related issues between EPB and HRD-related ministries and thus make HRD policies designed and implemented in an integrated manner within the framework of five-year national economic development plans.

[Figure 1-6] The relationship between the Economic Planning Board and HRD-related Ministries in Korea (1960s–mid 1990s)



Note: Each ministry was supported by a corresponding government-funded research institute or government agency such as the Korea Development Institute, the Korea Manpower Agency, the National Employment Stabilization Center, the Korean Educational Development Institute, and the Korea Advanced Institute of Science and Technology.

Source: Sung Joon Paik (2014). Governance and Coordination Structure for Skills Development System in Korea. ppt file.

3.2.2.2. Inter-ministerial Meeting on HRD and National HR Council

As the Knowledge Economy rapidly progressed, the Korean government recognized the urgent necessity of improving the quality of their labor force. In other words, the government needed systematic and close coordination and

123) Similarly the Prime Minister's Office also presided over the vice-ministers' meetings on major issues before the ministers' meeting by the President.

collaboration among ministries and government agencies to train and supply manpower for the sustainable development of the national economy. More specifically, the goal was to improve the efficiency of the national HRD system by identifying duplicate and/or blind areas, supply highly trained labor for the nation's new growth engines such as IT and BT that produce high value-added goods and services, and establish collaboration mechanisms among industries, schools, and research institutes.

In 2001, the Korean government restructured the Ministry of Education into the Ministry of Education and HRD, which was headed by the Deputy Prime Minister. The Deputy Prime Minister for Education and HRD presided over the Inter-ministerial Meeting on HRD (2001–2007) which consisted of the Ministers of Labor, Science and Technology, Industry and Resources, Information and Telecommunication, Internal Affairs, Health and Welfare, Gender Equality and Family, and Defense. The Deputy Prime Minister made five-year national HRD plans through inter-ministerial meetings and coordinated HRD-related policies among ministries.

However, the inter-ministerial meeting was not operated as effectively as intended. The Deputy Prime Minister was not authorized to appropriate the HRD budget to related ministries and evaluate the performance of ministries' HRD policies. In addition, officials in the Ministry of Education and HRD had no professional expertise for HRD policies other than in education. Recognizing the limits of the Inter-ministerial Meeting on HRD, the government established the National HR Council (2007–2008), the chairman of which was the president. The government expanded the council's member to industry and labor representatives, and HRD specialists, in addition to ministers of HRD-related ministries. The council made the second five-year national HRD plan. The council was discontinued when the new administration took power in 2009.

These two cases imply that it is vital for the leading ministry or the head of the coordination body to have practical power of budget appropriation and/or personnel appointment through establishing a legal framework and to have professional expertise. In addition, it is crucial to form a HRD policy coordination body that includes industry, labor, and TVET providers and maintain the coordination body in the long term.

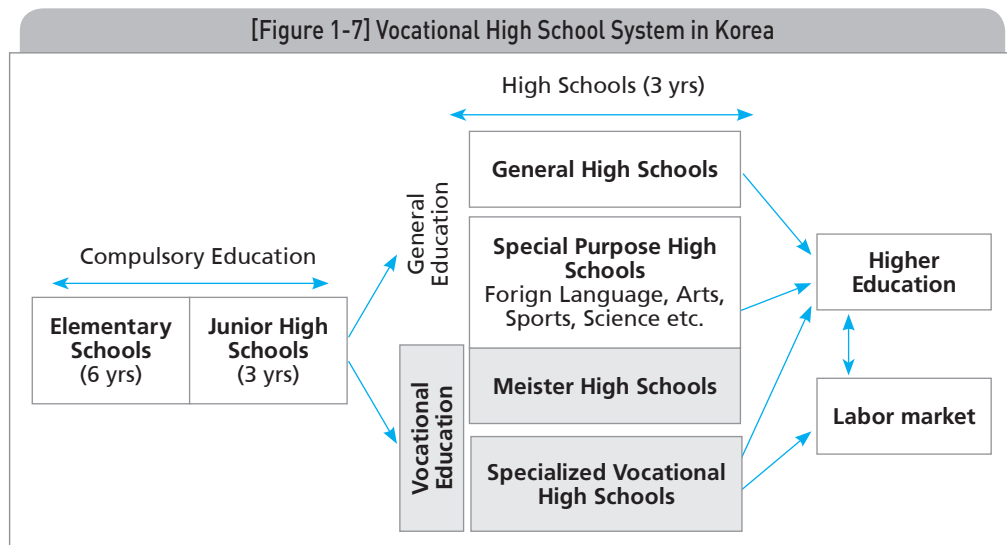
Through eight years of experiences of the inter-ministerial meeting on HRD and the National HR Council, the HRD-related ministries have learned valuable lessons that they could achieve greater policy effects through collaborating among themselves. Although the Korean government has not had an official coordination body such as the National HR Council at the national level since 2009, major policies

including the Meister High School Project¹²⁴⁾ and the “Employ First, then Study while Working” policy¹²⁵⁾ have been successfully implemented through coordination and collaboration among related ministries. These include the Ministry of Education, the Ministry of Labor, the Ministry of Land, Infrastructure and Transport, the Ministry of Agriculture, Fishery and Rural Affairs, the Ministry of Knowledge and Economy, and the Small and Medium Business Administration. These policy cases prove that policy linkages and collaboration between ministries are key success factors in the achievement of policy objectives in a more efficient and effective manner.

3.2.2.3. School–Industry Coordination and Collaboration

1) Restructuring the Vocational High School System

In 2010, the Korean government restructured the vocational high school system by changing the three types of vocational high school (specialized, Meister, and comprehensive) into two types (specialized and Meister) as described in [Figure 1-7], and reducing the number of vocational high schools from 692 to 400 (350 specialized and 50 Meister high schools) by 2015.



Source: Park, D.Y., Korean Policies on Secondary Vocational Education. BiBB BWP. 2011. p.31.

124) In 2008, the Korean government introduced the Meister high school as a new model of vocational high school (called a “special purpose high school” in the Elementary and Secondary Education Act) to provide students with opportunities to be trained as professionals in specific areas such as mechatronics, automobiles, IT, communication, medical equipment, electronics, etc. Meister high schools select high caliber middle school students through in-depth interviews with industry people and aptitude tests, develop a customized curriculum based on skill demands and job analysis in collaboration with industry, and provide an advanced level curriculum (equivalent to junior college level).

125) Please refer to Section 3.2.3.1.1 for the “Employed First, then Study while Working” policy.

This restructuring of the vocational high school system was attempted based on following backgrounds: (i) although demand for workers with junior college education continuously increased as the Korean economy became more advanced, demand for skilled workers with a high school education still remained to certain degree; (ii) however, vocational high schools failed to provide a vocational education that could meet industry's new skill demands; (iii) in addition, SMEs in which approximately 86% of waged workers were employed had difficulty recruiting skilled workers with high school education due to the lack of job applicants among vocational high school graduates; (iv) meanwhile, Korea was facing the problem of an oversupply of junior college and university graduates and thus youth unemployment, as more than 70% of vocational high school graduates entered junior colleges and universities, and (v) a sharp decrease in the high school age cohort was anticipated for the next 20 years.¹²⁶⁾ In other words, the situation of vocational high school in the 2000s was directly related to the problems of the lack of skilled workers, skill mismatches, youth unemployment, and demographic changes. Thus, the government decided to restructure the vocational high school system and implemented a restructuring policy.¹²⁷⁾

The government has also tried to solve the problem of skill mismatch by introducing an employment-oriented and competency-based curriculum. The National Competency Standards (NCSs),¹²⁸⁾ which are developed based on the analysis of the competencies required to do a job in collaboration with industry, have been applied to design the curricula of the Meister high schools and specialized vocational high schools. Internship programs have been emphasized. The tuitions of all vocational high school students are waived to form a learning environment in which students can study hard to acquire knowledge and skills without financial difficulties. Meister high schools provide a tailor-made curriculum under contracts with specific firms and hire industry people as principals and teachers. The government and vocational high schools have provided career guidance and job search services.

In addition, the government, through the 'Employed First and Study while Working' policy, established an institutional framework in which vocational high school graduates can continue their college or university education, when they think they need higher education, while working, in collaboration with firms and higher education institutions. The government has provided administrative support to industry initiatives to establish corporate colleges, and encouraged universities to

126) Park, Dong Yeol (2011). *Korean Policies on Secondary Vocational Education*. BiBB BWP.

127) As of 2015, there are 40 Meister high schools and 498 specialized high schools in Korea.

128) National Competency Standards(NCSs) are developed by benchmarking the UK's National Occupational Standards. NCSs are the matrix of types and levels of skills required to perform a specific job. As of 2016 more than 860 NCSs are developed.

open night and weekend degree programs for incumbent workers.¹²⁹⁾ Thanks to the consistent implementation of these policies, the ratio of employed vocational high school graduates continually increased from 16.7% in 2009 to 45.0% in 2014 and to 46.4% in 2016.¹³⁰⁾

In the case of the restructuring of vocational high schools in Korea, the following implications can be drawn: (i) the government needs to consider changes in skill demands and demographic structures when designing and developing HRD systems, including vocational education, (ii) it is integral to have systematic and close working relationships among governments, schools, TVET providers, and industry, (iii) the government needs to consistently take the initiative in HRD system reform and provide administrative and financial support, particularly to the private sector, and (iv) greater autonomy is necessary at the school level to provide programs that can promptly respond to skill demands.

2) Industry–College Collaboration Policy

In the 2000s, the Korean government adopted a new paradigm for industry–college/university cooperation. In the past, the industry–college/university cooperation policies were approached from the perspectives of the government, university, and junior college (supply side). Target groups were also limited to specific departments and projects, and the focus was on research and theory. In the new paradigm, industry–college/university collaboration policies were approached from the perspective of industry and firms (demand side), designed to restructure higher education institution’s organization to fit industry–college/university collaboration, and focused on the commercialization of research results and competency training.

〈Table 1-14〉 Industry–College/University Cooperation Paradigm Shift

	Old Ways	New Ways
Approach	Supply-based (from the perspectives of junior colleges, universities, and the government)	Demand-oriented (from the perspectives of firms, SMEs, and industry)
Support Strategy	Project-based/Department-based Partial Support	College-based Comprehensive Support (college system change)
Scope	Partial Participation (projects and professors)	Comprehensive (students, professors, and firms’ workers)
Focus	R&D focused	Commercialization-focused/Start-up
Education	Theory/Research-based	Practical Job Skills Training

Source: Sung Joon Paik (2014.3), Junior College System in Korea – Its Evolution, Challenges and Policy Responses. PPT presented in the World Bank Workshop on the Indonesian Tertiary Education - Expanding Community College.

129) As of 2015, more than 90 universities have separate degree programs for incumbent workers.

130) Ratio of the number of vocational high school graduates who joined the labor market to the total number of vocational high school graduates. KEDI educational statistics

Since 2003, the government has used this new paradigm to induce colleges and universities to establish an Industry–College/University Cooperation Body to manage contracts with firms, accounts, the acquisition of intellectual property rights, facilities and equipment support, technology transfer and commercialization, and financial rewards to technology contributors and researchers. Along with the establishment of the Industry–College/University Cooperation Body, the government encouraged higher education institutions to promote industry–college/university joint research, the commercialization of research results, start-ups, and employment.

Under the new paradigm, the government implemented the Industry–College Collaboration-focused College Project (2005–2012). The government selected 10 junior colleges in the first stage (2005–2009) and 15 in the second stage (2009–2012) to make them benchmark colleges by providing support for the following activities: (i) the development of curricula and internship programs that respond to the labor market skill demands and thus connect education to employment, (ii) the installment of college/university infrastructure such as the Industry–College Cooperation Body, the recruitment of professors with industry experience, and changes in professor’s performance appraisal to encourage industry–college collaboration activities, (iii) the development, transfer, and commercialization of new technology, (iv) the utilization of the facilities and equipment of colleges and firms, and (v) the provision of vocational training for incumbent workers. During 2012–2016, another project called Leader in Industry–College Cooperation (LINC) was conducted to support cooperation between local firms and junior colleges, train the quality manpower needed for regional economic development, and develop new technologies.¹³¹⁾ Through the LINC, the government provided financial subsidies to 30 junior colleges in the five great economic zones.

The Industry–College Cooperation policy cases imply (i) it is necessary to define the role of higher education institutions in consideration of social demands for higher education and demand for technical manpower from the perspective of national economic development, (ii) the government needs a legal, administrative and financial framework to induce and support the participation and cooperation of the private sector, which is a main beneficiary, and (iii) it is crucial to prioritize government support according to the government selection of strategic industry sectors.

3.2.2.4. Sector HRD Councils and Industry Skills Councils

In the early 2000s, the Korean government recognized the necessity of the industry’s active participation in policymaking and implementation to solve a

¹³¹⁾ Ministry of Education (2014.1). 2014 Plan for the LINC Project.

serious problem of skill mismatches in both quality and quantity. Having conducted case studies for the UK, Australia, and Canada, the Ministry of Industry and Resources, Ministry of Labor and Ministry of Education and HRD proposed a pilot project to establish and operate Sector HRD Councils in three industry areas—specifically mechanics, IT, and electronics—in 2003, and launched three Sector HRD Councils the next year that consisted of representatives from industry associations, leading firms, research institutes, and experts. There are 17 Sector HRD Councils in operation as of 2015.¹³²⁾

Sector HRD Councils analyze demands for labor and TVET in their sectors, develop and suggest qualifications and TVET standards, and develop TVET programs. The councils share information on the changes in skill demands with TVET providers and local governments, and participate in the provision of TVET and career guidance programs that are designed based on skill demands in collaboration with the Regional HRD Councils. The Ministry of Industry and Resources reviews candidates for the Sector Councils that are recommended by other ministries and provides financial support to selected councils.

Regarding the performance of the Sector HRD Councils, it was pointed out that they did not cover all major sectors and lacked expertise to perform the functions mentioned above. In 2015, the MoEL established the Industry Skills Councils that consisted of representatives from employers' associations, firms, and labor unions. The Industry Skills Councils surveyed and analyzed manpower demand and supply, and developed the National Competency Standards and qualification standards. There are 13 councils in operation as of 2016.¹³³⁾ At a glance, the new establishment of Industry Skills Councils could help the government solve the skill mismatch problem by covering sectors that are not dealt with by the Sector HRD Councils. However, this would cause an inefficiency problem in the use of limited government resources. The two ministries must coordinate.

Korea's experiences for the Sector HRD Councils and Industry Skills Councils could be good cases of showing the necessity of having institutional infrastructure that can minimize the difference between what schools teach (the curriculum and training standards) and what the labor market needs (job competencies). The following implications can be drawn based on the Korean case: (i) If a country does not have an organization that can identify the skills demanded by sectors and

132) Mechanics, Electronics, IT business, Ship-building, Steel, Textile, Semi-conduct, Display, Bio, Nano, Robot, Automobile Parts, Software, Medical Equipment, Design, Renewable Energy, and Root Industry – Ministry of Industry, Trade and Resources (2015. 6). Action Plan of the Sector HRD Council Project. p.1.

133) IT-Project Management, Business Management-Accounting-Clerical Work, Bank-Insurance, Design-Cultural Contents, Ship-building and Marine Industry, Mechanics, Mold-Welding, Materials, Chemistry, Textile-Fashion, Electricity-Energy-Resources, Electronics, and Broadcast-Communication Technology – HRDKorea (2016. 4). Synopsis of the Industry Skills Councils.

deliver the information on skills to schools, TVET providers, and the government, then the government needs to take the lead to establish and operate such an organization, (ii) when establishing a new organization that connects the labor market and schools, the government needs to check whether the industry and firms have a sense of urgency and ownership and to prepare incentive mechanisms to induce their active participation and collaboration, (iii) if industry and firms lack expertise, it is necessary to mobilize professionals such as university professors and researchers, and (iv) it is critical to coordinate ministries' policies to avoid the duplication caused by unnecessary competition between ministries.

3.2.3. The Production of Data and Information on Labor Demands and Jobs

3.2.3.1. Manpower Projection System¹³⁴⁾

Mid- and long term projections of manpower have been conducted by several government-funded research institutes in collaboration with relevant government ministries (e.g., projection of the supply and demand of IT professionals by the Korea Research Institute for Vocational Education and Training (KRIVET) with the Ministry of Information and Communication (2004), an analysis of labor demand and supply in the knowledge-based industry and prospects by the Korea Institute for Industrial Economics and Trade (KIET) with the Ministry of Industry and Resources (2000)).

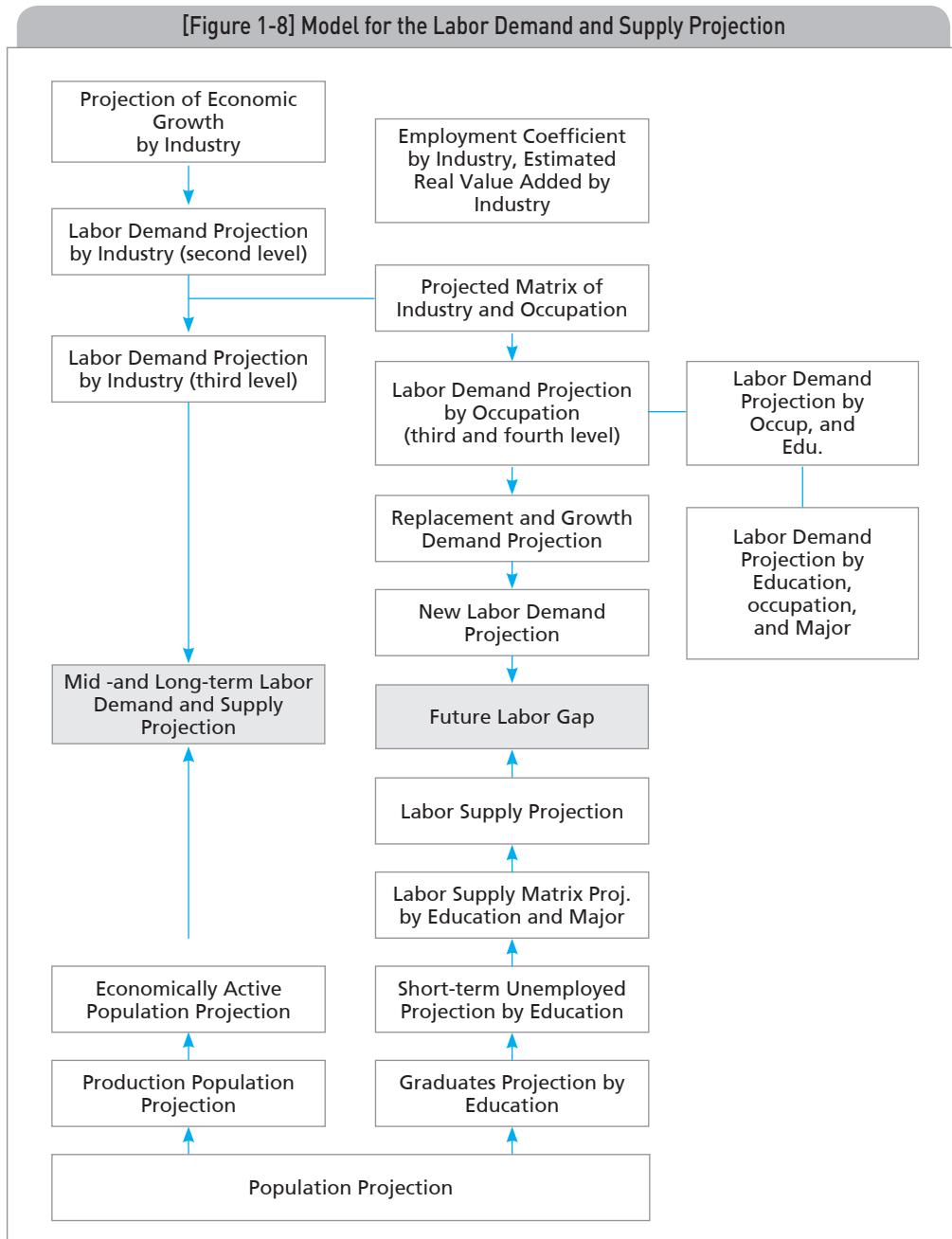
From a national policy perspective that covers all government ministries, the MoEL takes the lead of establishing a comprehensive system of labor demand and supply projection based on the Basic Act on Employment Policy. In other words, the MoEL is entitled by law to design and manage the national system of labor demand and supply projection in collaboration with other ministries. In 2014, the MoEL commissioned the Korea Employment Information Service (KEIS)¹³⁵⁾ to conduct a 10-year projection of labor demand and supply covering 62 industry sectors and 109 occupations. KEIS estimated a future gap between labor demand and supply by using a model for labor demand and supply projection, as shown in [Figure 1-8].

KEIS used several datasets for the projection of the labor supply including population census (Statistics Korea), Survey on Population Change (Statistics Korea), Korean Longitudinal Survey of Women and Families (Korean Women's Development Institute), Education Statistics Yearbook (Ministry of Education), Youth Panel (KEIS), Graduates Occupation Mobility Panel (KEIS), the Korea Education and Employment

134) Korea Employment Information Service (2015). *Mid- and Long-term Projection of Labor Demand and Supply 2014-2024*. pp.1-13, p.15 and p.271.

135) Government-funded independent institution transformed from the Central Employment Information Center in 2005.

Panel (KRIVET), Economically Active Population Survey (Statistics Korea), and Korea Labor Institute Panel Survey (Korea Labor Institute). KEIS used another set of data for the projection of labor demand, including data on national incomes and production by industry (Bank of Korea), real value added by industry (KIET), Regional Employment Survey, and the Index of Industry Changing Trends (Statistics Korea).



Source: KEIS (2015). Mid- and Long-term Projection of Labor Demand and Supply 2014–2024 p.4.

3.2.3.2. Job Information System – Work-Net

A job information system is crucial for connecting jobseekers and employers. KEIS collects and provides data and information on the labor market and jobs. KEIS manages information related to Employment Insurance (i.e., jobs covered by the Employment Insurance System and insurance budget) and changing trends in occupations. Regarding job information, KEIS operates the Work-Net, which opened in 1999 that is designed to provide available job information (by region, firm type, and occupation) to job seekers and information about job seekers (by occupation, region, qualification, and major) to employers.¹³⁶⁾

3.3. Implications

Since the 1960s, Korea's HRD system has successfully managed to adapt its forms, curricula, and operation styles properly according to the changes in labor market skill demands. In other words, Korea's HRD system has worked effectively to train and supply the manpower necessary for national economic development. The following implications can be drawn from the Korean experience:

- (1) Providing a quality basic education first and sequentially expanding education services to a higher level of schooling is a prerequisite. The provision of quality basic education would allow Senegal to secure the initial stock of the human capital it requires to start a national economic development plan. A quality basic education is also a crucial basis for the operation of a vocational training system and the expansion of a higher-level education system. As the national economy develops toward a more advanced level, Senegal will need a larger number of workers with a higher level of education.
- (2) It is crucial to reduce adult illiteracy to fully utilize the available manpower for national economic development. Through the planned large-scale adult literacy programs, Senegal can make young people and adults ready for vocational training and thus employment.
- (3) It is critical to make national HRD plans systematically linked to national socioeconomic development plans. Senegal can enhance the efficiency and effectiveness of the HRD system by promoting a close linkage between the two through policy coordination among governments and collaboration among industry, firms, schools, and training providers.

136) <http://www.work.go.kr/seekWantedMain.do> There are other private job information system like Saranin, JobKorea, and Incrut.

(4) It is important to constantly check and revise the national HRD system and strategy in accordance with the changing skills demands as the national economy develops. For this, Senegal needs to establish national systems for analyzing changes in labor market skill demands by sector and forecasting manpower demands, which will provide scientific evidence with which to make national economic development plans and HRD strategies.

(5) It is integral to establish legal and institutional frameworks for (iii) and (iv). Senegal needs to make laws and regulations that state the official procedures for coordination and collaboration among ministries and establish official organizations for the discussion and coordination of important policy issues. In addition, Senegal needs to make administrative and financial tools that can induce the active collaboration of industry and firms (e.g., analysis of labor market skill demands, technical and financial assistance to the vocational training system).

When Senegal's government designs policy measures to improve the national HRD system and strategies based on the above policy implications, it needs to take the following key success factors into account: (i) administrative and financial infrastructure that made it possible to closely link and coordinate national economic development plans and HRD in an integrated manner, (ii) the establishment and operation of coordination mechanisms in which central government ministries, industry organizations, firms, workers, education and TVET providers, and experts participated, (iii) making and implementing HRD policies including TVET from the perspective of industry and firms, (iv) the establishment of a legal framework and school infrastructure that promotes practical cooperation between industry and schools in both education and research, (v) the establishment and operation of representative organizations for the industry to identify and transfer each sector's skill requirements to education and TVET providers and the government, and (vi) strong leadership of the government to make key success factors work as intended.

Senegal is currently implementing PAQUET in relation to the Plan Senegal Emergent. The Local Group of Partners and the National Convention facilitate coordination and collaboration among HRD-related stakeholders. Recently, the government has placed much emphasis on increasing the budget for HRD and has also tried to provide more systematic employment services, all of which indicate that Senegal has formed a basic framework of national development and HRD. Senegal can further develop its national HRD system and strategies by applying the key ideas of the strategies and policies that the Korean government adopted and key success factors extracted from the Korean experience to solve the problems described in Section 2.4. The next section first makes overall policy recommendations regarding a national HRD system and strategy and then suggests specific projects that are needed most urgently.

4. Policy Recommendation

4.1. Recommendations for National HRD Systems and Strategies

4.1.1. Eradicate Illiteracy and Provide Quality Basic Education

Youth and adult illiteracy urgently need to be eradicated. Communication among people is necessary to build national identity as well as social cohesion and integration. Senegal's government should prioritize providing nationwide literacy programs so that people can enjoy decent social and economic lives. It is worth considering that the government provides two types of literacy program simultaneously, one in French (an official language) and the other in one of the national languages.

Transforming Senegal into a middle-income country will require workers with a higher level of education. If primary schools and lower secondary schools do not provide a quality education, parents will not want to send their children to schools and students themselves will lose interest in learning, which will lead to lower enrolment and higher dropout and repetition rates. Senegal would fail to secure a sufficient number of high school graduates or university graduates to implement its national economic development plans. Thus, ensuring that all children attend primary and lower secondary school and that all students master what they are supposed to learn is critical.

4.1.2. Increase Investment in TVET to Give a Second Chance to Early School Leavers and Enhance Worker Productivity

It is crucial that unemployed early school leavers are provided with the second chance to get vocational training so that they can start their own business, particularly in the informal sector, or become employed at a company, which will contribute to improving individuals' well-being, social inclusion, and national development. In that sense, it is worth making a national vocational training plan in collaboration with the Ministry of Vocational Training, Apprenticeship, and Crafts, Ministry of Youth, Employment and Citizenship Building and the Ministry of Economy, Finance, and Planning.

It is also important to retrain incumbent workers to upgrade their skills and teach them new skills and knowledge, since a country's economic transformation requires the constant acquisition of new technology. In that sense, Senegal's government needs to design and operate a national vocational training system

that covers both youths and adults who are unemployed and incumbent workers in both the formal and informal sectors. The government can utilize financial aids and technical assistance from donor countries and international organizations to establish training providers, design and implement programs, and train instructors.

4.1.3. Make a National HRD Plan that is Closely Linked to the National Economic Development Plan

HRD investment can achieve maximum results when it is systematically linked to national economic development plans. In that sense, the government of Senegal needs to project labor demands by industry sector and skill type and level, review the current capacity of the national HRD system in terms of supplying the required manpower, and estimate the gap between labor demand and supply. In other words, the government should diagnose the initial stock of human capital and estimate the human capital growth required to implement a national economic development plan and make a national HRD plan accordingly.

Senegal's government needs to design a HRD system that includes a regular school system and a vocational training system and implement specific policies based on the analysis results of labor demand and supply. It also needs to regularly review the level of matching between labor demand and supply and constantly adapt the HRD system and strategy as the national economy develops toward a more advanced level. This will require policy coordination mechanisms and national systems that can analyze and forecast labor market skill demands.

4.1.4. Establish and Operate Policy Coordination Mechanisms among Ministries

Senegal's HRD policies are designed and implemented by several ministries, which indicates that there may be a disconnection between secondary education and higher education, between regular school education and vocational training, or between education and national economic development plans. Coordination and collaboration between the Ministry of Economy, Finance, and Planning and HRD-related ministries and among HRD ministries are integral to the improvement of the vertical and horizontal linkages between related HRD policies and national economic development plans.

It is critical that Senegal's government establish and operate step-wise policy coordination mechanisms at the main levels of decision-making (e.g., director-general → ministers) based on legal frameworks. For example, director-generals in related ministries discuss and coordinate critical policy issues. If there are policy issues that cannot be coordinated at the director-general level, then those

issues will be discussed at ministers' meetings. Policy issues that need ministers' decisions will be discussed and coordinated at the ministers' meeting and the Prime Minister's Office can preside over these meetings. It is integral to make it impossible to implement HRD-related policies without agreement among ministers or to appropriate budget for those policies by law. It is important that a culture be developed within which the Ministry of Economy, Finance, and Planning and HRD-related ministries can work together in an integrated and harmonious manner. This mechanism would enable the next step of collaborating with private sector to be taken.¹³⁷⁾

4.1.5. Develop a National System for Analyzing Labor Market Skill Demands

The government needs to analyze changes in labor market skill demands by type and level in major strategic industry sectors in a consistent manner, especially when the country is trying to transform its economy through the rigorous implementation of a comprehensive development plan. This is because the analysis of skill demand changes provides crucial input for revising the school curriculum, vocational training standards, and qualification standards, which are integral to improving the efficiency and effectiveness of the national HRD system.

A prerequisite of skill demand change analysis and new skill demand identification is industry involvement in the process of collecting and analyzing data and information. Thus, this task requires the establishment of representative organizations by sector, the main functions of which are to analyze skill demand changes, identify new skill demands, and transfer information to governments, schools, and TVET providers so that they can use this information to design HRD-related policies and education or TVET programs. It is also necessary that one central government ministry be designated for this job and that professionals with expertise in job analysis are put in place to help the process.

4.1.6. Develop a National System for Manpower Forecasting

It is critical that future manpower requirements are accurately estimated to successfully implement the PSE Priority Action Plan (2014–2018) and subsequent PSE action plans. Forecasting future labor demands and supply by sector, and by level and type of skill requires cooperation among the Ministry of Economy, Finance, and Planning and HRD-related ministries. First, the Ministry of Economy, Finance, and

137) Well-designed and functional government coordination mechanisms are a prerequisite for creating an integrated, comprehensive, and systematic national development policy framework. Collaboration between the government and private sector can work best when this national development policy framework is set.

Planning needs to project labor demanded for a certain period based on the macro-economic development plan and estimate the gap between the labor demand and potential supply with the current HRD system in collaboration with HRD-related ministries. However, the government currently lacks this functionality.

It is currently impossible to precisely project manpower demands and expected manpower supply due to the lack of data accumulated by sector and skill type and level, substitutability among workers with different skills, and the uncertainty of future technology and innovation. However, the government needs information on the trends of changing labor demands as the PSE is implemented. The government should set up a legal framework for this that mandates the government to conduct regular manpower forecasts and develops an administrative infrastructure through which all ministries and related government agencies such as the National Agency for Statistics and Demography and research institutes can take their own responsibility for estimating both labor demand and supply.

4.1.7. Develop a New Curriculum for Education and TVET according to the Results of the Labor Market Skill Demands Analysis and Manpower Forecasting

The magnitude of education and TVET investment's impact on national economic development depends on the quality of education and TVET. In that sense, the degree of relevance of the school curriculum and TVET standards to labor market skill demands is critical. For example, if an analysis of labor market skill demands indicates a need to improve agricultural technology training, this result should be reflected in curriculum revisions. Sections 4.1.5. and 4.1.6. are suggested to enhance the relevance of education and TVET programs to skill demands.

One integral step is establishing systematic connection mechanisms between the national system for analyzing the labor market skill demands and the actors responsible for designing and implementing education curricula and TVET standards such as the Ministry of National Education, Ministry of Higher Education, Research and Innovation Ministry of Vocational Training, Apprenticeship, and Crafts, ISEP and universities. For example, it would be considered to make it legally binding for the Ministry of National Education and Higher Education and Research to take into account the information on skill demands (i.e., core competencies) when revising and newly designing curriculum and assessing the quality of curriculum. This would enhance the youth employment rate and result in capturing the demographic dividend.

4.1.8. Strengthen National System for Data Collection, Analysis and Management

The design, implementation, and evaluation of a national HRD system and strategy require comprehensive and well-organized national systems for regularly collecting, analyzing, and managing data. National statistics systems are a prerequisite for reviewing the current status, identifying policy issues and problems, analyzing causal relationships, and making policies that will solve problems.

Senegal's government needs to redesign national statistics systems to cover all major national policy areas including the economy, employment, higher education, science and technology, and finance. For this, it is necessary that each ministry identify a list of key indicators according to the policy cycle of input, process, output and outcome by policy areas, set up legal and institutional frameworks, and collect and manage data in a consistent manner.

The policy recommendations suggested above are expected to contribute to the establishment of a HRD foundation for implementing national economic and social transformation plans from the long-term perspective and properly responding to changing manpower demands as the country develops to a more advanced level.

4.2. Specific Project Suggestions

4.2.1. Pilot Vocational Training Institutes in Collaboration with Donor Countries and International Organizations

Given that Senegal lacks the budget, programs, and expertise in vocational training that are urgently needed to provide early school leavers with second chances and adults with new skills, it is critical that exemplary vocational training institutes are established with modern facilities and equipment that can provide the most up-to-date training programs in collaboration with donor countries or international organizations. Donor countries and organizations can provide both financial aid and technical advice and assistance such as instructor training. It is recommended that Senegal's government make project proposals in strategic industry sectors to donor agencies. Senegal already has experience of working with international donors;¹³⁸⁾ Senegal's government needs to further expand the TVET projects that are funded by international donors to develop training institutes, training instructors, and learn how to design vocational training programs and thus improve the overall performance of the national training system. Pilot institutes will play an important role as exemplary cases that other training providers can use as benchmarks.

138) See appendix Appendix 3.

4.2.2. Pilot Analysis of Labor Market Skill Demands in Major Strategic Industry Sectors with help from foreign institutes

It is crucial that changes in the labor market skill demands are identified and analyzed and that these are reflected in the school curriculum and TVET standards. This will lead to increased youth employment, which will induce FDI and consequently promote national economic development through enhancing the efficiency and effectiveness of the national HRD system. Senegal's government needs to launch a pilot project of designing and operating a national system to analyze skill demands in strategic industry sectors that are selected with the assistance of international organizations or individual donor countries that have expertise. This pilot case can be transferred to other industry sectors.

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(Appendix Table 1-1) Twenty-seven Key Flagship Projects

N°FP	Flagship Projects (FP)	Sectors	Pillars	
FP1	100–150 aggregation projects targeted on high value added industries and livestock	Agriculture, seafood and agri-food	Drivers of employment and social inclusion	
FP2	Development of 3–4 cereal corridors			
FP3	150–200 "micro-projects" to support family farming			
FP4	Restructure the groundnut industry			
FP5	Accelerate the development of aquaculture			
FP16a	Creation of three integrated agropoles			
FP16b	Three integrated industrial seafood processing clusters			
FP6	Social Housing Acceleration Program	Social Habitat and Ecosystem	Drivers of employment and social inclusion	
FP16c	Ecosystem of construction (materials and construction)			
FP7	Create 20 artisanal (craft) development centers	Gradual modernization of the social economy		Drivers of employment and social inclusion
FP8	Sectoral pilot plan for arts and crafts			
FP9	Micro-tourism sectoral pilot plan			
FP10	Business Infrastructures			
FP11	Relaunch the Integrated Iron Project - Falémé	Mines and Fertilizers		
FP12	Develop the phosphate industry			
FP13	Accelerate the exploitation of zirconium			
FP14	Accelerate operations in the gold sector			
FP14a	National Artisanal Mining Program			
FP15	Regional mining hub			
FP16	Two or three Integrated Industrial Platforms	Regional logistics and industrial hub	Export and FDI Drivers	
FP17	Integrated industrial bets			
FP18	Integrated logistics hub (port, Mali corridor, platforms)			
FP19	Digital Economy—Areas dedicated to export services	Multiservice Regional Hub and Tourism		Export and FDI Drivers
FP20	Business park for regional headquarters and life bases			
FP21	Dakar Medical City			
FP22	Dakar Regional reference Campus			
FP23	Three to six integrated tourist areas			
FP24	A recovery plan for air transport			
FP25	An integrated Electricity Recovery Plan	Strategic recovery of energy sector	Prerequisites	
FP26	Hydrocarbon Supply			
FP27	Universal Energy Service			

Source: Republic of Senegal – Plan Senegal Emergent: Présentation des projets et réformes phares - Table compiled and organized with data from p.4.

〈Appendix Table 1-2〉 Seventeen Flagship Reform Projects

N°FR	Flagship Reforms (FR)	Areas
FR1	Senegal Emergent Fund	Business environment and regulation
FR2	Recovery of attractiveness rankings	
FR3	Optimization of state enterprises and holdings	
FR4	Special Economic Areas and Investor Packages	
FR5	Accelerated land provision	
FR6	An incentive framework for real estate development	
FR7	Maximization of mining value captured by Senegal	
FR8	Access to social protection for the informal economy	
FR9	Regulatory framework for road transport	
FR10	A National Integrated Infrastructure Development Plan	Infrastructure
FR11	Aligning higher education with economic needs	Human capital
FR12	The accelerated development of technical and vocational training	
FR13	The structuring and promotion of education continuation pathways	Digital Economy
FR14	The dissemination of ICT in the economy ("Digital Economy Council")	
FR15	Access to VSEs and SMEs	Economy Financing
FR16	The development of the mortgage industry	
FR17	Bancarization of low-income areas	

Source: Republic of Senegal – Plan Senegal Emergent: Présentation des projets et réformes phares - Table compiled and organized with data from p.44.

Appendix Table 1-3 Higher Education Expenditure by Purpose in 2014

Budget Structure	Expenditure by purpose in USD (average 1 USD = 556 FCFA)													Percentage (total)
	Teacher Salary	Non-Teaching staff salary	Training Materials/Supplies	Allocation of research travels and teacher scholarships	Grants to education and student social affairs institutions	Other current expenditure	Investment	Salaries and Allowances for Auxiliary Services	Health/Nutrition/Internet	Other current expenditure	Scholarships and Family Allowances	Other transfers	Total Initial Funding	
Public Universities	50,517,187	22,144,618	424,174	4,124,906	13,047,879	11,089,154	60,130,758	-	-	-	97,225,275	3,723	258,707,676	78.44
Private universities	-	-	-	-	9,457,842	-	-	-	-	-	-	-	9,457,842	2.87
Public Institutes	69,842	-	-	-	-	-	37,711	-	-	-	-	-	107,553	0.03
Private Institutes	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
Private technical school	964,919	5,317	-	-	2,068,345	261,842	-	-	-	-	-	-	3,300,423	1.00
Center of student social affairs	-	-	-	-	-	-	-	2,975,684	709,287	8,965,366	-	32,806,746	45,457,083	13.78
Central Administration (Ministry of HE)	-	809,237	-	-	-	10,322,256	1,660,056	-	-	-	-	-	12,791,549	3.88
Total	51,551,948	22,959,172	424,174	4,124,906	24,574,067	21,673,252	61,828,525	2,975,684	709,287	8,965,366	97,225,275	32,810,469	329,822,125	100.00
Percentage (total)	15.63	6.96	0.13	1.25	7.45	6.57	18.75	0.90	0.22	2.72	29.48	9.95	100.00	

Source: Republic of Senegal (2016) - National Account for Education pp.81-83.

〈Appendix Table 1-4〉 Composition of Senegal's Budget in 2015

Repartition of Senegal voted budget in 2015	Budget FCFA (LFR)	USD (average rate 2015)	Percentage (%)
Public debt	598,010,000,000	1,016,617,000	20.57
The Ministry of National Education	377,915,403,843	642,456,187	13.00
Common Expenditure "Undistributed Charges"	238,297,936,893	405,106,493	8.20
The Ministry of Economy, Finance, and Planning	173,657,101,739	295,217,073	5.97
The Ministry of Agriculture and Rural Equipment	172,228,982,658	292,789,271	5.93
The Ministry of Infrastructure, Land Transport and Opening Up	159,993,589,759	271,989,103	5.50
The Ministry of the Armed Forces	147,313,453,682	250,432,871	5.07
The Ministry of Higher Education and Research	144,430,226,151	245,531,384	4.97
The Ministry of Health and Social Action	135,540,909,437	230,419,546	4.66
The Ministry of Energy and Renewable Energy Development	92,971,202,554	158,051,044	3.20
The Ministry of the Interior and Public Security	76,138,097,350	129,434,765	2.62
The Presidency of the Republic	71,534,724,132	121,609,031	2.46
The Ministry of Local Governance and Territory Development and Planning	61,949,836,675	105,314,722	2.13
The Ministry of Foreign Affairs and Senegalese of abroad	53,961,340,333	91,734,279	1.86
The Primature (Prime Minister administration)	51,829,288,757	88,109,791	1.78
The Ministry of Hydraulic and Sanitation	49,520,857,836	84,185,458	1.70
The Ministry for the Promotion of Investments, Partnerships, and Development of Teleservices of the State	31,371,932,937	53,332,286	1.08
The Ministry of Vocational Training, Apprenticeship, and Crafts	29,566,079,737	50,262,336	1.02
The Ministry of Justice	28,267,089,758	48,054,053	0.97
The Ministry of Tourism and Air Transportation	25,062,659,330	42,606,521	0.86

〈Appendix Table 1-4〉 Continued

Repartition of Senegal voted budget in 2015	Budget FCFA (LFR)	USD (average rate 2015)	Percentage (%)
The Ministry of Industry and Mines	22,001,013,650	37,401,723	0.76
The Ministry of Urban Renewal, Habitat, and Living Environment	21,691,942,263	36,876,302	0.75
The Ministry of Environment and Sustainable Development	20,877,600,880	35,491,921	0.72
The Ministry of Culture and Communication	15,805,351,008	26,869,097	0.54
The National Assembly	15,129,649,520	25,720,404	0.52
The Ministry of Fisheries and Maritime Economy	14,136,629,614	24,032,270	0.49
The Ministry of Woman, Family, and Childhood	14,105,866,491	23,979,973	0.49
The Ministry of Youth, Employment, and Citizenship Building	12,740,896,192	21,659,524	0.44
The Ministry of Commerce, Informal Sector, Consumer Affairs, Promotion of Local Products, and SMEs	12,265,840,385	20,851,929	0.42
The Economic, Social, and Environmental Council	9,353,961,724	15,901,735	0.32
The Ministry of Livestock and Animal Production	9,173,586,280	15,595,097	0.32
The Ministry of Sports	7,416,782,704	12,608,531	0.26
The Audit Court	2,883,146,080	4,901,348	0.10
The Ministry of Labor, Social Dialogue, Professional Organizations, and Relations with Institutions	1,934,799,421	3,289,159	0.07
The Supreme Court	1,752,077,620	2,978,532	0.06
The National Autonomous Electoral Commission	1,600,983,000	2,721,671	0.06
The Ministry of Civil Service, Workforce Rationalization, and Public Service Renewal	1,547,904,669	2,631,438	0.05
The Ministry of African Integration, NEPAD, and the Promotion of Good Governance	1,285,690,868	2,185,674	0.04
The Ministry of Posts and Telecommunications (ICT)	1,022,365,870	1,738,022	0.04
The Constitutional Council	402,198,200	683,737	0.01
Total	2,906,689,000,000	4,941,371,300	100.00

Source: The Republic of Senegal, Ministry of Economy, Finance, and Planning (2015): Loi des Finances Rectificative 2015 (i.e., Amended Law of Finance 2015). pp.27–40.

⟨Appendix Table 1-5⟩ TVET Projects by Donor

Project Name	Objective	Period	Amount (USD)	Donors
Support Program for Integrated Learning Development		2014/2016	4,270,601	ACDI/Canada
Human Resources Qualification Project (PQRH2)	Construct sectoral training centers.	2013/2017	4,770,574	AFD/France
PROJECT SEN028	Contribute to the development of quality vocational and technical training that is equally accessible to girls and boys and that meets economic and social development needs.	2013/2017	21,436,364	Luxembourg, BIT, ONUDI, PNUD
Project APEFE	Improve the quality and performance of the training of trainers in the vocational and technical training sector by strengthening three national structures for trainer training	2011/2016	1,654,429	French Community of Belgium
Vocational Training for Employment and Competitiveness Project	Strengthen vocational and technical training systems and improve the employability of young people in three sectors (poultry farming, horticulture, and tourism) as identified by the government to support accelerated growth and stimulate job creation	2015/2020	67,272,727	World Bank/AFD France

Source: Ministry of Vocational Training, Craft and Apprenticeship – 2016: Compilation and summary of ongoing projects pp.52–56.

〈Appendix Table 1-6〉 STI Manpower Development Structure in Public Universities

University	Faculty/school	Department
UCAD	ESP	<ul style="list-style-type: none"> • Chemical engineering • Civil engineering • Electrical engineering • Computer engineering • Mechanical engineering
	FASTEF	<ul style="list-style-type: none"> • Mathematics • Physics–Chemistry
	FMPO	<ul style="list-style-type: none"> • Medical biology and functional explorations • Surgery and Surgical Specialties • Medicine • Medicine and Medical Specialties • Dentistry • Pharmacy • Biological and Pharmaceutical Applied Sciences • Pharmaceutical, Physics and Chemistry Sciences
	FST	<ul style="list-style-type: none"> • Animal Biology • Plant Biology • Chemistry • Geology • Institute of Earth Sciences • Institute of Environmental Sciences • Mathematics-Computer Science • Physics
UGB	IPSL	<ul style="list-style-type: none"> • Civil Engineering • Mechanical Engineering
	S2ATA	<ul style="list-style-type: none"> • Aquaculture • Livestock Production • Plant Production • Food Processing
	SAT	<ul style="list-style-type: none"> • Applied Mathematics • Computer Science • Physics • Electronics and Telecommunication Engineering
	SEFS (Educators)	<ul style="list-style-type: none"> • Math–Physics–Chemistry • Math–Earth and Life Science • Math–Sports
	2S	<ul style="list-style-type: none"> • Medicine • Biological and Medical Sciences
UT	SET	<ul style="list-style-type: none"> • Mathematics • Mathematics for Teaching • Water and Environmental Sciences • Physical Sciences • Computer Science

⟨Appendix Table 1-6⟩ Continued

University	Faculty/school	Department
UT	Health	<ul style="list-style-type: none"> • Medicine • Physical and Sporting Activities Sciences et Technics
	UFR SI	<ul style="list-style-type: none"> • Architecture • Civil Engineering • Geomatics Engineering • Geotechnical Engineering • Hydrogeology
	IUT	<ul style="list-style-type: none"> • Electrical and Industrial Computing Engineering • Geomatics Engineering • Civil Engineering • Logistics and Transportation
	ENSA	<ul style="list-style-type: none"> • Agricultural Engineering • Value Chain and Agribusiness • Forestry and environment for sustainable management of Natural Resources • Agronomy and Crop Protection
	ISFAR	<ul style="list-style-type: none"> • Management of Wildlife and Protected Areas • Rural and Farm Advisory • Agricultural and Rural Development
UADB	SATIC	<ul style="list-style-type: none"> • Mathematics • Physics-Chemistry • IT
	SDD	<ul style="list-style-type: none"> • Community Health
UASZ	2S	<ul style="list-style-type: none"> • Medicine
	ST	<ul style="list-style-type: none"> • Agroforestry • Chemistry • Geography • Computer Science • Mathematics • Physics
EPT		<ul style="list-style-type: none"> • Civil Engineering • Electromechanical engineering • Computer Science and Telecommunication Engineering
UVS		<ul style="list-style-type: none"> • Mathematics and Computer Science • Computer Science

Source: Professeur Abdou Sène (2017). Ministry of Higher Education and Research: Data compiled and summarized from universities' websites (www.ucad.sn, www.ugb.sn, www.univ-thies.sn, www.uadb.edu.sn, www.univ-zig.sn, www.uvs.sn).

2016/17 Knowledge Sharing Program with PASET:
National HRD Strategy to Support the Social and
Economic Transformation of PASET Member Countries
with Focus on Senegal

Chapter 2

Strategic Plan for Establishing TVET Centers of Excellence (CoEs)

1. Introduction
2. Overview of TVET Systems in Senegal
3. The Korean Experience of Solving Pressing Problems in TVET Systems
4. Policy Recommendation for the Establishment of TVET Centers of Excellence (CoEs) to Strengthen TVET Systems in Senegal
5. Conclusions and Remarks

Strategic Plan for Establishing TVET Centers of Excellence (CoEs)

Man-Gon Park (Pukyong National University)

Summary

Regarding Centers of Excellence (CoEs), Stephen Jenner, the Office of Government Commerce, and Craig Kilford mentioned that CoEs are teams, shared facilities, or entities that provide leadership, best practices, research, support, and/or training for focus areas. They may also be known as a competency centers or capability centers. The term may also refer to a network of institutions that collaborate with one another to pursue excellence in a particular area. The key functions of TVET CoEs can be summarized as coordination and collaboration, change initiatives, leadership, best practices, research, support, training, standards, revitalization, competency, and capabilities in TVET systems.

Most African governments work in collaboration and cooperation with international organizations and international cooperation agencies to expand TVET projects and programs and make every effort to develop TVET policies and strategies. Partnership for skills in Applied Sciences, Engineering and Technology (PASET), which was launched in 2013 by Sub-Saharan African (SSA) governments and was facilitated by the World Bank, has built a strong relationship with the Republic of Korea. In addition, one of PASET's key regional initiatives is the establishment and operation of regional Technical and Vocational Education and Training (TVET) Centers of Excellence (CoEs). Through these environments, PASET KSP is spearheading the development of a new strategy to revitalize TVET in PASET countries through the establishment of a PASET TVET CoE Network in Senegal and

other PASET Countries.

Senegal's government is striving to strengthen TVET systems by establishing TVET CoEs there and in other PASET countries to solve pressing problems and hot issues of TVET systems under the Program for Improvement of the Quality, Equity, and the Transparency of the Education and Training Sector (PAQUET), as per the detailed action plan of the Plan Senegal Emergent (PSE).

Under these visiting plans to relevant ministries, agencies, and institutions in Senegal, all members of the PASET KSP team visited most of the relevant ministries, agencies, and institutions as planned for actual surveys. It is necessary to readjust and confirm the scope of policy research into building TVET infrastructure by considering the surveyed results and the research period by the Advisory and Evaluation Committee as follows.

- (1) Choose and concentrate on some important demands for Senegal and other PASET countries in building TVET infrastructure (TVET CoEs).
- (2) Emphasize and adapt the Korean experience during Korea's industrial growth era with the development of skills and TVET systems through refocusing, restructuring, and readjustment.

With this advice, this paper synthesizes pressing problems and hot issues concerning TVET systems in Senegal as a PASET country with a survey of necessary and emerging skills according to environmental changes of new technologies and labor markets. Furthermore, we can determine the current status of TVET systems of Senegal under PAQUET through a detailed PSE action plan. With this, we can investigate the needs of the refocusing, restructuring, and readjustment of TVET systems in Senegal. In addition, we would like to introduce overviews, lessons, and the implications of the Korean experience to solve the pressing problems that arise during economic development in TVET systems through strategic points such as choice and concentration strategies that use limited resources, local community-based skills, and TVET systems development, capability building efforts of TVET-related government officials and teachers to maintain sustainability, the effective utilization of overseas aid, and refocusing, restructuring, and readjustment through the establishment of TVET CoEs.

Finally, we will propose approaching strategies and methods for the establishment of PASET TVET CoEs, and suggest and recommend important strategic points and action steps for the establishment and utilization of PASET TVET CoEs to improve and reengineer skills and TVET systems compared to the Korean TVET experience and wisdom via the following strategies:

- Strategy 1: Choice and Concentration
- Strategy 2: Strengthening Research Function
- Strategy 3: One Flow and One Frame Management
- Strategy 4: Standardized and Competent TVET Systems
- Strategy 5: Harmonized and Recognized TVET Systems in PASET Countries
- Strategy 6: Accredited and Certified TVET Systems by Regional Accreditation Commission

1. Introduction

The young and developing economies of Sub-Saharan Africa (SSA) PASET countries have been emerging as leading sources of workers in the global labor market. In recognition of the critical shortages of skills and human resources, PASET countries have been making significant efforts to promote regional integration to create larger markets and facilitate the movement of labor and capital to their most productive uses. However, there is a huge gap between the demand and supply of necessary skills in PASET countries. Key skills shortage areas lie in Science, Technology, Engineering and Mathematics (STEM), ICT, healthcare, and other applied sciences. Furthermore, SSA countries have faced a brain drain among their top talents, and women make up a small fraction of the skilled workforce. Necessary and emerging skills for Senegal and other PASET countries according to environmental changes with new technologies and labor markets should be investigated using the Korean experience in skills development and training to cultivate a knowledgeable workforce. Therefore, we will develop strategic approaches for necessary and emerging skills and TVET development by establishing CoEs.

In this paper, we will synthesize the pressing problems and hot issues of Senegal's TVET systems as a PASET country by surveying necessary and emerging skills according to the environmental changes that are created by new technologies and labor markets. Moreover, we will determine the current status of Senegal's TVET systems under the "Program to Improve the Quality, Equity and the Transparency of the Education and Training Sector" called Program for Improving the Quality, Equity, and Transparency of Education and Training (PAQUET) as per the detailed action plan of the Plan Senegal Emergent (PSE). With this, we will investigate the needs for refocusing, restructuring, and readjusting TVET Systems in Senegal.

In addition, we would like to introduce overviews, lessons, and implications from the Korean experience to solve pressing problems of economy development in TVET systems via the following strategic points:

- (1) Choice of and concentration on strategies using limited resources.
- (2) Local community-based skill and TVET system development.
- (3) Capability building efforts of TVET-related government officials and teachers to ensure sustainability.
- (4) Effective utilization of overseas aid.
- (5) Refocusing, restructuring, and readjustment through the establishment of TVET CoEs.

The TVET Center of Excellence (CoE) is a shared facility or organization that provides leadership, best practices, research, support, and/or training for TVET systems. Stephen Jenner, the Office of Government Commerce, and Craig Kilford¹⁾, in Management of Portfolios, mention CoE as a coordination function that ensures that change initiatives can be delivered consistently and well through standard processes and employing competent staff. Building these TVET CoEs in Senegal and other PASET countries requires designing the appropriate functions and roles of each TVET research CoE with Korean experiences by surveying the functions and roles of HRD Korea and the Korea University of Technology Education (KoreaTech) HRDI in the Korean Industrial Growth Era.

Finally, we will propose approaching strategies and methods for the establishment of TVET CoEs, and suggest and recommend some important strategic points and action steps for the establishment and utilization of a PASET TVET CoE Network to improve and reengineer skills and TVET systems in Senegal and other PASET countries.

2. Overview of TVET Systems in Senegal

2.1. The Current Status of Senegal's TVET Systems

Most PASET countries such as Senegal, Ethiopia, and Rwanda were identified at the lowest levels in the 2015 UN Human Development Index (HDI) and in the Multidimensional Poverty Index (MPI). Senegal was ranked 170th place, Ethiopia was 174th place, and Rwanda was 163th place among 188 UN member countries, but the youth unemployment rate and the employment rate are not as bad, as shown in <Table 2-1>.

1) Stephen Jenner (2011), Office of Government Commerce, and Craig Kilford, Management of Portfolios, The Stationery Office, ISBN 978-0-11-331294-8.

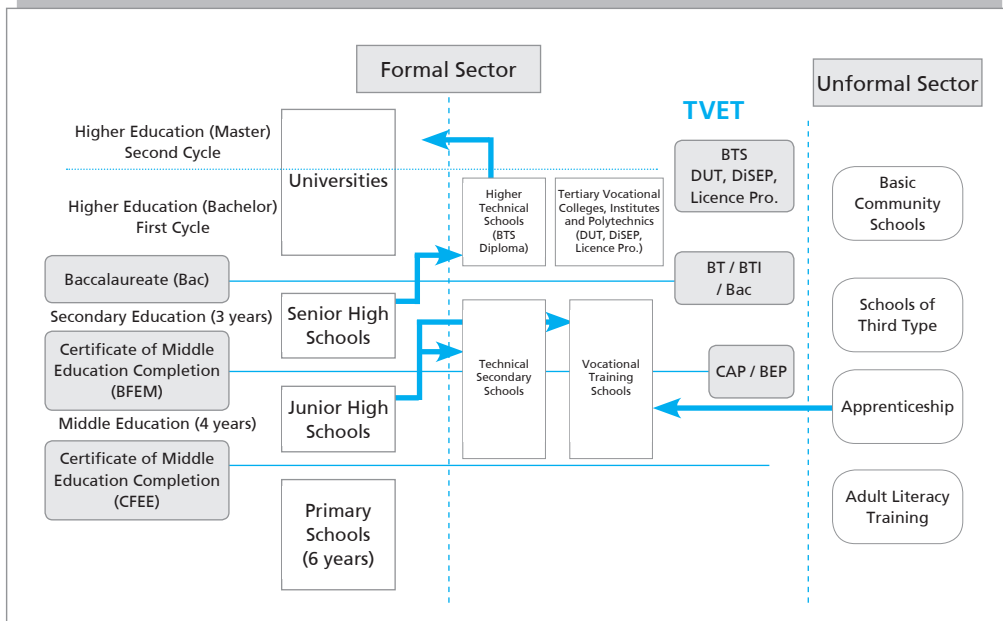
(Table 2-1) UN Statistics of HDI, MPI, and Employment Rate of PASET Countries

Country	HDI/Ranking (188)	MPI	Youth Unemployment Rate (%)	Employment Rate (%)
Senegal	0.466/170	0.278	12.7	68.7
Ethiopia	0.442/174	0.352	7.3	79.0
Rwanda	0.483/163	0.537	4.5	85.4

Source: 2015 UNDP Human Development Report.

According to the report by the World Bank and National Agency for Statistic and Demography (ANDS), the population of Senegal was estimated as 15.3 million in 2016, which is an increase of about four million over the past decade; 43.3% of the population is under 15 years old and 64% is under 25 years old. The population of Senegal will increase to 18.9 million by 2030. The Senegalese education system, which is based on the French education system, is composed of six years of primary education, four years of middle school, three years of secondary school, and higher education. The regular TVET is a secondary and post-secondary diploma, and TVET with a Higher Technical Schools Diploma (BTS) and Tertiary Vocational Colleges, Institutes and Polytechnics Diplomas (DUT, DiSEP, and Licence Pro.) is integrated into the regular education system, as depicted in [Figure 2-1].

[Figure 2-1] Relationship between Regular Education and TVET Systems in Senegal



Source: Ministry of Higher Education, Research and Innovation.

Senegal's TVET qualifications are classified as follows:

- (1) Certificate of vocational education (CAP, BEP),
- (2) Technician certificate (BT) for Secondary vocational education (two years–short cycle/Three years–long cycle),
- (3) Technical Baccalaureate for Secondary technical education (three years),
- (4) Higher technician certificate (Brevet de Technicien Supérieur – BTS),
- (5) Tertiary Vocational Training Diploma (Diplôme Supérieur d'Enseignement Professionnel – DiSEP),
- (6) University technology diploma (DUT) for Tertiary education (two to three years),
- (7) Engineering Diploma (Diplôme d'Ingénieur Technologue – DIT), and
- (8) Design Engineering Diploma (Diplôme d'Ingénieur de Conception – DIC) for Engineering of post-secondary vocational education (four to five years).

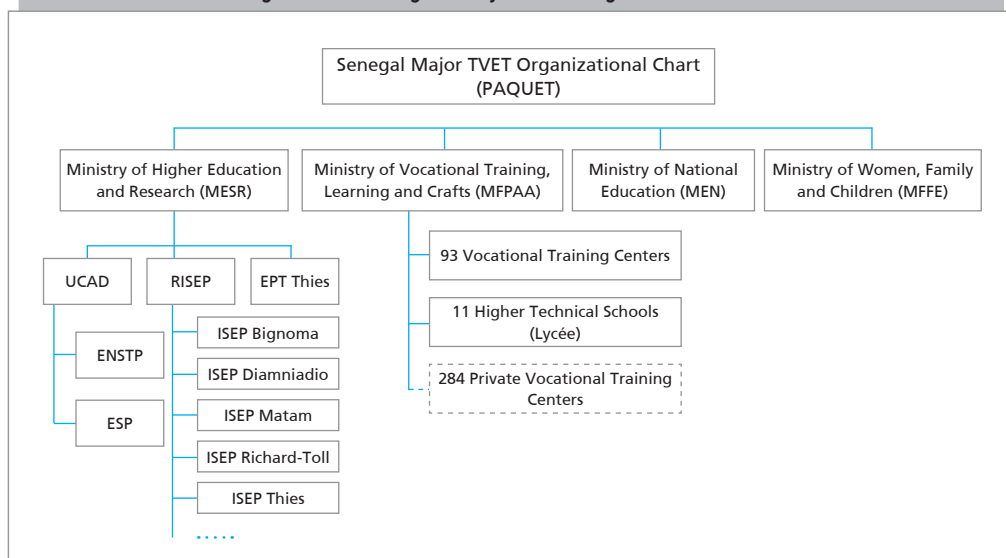
Education and training in Senegal is carried out by four ministries: the Ministry of Women, Family, and Children (MFFE), the Ministry of Higher Education, Research and Innovation (MHERI), which is responsible for tertiary education, universities, polytechnic schools and institutes, and the Ministry of National Education (MEN), which is responsible for kindergarten, primary, middle and secondary general education. The Ministry of Vocational Training, Learning and Crafts (MFPAA) is responsible for training only in skills and occupations, administering TVET at the secondary level (middle school/CEM for four years, higher technical schools/lycées for three years for students aged 15–18), operating a two-year diploma program at vocational training schools.

The Ministry of Higher Education, Research and Innovation (MHERI) administers courses aimed at students who have passed the high school graduation examination. The Higher Institute of Vocational Education (ISEP) runs a two-year post-secondary course administered by the Ministry of Higher Education, Research and Innovation that overlaps with the diploma course offered by vocational secondary schools under the Minister of Vocational Training, Learning, and Crafts. This is due to an independent and parallel TVET system at the Ministry of Higher Education, Research and Innovation. On September 23, 2013, the Minister of Vocational Training, Learning, and Crafts (MFPAA) abandoned technical education and vocational education and only focused on technical training and vocational training by Decree No. 2013-1291.

In July 2013, four ministries (MESR, MFPAA, MEN, and MFFE) jointly established an action plan called the Program for Improvement of Quality, Equity, and Transparency of the Education and Training Sector (PAQUET) to resolve major issues in the areas of education and training. The direction of PAQUET is becoming clearer

in accordance with the 2014 Plan Emergent Senegal (PSE). As of 2015, Tertiary-TVET courses are offered at public (6) universities such as UCAD, UGB, UT, UADB, UASZ, and UVS, and private (15) universities, public (4) and private (120) institutes and engineering schools, and public (14) tertiary institutes for vocational training (ISEP). In addition, there are 388 TVET middle and secondary institutions in Senegal, of which 104 are public (27%) and 284 are private (73%). Among the 104 public institutions, there are 11 High Schools, which are Higher Technical Schools (3%), 39 vocational training centers, 42 female centers for technical education (CETF) and female regional centers for technical education (CRETf), four training schools for technical teachers, five handicraft training centers, and three specific training institutes under Senegal's TVET organization, as shown in [Figure 2-2].

[Figure 2-2] Senegal's Major TVET Organizational Chart



Source: Ministry of Higher Education, Research and Innovation.

Tertiary TVET courses are offered by public (6) and private (15) universities, public (4) and private (120) institutes and engineering schools, and public (14) tertiary institutes for vocational training (ISEP). There are 137,684 learners, of who fewer are girls (39.5%), and 19.3% are at private institutions.

(Table 2-2) The Distribution of Senegal's Major TVET Institutions (MFPAAs) according to 14 Regions

Province (Region)	Private	Public			Total	Percentage (%)
	Training Centers	Higher Schools	Training Centers	Total Public		
Dakar	171	3	18	21	192	49
Diourbel	6	1	7	8	14	4
Fatick	0	0	8	8	8	2
Kaffrine	2	0	3	3	5	1
Kaolack	14	1	5	6	20	5
Kédougou	0	1	2	3	3	1
Kolda	5	1	5	6	11	3
Louga	3	0	3	3	6	2
Matam	0	0	5	5	5	1
Saint-Louis	9	1	7	8	17	4
Sédhiou	0	0	1	1	1	0
Tambacounda	7	1	5	6	13	3
Thiès	48	1	14	15	63	16
Ziguinchor	19	1	10	11	30	8
Total (14)	284	11	93	104	388	100

Source: Ministry of Higher Education, Research and Innovation.

Technical Teacher training institutions include ENSETP de Dakar, a central vocational teacher training institution under the Cheikh Anta Diop University of higher education in Dakar, CNFMETP de Kaffrine, a national technical teachers-in-practice training institute in the fields of metal structure, wood, construction, auto mechanics, and electricity, and ENFEFS de Dakar, a college for fostering vocational training teachers in the fields of family and socioeconomics such as restaurants, apparel, community development, and nutrition.

The newly established Ecole Polytechnique (ISEP) network (RISEP) offers two-year post-secondary courses that are administered by MESR in Bignona, Diamniadio, Matam, Richard-Toll, and Thies as these public institutions meet the labor market's workforce needs to address mismatches between TVET systems and labor markets in higher education and employment. Recently, Senegal's government has made efforts to extend the number of ISEP schools nationwide through Presidential Decision No. 01 (to refocus, restructure, and readjust the tertiary education system towards science, technology, and short-term vocational training) and Recommendation No. 50 (to expand the ISEP network by establishing at least one ISEP school in each province in accordance with the potential of future higher education by the recommendation of the National Advisory Committee).

2.2. Needs of Refocusing, Restructuring and Readjustment of TVET Systems to Solve Pressing Problems

2.2.1. Challenges of the Senegalese TVET Systems

The results of the 2013 General Census of Population and Housing, Agriculture and Livestock (RGPHAE) revealed that 45.4% of Senegalese aged ten or older can read and write in any language (53.7% for men vs. 37.7% for women). The census evaluated the education levels of 2,852,983 learners, as depicted in <Table 2-3>. In terms of vocational training, the distribution of individuals aged at least 6 years indicated that 89.5% of individuals had not received any training, and women (92.5%) were generally more disadvantaged than men (86.3%) in terms of their ability to access vocational training services. This census also reported that the percentage of people who had received vocational training was 10.5%, with the 6.4% receiving formal training and 4.1% receiving informal training. This is the real situation of the Vocational Training, Skills, and Crafts (FPTA) sector in Senegal.

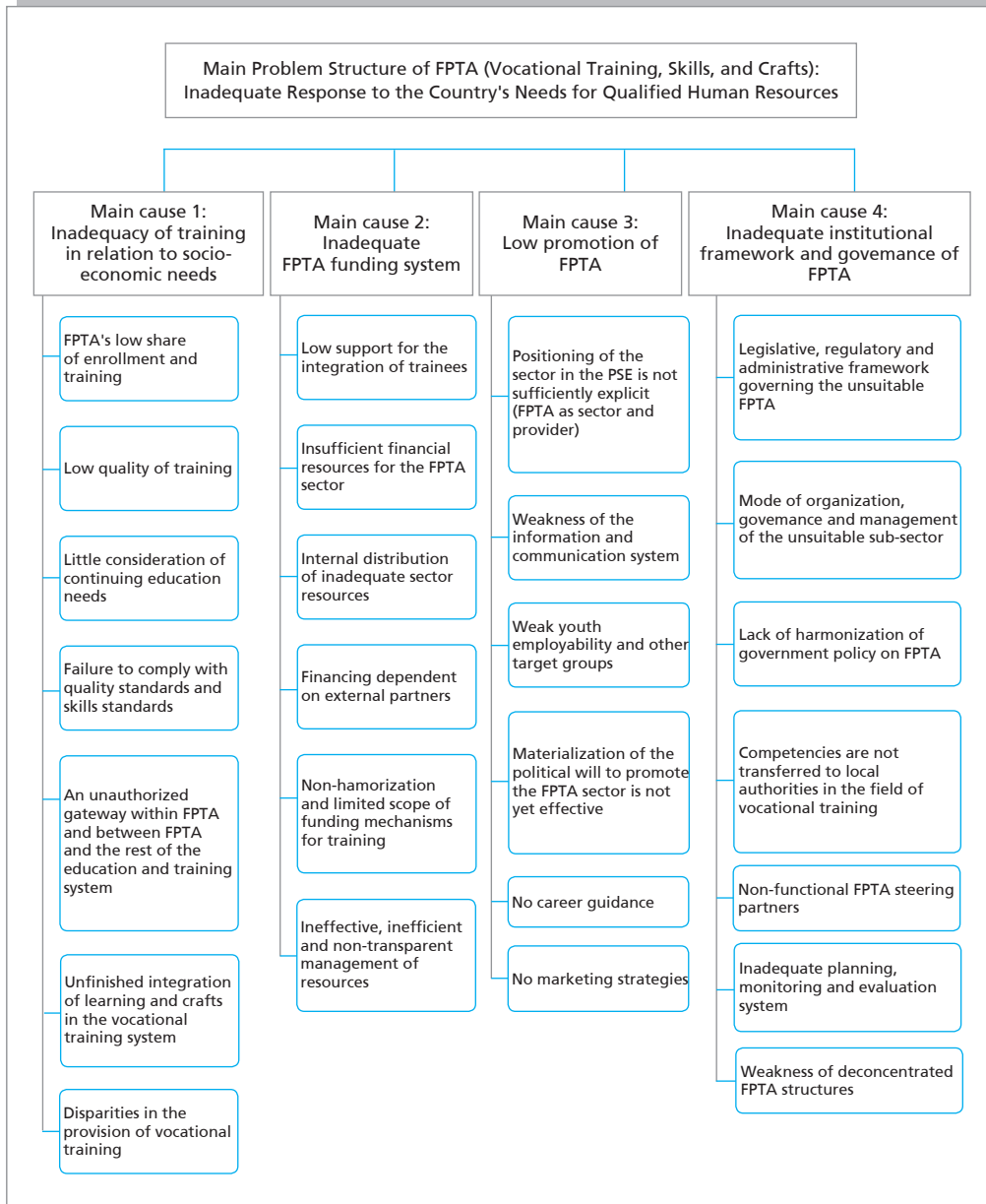
<Table 2-3> School Graduation Level of Senegalese Enrolled Learners

Graduation	Numbers	Percentage (%)
Preschool	170,351	6.0
Primary School	1,521,572	53.3
Post-Primary School	701,577	24.6
Secondary School	321,799	11.3
Tertiary	137,684	4.8
Total	2,852,983	100

Source: 2013 General Census of Population and Housing, Agriculture and Livestock RGPHAE Report.

FPTA is a major part of TVET in Senegal and has faced a serious problem with the inadequate response to the country's needs for qualified human resources caused by the inadequacy of training in relation to socioeconomic needs, the inadequate funding system, low promotion, and the inadequate institutional framework and governance as summarized in [Figure 2-3].

[Figure 2-3] The Main Problem Structure of Vocational Training, Skills and Crafts (FPTA)



According to the reports and recommendations of the 2015 Annual Report of MFPAA and the 2016 Study Report on “Qualified Human Resources Needs in the Priority Sectors of the Economy for 2025 Horizon by the Cabinet SEMACO and AMOS,” Senegalese TVET systems have been confronted with the following selected challenges that should be overcome through refocusing, restructuring, and the readjustment of TVET systems.

- (1) Contributing to the increase and improvement in labor productivity for a more competitive and dynamic economy;
- (2) Providing quality training opportunities for the young and middle-aged in TVET systems;
- (3) Responding to the demands for necessary and emerging skills in the labor market;
- (4) Reforming teaching and learning methodologies and tools, approaching competency-based education and training, and emphasizing a dual work–learning system;
- (5) Establishing a National Vocational Qualification (NVQ) framework for the harmonization of the issuance of TVET diplomas with the qualifications awarded by professional branches;
- (6) Improving the effectiveness and efficiency of TVET institutions and programs via evaluation and accreditation systems;
- (7) Developing the Labor Market Information System (LMIS) is an important tool for solving serious problems such as the inadequate responses of TVET institutions to the country's needs for a skilled workforce, the lack of awareness regarding skills demands for industries, and the unavailability of relevant information about job offers, job seekers, and their required qualifications.
- (8) Improving the coordination capabilities of government actions among TVET policy stakeholders;
- (9) Introducing Quality Assurance (QA) systems and Total Quality Management (TQM) systems in the TVET sector;
- (10) Strengthening the social and commercial aggregation activities of TVET institutions.

In spite of these challenges, Senegal aims to create 300,000 jobs over the next five years to reduce the unemployment rate from 31.3% to 6.0%. Senegal's highest priorities for achieving this goal are: (1) improving the productivity of the economy and the qualifications of the youth population; (2) ensuring better matches between TVET programs and the needs of the economy and industry; (3) reinforcing the institutional framework to manage the jobs agenda; (4) incentivizing the creation of enterprises; and (5) implementing a LMIS to monitor the labor market and employment trends under poverty reduction strategies.

The mobilization of the workforce across national borders is becoming rapid and has increased from Senegal to both the world and SSA.²⁾ According to the World Bank, approximately 463,000 Senegalese (or 4% of the population) live abroad. The results of a household survey carried out by the Senegalese Ministry of Economy

2) Focus Migration, Accessed from <http://focus-migration.hwwi.de/Senegal.2636.0.html> on 5th Feb. 2017, Service Provided by Institut für Migrationsforschung und Interkulturelle Studien (IMIS).

and Finance showed that 76% of urban households and 70% of households nationwide had at least one family member abroad. In total, 46% have gone to the EU (e.g., Italy, France, and Spain) and 8% have gone to North America (e.g. Canada and the US). The most important destinations for Senegalese migrants within Africa are Gambia, the Ivory Coast, Mali, and Mauritania due to their geographical proximity. Gambia's population includes approximately 300,000 Senegalese.

The movement of people, knowledge, and technology is seen as a real driver and cause of globalization, as it generates institutional and social changes that take place within and beyond national borders. However, workforce mobility according to labor market openings faces numerous problems due to the disparity between workers' skills and competencies and the optimum qualifications that are required. Therefore, there is a growing demand to standardize and harmonize TVET systems through accreditation and certification, by developing occupational skills standards, and recognizing vocational qualifications in the region and the world. Unaccredited TVET institutions, non-equivalent qualification systems, accreditation and certification systems that are not unified, and qualifications that are not recognized in other countries threaten workforce mobilization across borders and create discrepancies in labor markets where skills and qualification systems are not standardized.

A serious digital divide has recently arisen in the global labor market from the emerging third space as an integrated cross-space between cyberspace and the physical (real) space through the advancement of Cyber-Physical Systems (CPS) and the Internet of Things (IoT) with the fourth industrial revolution. Industry 4.0 or the "fourth industrial revolution" is the current trend of automation and data exchange in manufacturing technologies. Industry 4.0 creates "smart factories" and includes CPS, the Industrial Internet of Things (IIoT), Big Data, and Artificial Intelligence (AI). CPS enables the merging of the physical world with the virtual, leading to IoT, Big Data, and services that include systems such as Smart Cities, Smart Grids, Smart Factories, Smart Buildings, Smart Homes, and Smart Cars. A technologically oriented (skilled and knowledgeable) workforce is increasingly necessary in many workplaces in the global labor market.

These labor market demands of technological environmental changes mean that Senegal and other PASET countries need to refocus, restructure, and readjust their TVET Systems, as summarized in <Table 2-4>.

(Table 2-4) A Summary of the Refocusing, Restructuring and Readjustment of TVET Systems in Developing Countries

TVET Area	Description of Refocusing, Restructuring and Readjustment
Skills standards and vocational qualifications	<ol style="list-style-type: none"> 1. Some developing countries are moving towards national qualifications systems as a means of raising occupational skills standards and facilitating workforce mobility. 2. These standards, which are benchmarked from existing national standards, describe the abilities, skills, knowledge, and operations that individuals require for specific occupations, industrial processes, or technological applications. 3. The recognition of national skill competencies and qualifications in the region and the world will spur the free movement of skills while focusing on common vocational standards. 4. This will help workers increase their marketability and job mobility through demonstrating the skills that they have acquired in any context. 5. It can also help industries boost their overall productivity and competitiveness by applying skill standards of excellence.
Accreditation and certification	<ol style="list-style-type: none"> 1. Regional and global accreditation and certification bodies respond to the inevitable transmigration of workers and the emergence of a multicultural environment. 2. TVET providers in PASET countries are encouraged to adapt best practices for their institutions through this initiative.
Labor market information needs	<ol style="list-style-type: none"> 1. The labor market information system (LMIS) tracks and analyses a country's economy by determining the future workforce training needs, identifying the availability of labor, verifying the prevailing wage rates, and discovering potential markets. 2. By providing these data, jobs will be generated, thus reducing unemployment. 3. LMIS is also valuable for local and regional planners in both academia and industry for helping them target locations, seek methods of attracting and retaining skilled workers, and assessing the scope and size of potential markets. 4. Labor market-oriented TVET systems in training areas, skills, and curricula
Enhancing international networks	<ol style="list-style-type: none"> 1. The development of sustainable human resources requires concerted efforts and approaches from all national, regional, and international training organizations. 2. With the globalization of markets and economies, challenges are no longer specific to one country or institution. 3. Hence, strong networks and partnerships are required among regional and international organizations and institutions.
Employment supporting systems	<ol style="list-style-type: none"> 1. An employment support system is a network that provides employment, education, and training services. 2. These are often established as one-stop career centers; they provide a wealth of information and assistance finding a job; information and services related to employment, training, and education links; and information and claims on unemployment insurance, disability insurance, employment and training, labor market information, and employment taxes.
Capability building of TVET teachers	<ol style="list-style-type: none"> 1. TVET teachers should possess the appropriate personal, ethical, professional, and teaching qualities. 2. Onsite job training linked industry for TVET teachers 3. Retraining for reskilling and requalification

Sources: Man-Gon Park (2009), "Global Trends and their Implications for Sustainable Human Resource Development through TVET," Work, Learning and Sustainable Development (Springer Science + Busi.

2.2.2. Necessary and Emerging TVET Skills According to Environmental Changes and Demands of Labor Markets

There is global recognition that technological transformation is central to economic growth; in this regard, both macroeconomic and ST&I policies must be adequately designed to promote innovation. Senegal requires an effective innovation system to become able to harness the potential offered by modern science and technology to its social and economic advantage. The proposed national innovation system should incorporate innovations such as improved investment in research and development, arrangements that go beyond public-private partnerships, and the commercialization of innovations. It should also consider the changing nature of innovation from isolated ivory tower activity to one of networking where players can bring ideas together online through simulations and other such contemporary approaches that result in wealth and job creation.

On the 2011 Kearney Global Services Location Index (GSLI), Senegal was ranked 29th in the world for providing the most common remote functions for offshoring, including information technology services and support, contact centers, and back office support. Foreign Direct Investment (FDI) concluded that Senegal's resource endowments (particularly minerals), stable political and macroeconomic environments, proximity to European markets, and good port facilities create an attractive location for FDI. The business environment has improved, but people skills and availability have declined from 0.78 to 0.70 over the last five years and the statistics of training skills and job creation according to economic activity fields in 2015 are as shown in <Table 2-6>.

<Table 2-5> Trend of Senegal's Global Services Location Index (GSLI)

Year	Rank	Financial Attractiveness	People Skills and Availability	Business Environment	Total Index
2011	29	3.23	0.78	1.11	5.12
2014	40	3.26	0.80	0.98	5.04
2016	45	3.06	0.70	1.13	4.89

Source: A.T. Kearney Global Services Location Index (GSLI) Report.

(Table 2-6) Statistics of Training Skills Provided and Jobs Created according to Economic Activities Fields in 2015

Economic Activities Fields	Training Skills Provided		Jobs Created (Employed)				Average
	No	%	Permanent	Others	Total	%	
Commerce/Trade	538	36.9	1,406	84	1,490	23.8	2.8
Finance and insurance	285	19.5	1,396	69	1,465	23.4	5.1
Construction	279	19.1	866	588	1,454	23.2	5.2
Accommodation and Restaurants (food service)	69	4.7	226	91	317	5.1	4.6
Manufacturing	53	3.6	203	59	262	4.2	4.9
Other service activities	53	3.6	172	5	177	2.8	3.3
Transportation and Warehousing	36	2.5	144	5	149	2.4	4.1
Agriculture, forestry, and fishing	34	2.3	163	60	223	3.6	6.6
Public administration and defense	33	2.3	396	20	416	6.6	12.6
Education	32	2.2	77	35	112	1.8	3.5
Water distribution; Sewerage network; Waste management & recycling	26	1.8	34	0	34	1.5	1.3
Not determined	11	0.8	25	0	25	0.4	2.3
Administrative and support service	9	0.6	31	8	39	0.6	4.3
Extractive activities	6	0.4	45	3	48	0.8	8.0
Private households with employed domestic persons	5	0.3	7	3	10	0.2	2.0
Health and social work	5	0.3	28	1	29	0.5	5.8
Professional, Scientific, and Technical Activities	4	0.3	7	0	7	0.1	1.8
Arts, entertainment, and recreation	1	0.1	1	0	1	0.0	1.0
Information and communication	1	0.1	1	0	1	0.0	1.0
Total	1,459	100	5,234	1,031	6,265	100	4.3

Source: 2015 Annual Report, Directorate of Labor Statistics and Studies (DSTE), Ministry of Labor, Social Dialogue, Professional Organizations, and Relations with Institutions, Senegal.

The economic sectors for which the recruitment forecasts are the most important in Senegal are investigated by the Office National de Formation Professionnelle (ONFP) as follows:

- (1) Para-chemical and pharmaceutical industry;
- (2) Metal industry and machine manufacturing;
- (3) Leather, textile, and clothing;
- (4) Food-processing industry;
- (5) Building and civil engineering works;
- (6) Transport and communication;
- (7) Tourism and hotel business;
- (8) Professional services;
- (9) Industrial fishing;
- (10) Industrial food crops.

In comparison, the main projects and programs registered in the public financing sector of PSE,³⁾ with 2,361 billion CFA in total show the ascendancy of the following six (6) sectors:

- (1) Infrastructure, services, and transport (621 billion CFA; 26.3%)
- (2) Energy (304 billion CFA; 13%);
- (3) Agriculture (261.8 billion CFA; 11.1%)
- (4) Education and training (257.3 billion CFA; 10.9%);
- (5) Drinking water and sanitation (251.6 billion CFA; 10.7%);
- (6) Health (124.6 billion CFA; 5.3%)
- (7) Other sectors (540.7 billion CFA, 22.7%)

Under the Work Bank Project,⁴⁾ the Directorate of Apprenticeship (DA, Direction de l'Apprentissage), and the Examination and Professional Certification Directorate (DECPC, Direction des Examens, Concours Professionnels et Certification) of MFPAA are identified and selected as key areas in which TVET skills must be improved according to Senegal's major industries and services as detailed in <Table 2-7>.

3) 2014 Plan Emergent Senegal (PSE).

4) World Bank Report No.: 88066-SN (2014), Senegal Skills for Jobs and Competiveness Project.

〈Table 2-7〉 Identified and Selected the Key Areas of Necessary TVET Skills

Key Industries and Services	Necessary TVET Skills
Agriculture	<p>Nursery Worker, Fruit and Vegetable Processing, Dairy, Processing of Enriched Cereal Products, Peanuts</p> <hr/> <p>Horticulture Sector Training Subjects</p> <ul style="list-style-type: none"> - CAP Agricultural Worker - CAP Nursery Worker - BTS Cultural Specialist - BTS Assistant, Expedition Leader - BTS Agricultural Engineer - CAP Agribusiness Production Worker - BTS Agricultural Science of Agribusiness Technician - BTS Senior Agribusiness Technician - BTS Quality Assurance and Packaging Technician <hr/> <p>Poultry Sector Training Subjects</p> <ul style="list-style-type: none"> - Head of Poultry Husbandry - Poulterer, Husbandry - Hatchery Technician - Poultry Production Supervisor - Poulterer, Production - Production Technician, Poultry Meat - Supervisor Technology for the Processing and Packaging of Poultry Products - General Technician: Meat and Poultry Products - Manager of Poultry Farming Project - Henhouse Manufacturer - Manufacturer of Poultry Farming Equipment
Services	Specialist Car Mechanic (tires, engine, electro-mechanics, moped, outboard motor, body work, and paintwork), Coil specialist, Engine Maintenance, Hair and Beauty, Plastics Manufacturing, Agricultural Mechanization, Leather Goods, Packaging
Industrial Manufacturing	Welding, Surface Finishing, Ceramic Molds and Forms, Soap
ICT	Computer Maintenance, Mobile Phone Repair, Television Specialist

<Table 2-7> Continued

Key Industries and Services	Necessary TVET Skills
Tourism and Hospitality	Housekeeping, Holiday Cottage Manager, Local Guide, Maintenance and Catering Materials, Bartender, Waiter/Waitress, Junior Chef, Laundry <hr/> Tourism Training Subjects - CAP Hotel services (valet) - BT Hospitality - BTS Hotel Management - CAP Housekeeping/Laundry - CAP Receptionist - CAP Cook - CAP Restaurant Service - CAP Pastry Chef - CAP Cuisine - Sommelier (Wine waiter) - BTS Culinary Arts - BT Commercial tourism agent - BTS Tourism - BT Tour Guide - Eco-tourism
Construction	Masonry General Options: ironwork, formwork, tiler, painter and decorator, plumber, water proofing technician, plasterer, joiner, metal fittings
Power & Energy	Solar, Renewable Energy
Fashion	Seamstress, Embroidery, Dyeing, Printing

Source: World Bank Report No.: 88066-SN (2014), Senegal Skills for Jobs and Competiveness Project.

The Senegalese tourism industry has traditionally been the largest foreign exchange earner, but this is in decline, encumbered by poor quality services and the limited range of offered services, caused by a lack of qualified workers. The Senegalese horticulture sector lags behind in terms of scientific knowledge about production methods and processes, packaging, and transportation, which all constrain its development and contribution to economic growth. In addition, the productivity and competitiveness of the poultry industry are impeded by a huge deficit of skilled workers and technicians throughout the value chain. Key solutions to these three industry sectors include improving the quality and relevance of TVET systems through (1) refocusing, restructuring, and readjusting existing TVET institutions, (2) training skilled workers in tourism, horticulture, and poultry sectors, and (3) developing national skills qualifications and certification systems in these sectors from the beginning. In addition, we would like to suggest emerging and futuristic skills for Senegal and other PASET countries according to the environmental changes of new technologies and labor market demands, as shown in <Table 2-8>.

〈Table 2-8〉 Emerging and Futuristic TVET Skills for Senegal

Key Industries and Services	Emerging and Futuristic TVET Skills
Fishing Industry	Industrial fishing, Seafood processing, Aquaculture, Seafood canning and packing, Refrigeration and air-conditioning, Fishery management
Security and Safety System Engineering	Information security engineer, Safety-critical system engineer, Disaster and safety management
Digital Contents	Digital game production, Graphic design, Animation and cartoon, Digital broadcasting, Movie film production, Education contents development
Textile and Fashion	Fashion design, Fashion making, Fashion marketing, Textile color design, Fashion materials
4 th Industry	Big Data, Industrial Internet of Things (IIoT), Cyber-Physical System (CPS), Artificial Intelligence (AI)

Source: World Bank Report No.: 88066-SN (2014), Senegal Skills for Jobs and Competiveness Project.

3. The Korean Experience of Solving Pressing Problems in TVET Systems

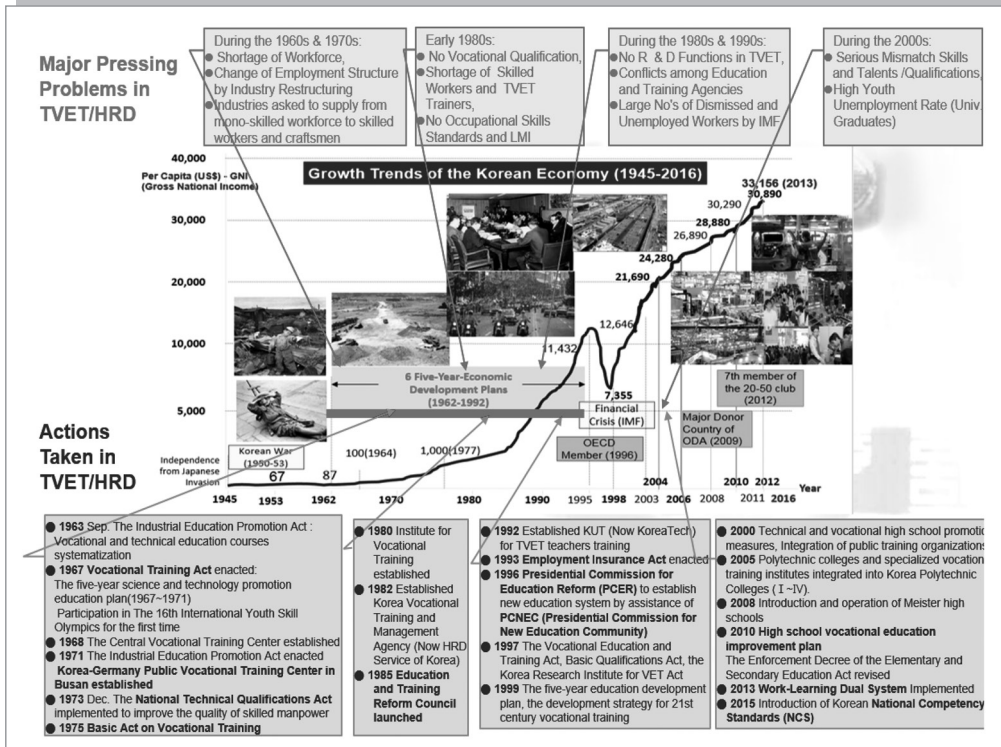
3.1. Overview

As shown in [Figure 2-4], TVET in Korea is widely recognized as effectively supporting rapid economic growth over the past 40 years. TVET was adjusted from the 1960's to the 1970's to provide initial training to many learners to accommodate the increasing labor demands, and TVET was improved in the 1980s to enhance workers' skill levels. The TVET system was expanded, the Employment Insurance Act was enforced, and the Republic of Korea overcame the Asian financial crisis in the 1990s. Since 2000, the goal has been to rationalize the division of roles and responsibilities and strengthen cooperative relationships between TVET officials. For this, extensive efforts have been made to reform TVET's framework and policies and overcome the mismatch between skill and talent. The most recent item on the agenda is reviewing the TVET system to allow the industry that is driving demand for TVET to take greater initiative.

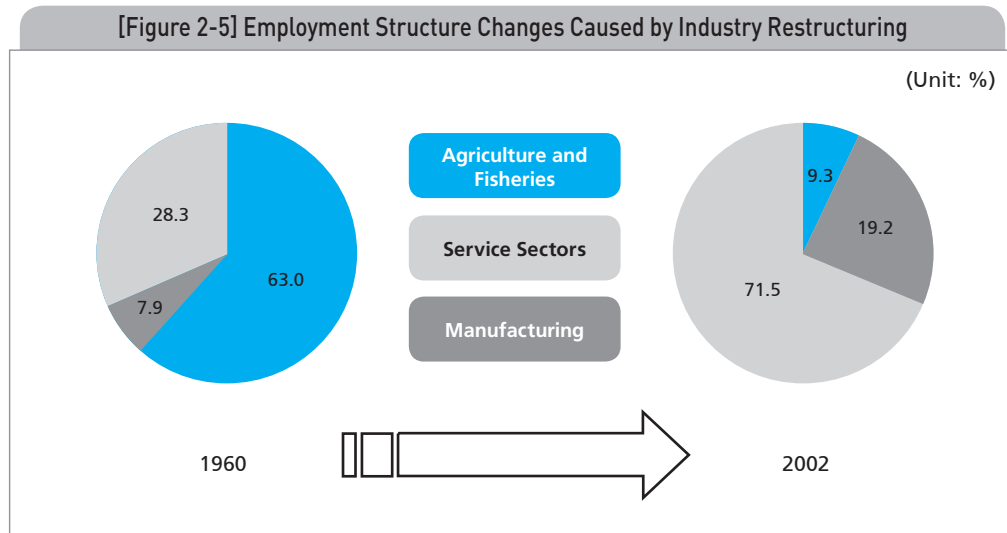
One basic goal of Korea's five-year economic development plan, which was implemented six times from 1962 to 1992, was to restructure Korean industries with the classification of three areas such as promising high-tech industries, growing industries, and competitiveness-weakening industries. Promising high-

tech industries such as semiconductors, computers, biotechnology, new materials, optical communications, robots, space, and aviation were provided with expanded financial support, while growing industries such as mechanical, electrical, electronic, automotive, and chemical were encouraged to produce high value-added products.

[Figure 2-4] Chronological Situations of Pressing Problems and Actions Taken in Korean TVET Systems according to Economic Development








Competitiveness-weakening industries such as shoes, toys, textiles, and apparel were restructured by suggesting support for business transformation, diversification of management, and support for overseas investment. The result of Korea's industry restructuring was rapid changes in employment structure, as shown in [Figure 2-5].



The Korean government established the “Korea Vocational Training Management Agency (now the HRD Service of Korea)” to supply the enormous manpower needed for the industrial manufacturing field and service industries smoothly in accordance with the changing employment structure. The Korean government has established various vocational training institutions and facilities under the Korea Vocational Training Management Agency to cultivate vocational training teachers, introduce technical qualification and examination systems, foster skills competitions, carry out skills promotion projects, and accomplish related research and development projects to undertake large-scale manpower cultivation and national skill development projects.

The Korean education system is a 6-3-3-4 single-track consisting of elementary school (six years), junior high school (three years), high school (three years), university (four years) and post-graduate school. Beginning with TVET at the high school level, students can choose from several different school tracks based on their aptitude and future education and career plans. Korean TVET is categorized into three systems, as depicted in <Table 2-9>. They are managed by the Ministry of Education and the Ministry of Employment and Labor as two major wings to support TVET systems through their belonging to agencies and institutions.

〈Table 2-9〉 Korean TVET Service Systems

Category	Classification of TVET Services		Be affiliated to
Formal School System	Primary education (six years)		 MINISTRY OF EDUCATION REPUBLIC OF KOREA
	Secondary education (three years of middle and three years of high school)		
	University (four years)		
	Korea University of Technology and Education (KoreaTech, four years)		 Ministry of Employment and Labor
Technical and Vocational Education (TVE) under Formal Education System	Secondary vocational high schools (three years)	Meister high schools (36)	 MINISTRY OF EDUCATION REPUBLIC OF KOREA
		Specialized vocational high schools (499)	
		General high schools having vocational modules (177)	
	Technical junior colleges (142)	Associate Degree (2–3 years)	 Ministry of Employment and Labor
		Post-secondary vocational education and training (0.5–1 year)	
	Polytechnic colleges (8 Colleges, 34 Campuses)	Industrial Associate Degree Programs (two years)	 Ministry of Employment and Labor
		Intensified Major Course [Bachelor Degree Course] (two years)	
		Vocational training programs [Aged 15 or older seeking employment, regardless of educational background] (0.5–1 year)	
Master Technician Course [Industrial engineers, technicians, or higher with 8–9 years of experience in related fields] (1–2 years)			
Non-formal Vocational Training System	Public-Private vocational training institutes (KCCI Training Centers, Other Governmental Agencies)		Company /Institutions
	In-house training centers		

Source: Ministry of Education and Ministry of Labor and Employment, 2015.

Vocational education starts at high school; high schools are classified as general high schools, vocational high schools, and schools that specialize in languages, science, arts, and physical education. Vocational high schools respond to rapid changes in knowledge-based industrial societies and aim to foster skilled human resources. Vocational high schools provide vocational and technical education in technology, agriculture, commerce, maritime science, homemaking, and so on. Korean TVET teachers' cultivation and employment are driven by two responsible

ministries: The Ministry of Education (MOE) and the Ministry of Employment and Labor (MOEL) with their authorized subordinate agencies and institutions. According to the Ministry of Education, secondary school teachers were cultivated through two-year colleges of education for middle school teachers, and four-year colleges of education for high school teachers before 1960. Since the mid-1950s, many secondary teachers have been cultivated and recruited through teacher education courses that were established at general universities due to a lack of teacher resources. Since the 1980s, many secondary school teachers have been cultivated through various channels, such as colleges of education, graduate schools of education, and teacher education courses established at general universities. Among the 470 specialized vocational high schools, 12,620 teachers have specialized subject certifications (48%) and 13,708 teachers have general subject certifications (52%), as shown in <Table 2-10>. The teachers at 470 specialized vocational high schools are composed of 494 principals, 503 vice-principals, 19,266 (73.2%) first class teachers, 5,063 (19.2%) second class teachers, and 1,000 other assistant teachers; 44.3% of these teachers are female.

<Table 2-10> Number of Teachers Having Special Subject Certifications in 470 Specialized Vocational High Schools

Classification	No. of Schools	No. of Classes	No. of Students	No. of Teachers	
				Specialized Subjects	General Subjects
Agriculture and Life	34	622	15,825	643	Korean Language (1,714) English (1,730) Chinese Char. (221) Liberal Arts (467) Other (2,762) 2nd Foreign Languages (506)
Engineering	198	5,202	144,254	6,668	
Commerce and IT	185	4,657	131,940	3,867	
Fisheries and Marine	9	126	3,056	106	
Home Economics & Other	44	866	22,370	1,010	
			326		
Total	470	11,473	317,445	12,620	13,708

Source: Ministry of Education, 2012.

In 2010, the ILO⁵⁾ noted that at the core of the Republic of Korea's sustained growth pattern lies a government-led skills development strategy. The rapid progress in closing the productivity gap reflects an economic development strategy based on investment, research, and development. Investment in a well-educated and highly skilled workforce was an integral part of encouraging the adoption of new technologies. Averting shortages in more highly skilled vocational occupations by increasing the attractiveness of non-academic skill development paths is a current challenge.

With the remarkable economic development in the early 1960s, the qualification system in Korea made quantitative growth in line with the creation of various qualifications based on individual law. The enactment of National Technical Qualification Act in 1973 standardized the criteria and titles of technical qualifications to lay trustworthy grounds for a national qualification system. The enactment of the Basic Qualification Act in 1997 meant that the qualification system was categorized into national and private qualifications, and the subjects available in the qualification system became varied. The HRD Service of Korea is the main responsible agency and there are three major types of qualifications in the Republic of Korea such as (1) 527 National Technical Qualifications (NTQ) that focus on manufacturing, services, and businesses; (2) National Qualifications of Non-Technical Categories (NQNTC) including 149 vocations such as lawyers, accountants, and patent experts; and (3) 20,049 private qualifications (PQ) including areas such as computers, language skills, sports and health, leisure and recreation activities, social welfare, and counseling by the Framework Act on Qualifications (in 2011) as shown in <Table 2-11>.

5) ILO (2010), *A Skilled Workforce for Strong, Sustainable and Balanced Growth-A G20 Training Strategy*.

<Table 2-11> Classification of Korean Qualifications

Classification of Qualifications		Test Numbers	Related Laws	Related Ministries	Qualifications (Examples)
National Qualification	Skills	527	National Technical Qualifications Act (MOEL) in 1973	MoEL (19 government agencies)	Professional engineer, master craftsman, engineer, industrial engineer, craftsman, word processor, etc.
	Professional	149	Individual laws	24 government agencies	Lawyer (Attorney-at-Law Act), doctor (Medical Service Act), etc.
Private Qualification	Certified private	101	Framework Act on Qualifications (MoE)	12 government agencies	Internet Information Search, TEPS, etc.
	Non-certified private	19,833	Framework Act on Qualifications (MoE)	MoE and MoEL	Marriage counselor, stocks analyst, etc.
	in business	115	Employment Insurance Act (MOEL)	MoEL	Digital master, customer service, etc.

Source: HRD Service of Korea, 2016.

The Korean National Competency Standards (NCSs) are the set of knowledge, skills, and attitudes that are required to perform a particular job in a workplace, which are standardized by industry and competency level. These standards are intended to systemically reform the TVET and qualification systems to meet the needs of industries (jobs) and encourage competency-oriented human resource management (HRM, hiring, promotion, wages, etc.) among companies. For promising industries and new occupations, NCSs will be developed each year starting from 2015 to keep up with every paradigm shift in industry (30 or more NCSs per year). "Industry Skills Councils" were designed to be responsible for the development and improvement of NCSs. NCSs are routinely reviewed and improved using networks of companies, schools, and experts. The practical situation of the NCS system is presented in detail in <Table 2-12>.

〈Table 2-12〉 The Practical Situation of the Korean NCS System

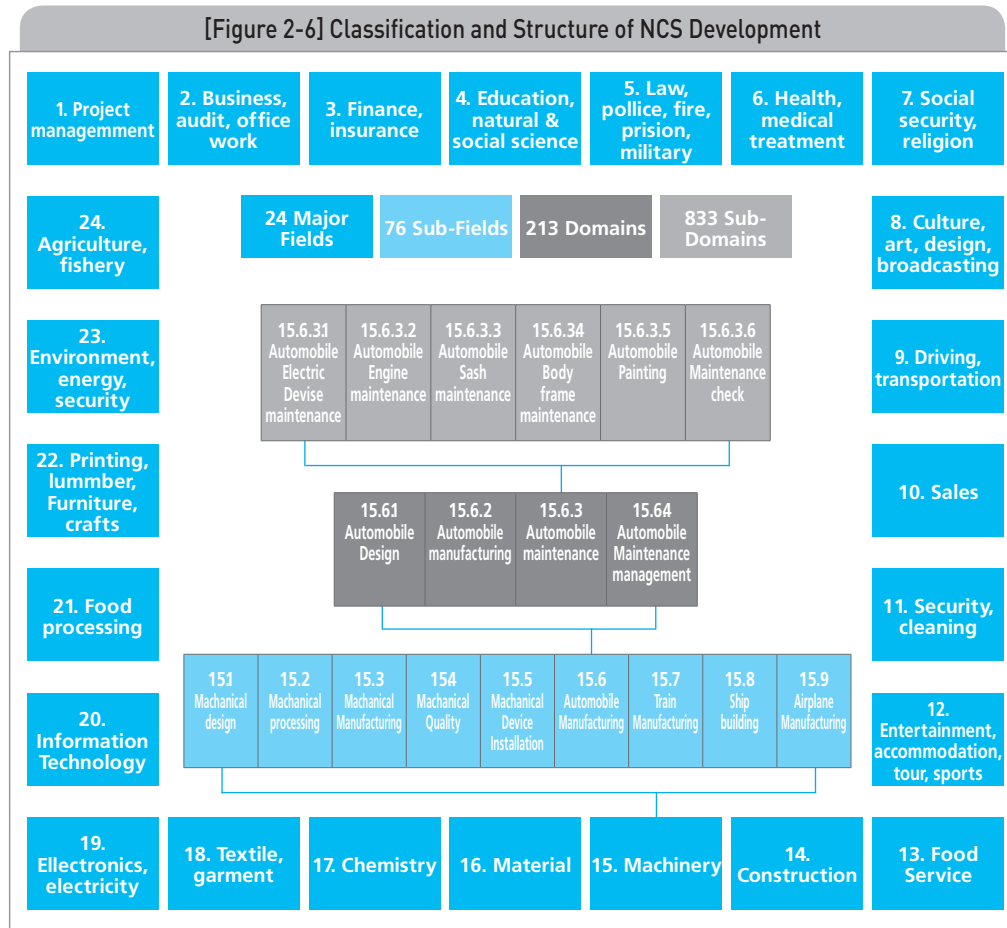
Areas	Main Content
Qualification System	The number of course-type qualifications was further increased in the 24 major fields that require high levels of practical skills, and examination criteria have been overhauled into NCS-based qualifications. NCS-based qualifications are developing by responsible agencies and most industries
TVET System	Education and training courses offered by TVET institutions are being restructured into NCS-based vocational qualification courses that confer vocational qualifications to cultivate the “field-oriented talent” that industries require. Between 2014 and 2016, 797 NCSs were developed and improved in total. NCS-based curricula were introduced in three specialized high schools and 78 junior colleges, and NCSs were applied to 1,589 courses at 34 polytechnic colleges and 1,052 courses at private training institutions.
Hiring Process	NCS-based job competency assessment and hiring models are being disseminated across workplaces. The government set a pioneering precedent by introducing competency-based hiring systems in 130 public institutions; it is also making efforts to spread the system across all industries.

Source: National Competency Standards (<http://www.ncs.go.kr>), 2017.

As of March 20, 2017, the Working Group Committee for NCS with sectorial councils has developed 24 major fields, 76 sub-fields, 213 domains, and 833 sub-domains (833 standards) as depicted in [Figure 2-6]. In addition, 615 NCS-based qualifications are developed by the HRD service of Korea in collaboration with most of the ministries, governmental agencies, related associations, and industries according to 24 NCS major fields.

Korean TVET systems are currently driving to promote strength linkages between work-education and training-qualification through the development and utilization of NCS systems, which aim to standardize abilities (knowledge, skill, and competency) at the national level to perform one's duties in an industrial setting under a Work–Learning Dual System. The future direction is to make TVET relevant to the demands of industries so that it can train and utilize learners with the necessary technological expertise and skills. The Republic of Korea promotes a skills development framework to realize a competency-oriented society. The main context includes skills development throughout working life, skills development as a universal right, the expansion of competency-oriented systems and cultures, the maintenance of a TVET advancement system, the reinforcement of workplace competency, the harmonization of work and education, and support for “employment first, university later.” Moreover, the government introduced “VISION 2020: Vocational Education for All” to link work, education, and life-promoting innovation in vocational education systems with vision, direction, and strategy. The

innovation intends to promote an open vocational education system that is aimed at vocational competency, and the effective transition from education to work and from work to education.



Source: National Competency Standards (<http://www.ncs.go.kr>), 2017.

3.2. Lessons and Implications

3.2.1. Choice and Concentration Strategy Using Limited Resources

According to Korea's industrial development strategy during the six economic development plans from 1962 to 1992, the Korean government adopted a Choice and Concentration strategy to boost promising high-tech industries (semiconductors, computers, biotechnology, new materials, robots, optical communications, space, and aviation) and growth industries (mechanical, electrical, electronic, automotive, and chemical) under industry restructuring policies due

to the limited resources. The Choice and Concentration strategy in industry restructures mean that TVET systems for skilled workforce development follow the same route of Choice and Concentration strategies, as depicted in <Table 2-13>.

The government founded CoEs and established public training institutions under CoEs to train workers while laying the obligation to train and educate employees on employers. These initiatives gave strong backing to the fast growth of the national economy. Under the Choice and Concentration strategy, the efficiency and effectiveness of financial and physical resources support for TVET projects were significantly improved considering the characteristics of the employment insurance system called the levy-grant system.

<Table 2-13> Target Group of TVET under Choice and Concentration Strategy

Era	Choice and Concentration
1960s –1970s	Introduced TVET service systems and established many vocational training centers that targeted young people who have not attended school under an industry restructuring policy
1980s	Trained multi-skilled workers and trained employees to improve their skills under industry restructuring policies
1990s	Trained to improve vocational abilities and trained unemployed people in response to mass unemployment
2000s	The cultivation of professional manpower, the utilization of the idle labor force, and the development of socioeconomic policies to cope with polarization in the labor market

Source: MOST, 25-year history of S&T administration (1987), 30-year history of S&T (1997).

3.2.2 Local Community-based Skills and TVET Systems Development

Local community HRD committees were established in the 1970s and 1980s centered on local communities and industries. The committees led to the selection of some joint education and training institutions to establish a local community customized workforce cultivation system for demand surveys of local community skills and TVET systems, joint training under Industry-Institution Linkage (IIL) systems, and recruitment services. This activity aims to provide customized TVET programs based on the demands of local enterprises and industries to improve the workforce employment of the SMEs, raise the employment rate, and improve SME’s technological capabilities and competitiveness by enhancing the participation rate in TVET programs by faithfully reflecting the skill demands of local SMEs. The local community HRD committee was composed of local labor unions, local employment centers, local small and medium business administration agencies, local governments, and local colleges and universities.

Participating joint TVET institutions were composed of public TVET facilities in accordance with the Workers Skills Development Act, Employer organizations and associations, universities, and colleges under the Higher Education Act, public institutions under the Act on Public Administration (Institutions with training experience), and excellent TVET institutions (non-profit organizations) that have publicity and expertise. Moreover, when Korea's HRD Services have organized local skills competitions each year in April, local community HRD committees and participating joint TVET institutions have taken primary roles and made efforts to improve local community-based skills capabilities and competencies through local skills competitions.

3.2.3. The Capability Building Efforts of TVET-related Government Officials and Teachers for Maintaining Sustainability

From the 1970s to the 1990s, Korean TVET officials, teachers, and professionals have contributed to sustainable development by planning, promoting, and evaluating works with a long-term strategy through maintaining sustainability while working in the same field for a long time. They provided post-graduate programs (special, Master's, and Ph.D. courses) in HRD, TVET, and policy management subjects. Many had opportunities to participate in overseas education and training programs. In addition, the Korean government supported public officials and professionals engaged in TVET to attend special programs on re-education, reskilling, and requalification to develop the capabilities and competencies of TVET officials and professionals. It was a key driving force that provided sustainability to TVET officials, teachers, and professionals that made national TVET policies more sustainable. <Table 2-14> contains evidence from the news media during that time.

<Box 2-1> A Newspaper Article regarding TVET Teachers' Capability Building Efforts in 1982

Maeil Business Newspaper Korea on April 12, 1982.

News Headline: From this year, the Ministry of Labor will conduct industry-academy exchange programs for public vocational training teachers

The qualifications of vocational training teachers who are training skilled workers will be improved using a re-education system that will be introduced this year. The Ministry of Labor will prepare a retraining plan for vocational training teachers on April 12, and will provide a supplementary education program to vocational training teachers who have worked for two years or longer for a period of four weeks per year. The industry-academy exchange program will be provided to public vocational training teachers for a period of 3-12 months. The Ministry of Labor also decided to set up a promotion course for vocational training teachers to boost their morale, to expand overseas training opportunities to Germany, Japan, and other advanced countries, and to adjust the compensation level to higher than that of general public education teachers.

3.2.4. The Effective Utilization of Overseas Aid

There were no facilities for vocational training at the end of the 1960s and absolutely no funding with which to build them. In addition, there were no qualified teachers to do the training. It was even more difficult to allocate funds to cultivate a skilled workforce in the absence of the necessary funds to buy the facilities and equipment required for industrialization. It was very important to obtain an excellent skilled workforce for industries to accelerate economic growth. Therefore, Korea was first supported by the UNDP, the ILO, West Germany, and Japan in the mid-1970s and it built a training center and secured equipment with the support of Belgium.⁶⁾

In this process, a consensus was formed among relevant ministry officials that it was urgent to provide a special fund with which to expand the vocational training facilities to an appropriate size. Thus, it was agreed that it would be necessary to utilize loan money to purchase vocational training facilities as industrial production facilities. In the Korean case, Korean government officials had greater flexibility and discretion to give higher policy priorities to securing an excellent skilled workforce through vocational training and to take reasonable measures without restrictions compared to officials in other countries.⁷⁾

Soft competences such as technical education and vocational training are harder to develop in the short term than industrial production. It will take time to accumulate experience with related facilities and systems, teachers' theoretical and practical skills, teaching techniques, training manuals, etc. Nevertheless, the Koreans had grown all of these simultaneously. At that time, many West German technical advisors had been dispatched to the Republic of Korea; they helped persuade high-ranking Korean officials to draft major policies based on their solid expertise and experience with theory and practice in the field of vocational training.

With the help of such overseas aid, the Republic of Korea quickly became a model country for vocational training with advanced training facilities and the best training courses and operation capability. Throughout the late 1970s and early 1980s, the ILO recommended that most developing countries send their representatives to the Republic of Korea to learn about the most advanced vocational training developments among developing countries.

6) Byung Suk Chung (2017), "Historical Change and Outlook of Vocational Capability Development Policy", to be published.

7) Sang-Sun Seo (2002), Footnote of Korea vocational training system - base on back stories related to institutional course, Korea Chamber of Commercial and Industry.

3.2.5. Refocusing, Restructuring and Readjustment through the Establishment of TVET CoEs

On November 12, 1981, the Korean government set up a plan to cultivate a skilled workforce and promote vocational stability by establishing the Korea vocational training management corporation to oversee and manage all tasks related to training skilled workers such as vocational training, qualifications, and tests. It decided that this should be conducted on an annual basis. This plan, as announced by the Ministry of Labor, was intended to enable the training of a skilled workforce that would meet industrial demands, the evaluation and preferential treatment of reasonable skills levels, and the proper allocation and management of a skilled workforce with detailed objectives such as (1) enhance productivity and international competitiveness through the standardization of skills levels, (2) induce human resource development by the private sector through the vitalization of private manpower cultivation, (3) enhance skills levels through the rationalization of skills tests, (4) unify vocational training and skills testing, and (5) harmonize manpower supply and demand systems by revitalizing vocational stability functions. Accordingly, the government planned to (1) expand the training period for the skilled workforce from one to three years, (2) expand companies to receive in-house training and support tax and financial benefits, (3) reform labor market information networks via the computerization of labor data, and (4) revise test criteria as to give greater importance to practical skills ahead of theory for the rationalization of skills tests.

At that time, Korean government was able to successfully encourage skilled workforce cultivation and vocational stability promotion plans by establishing TVET CoEs through refocusing, restructuring, and readjustment as follows:

〈Table 2-14〉 Korean TVET CoEs Restructured by the Ministry of Employment and Labor

TVET CoE	Main Roles	Refocus and Readjustment Functions	Core CoE Functions
<p>Korea Polytechnic (KOPO)</p> <p>(Established in 1968 as the Central Vocational Training Institute)</p>	<ul style="list-style-type: none"> - Junior college to education of necessary human resources at industrial sites that supports workers' vocational ability development - Advanced major courses such as associate degree courses along with TVET curricula 	<ul style="list-style-type: none"> - Educate the best technicians dedicated to practice and fieldwork; - Train intermediate technicians in advanced industry and national key industries (multi-skilled and master technicians); - Train technicians in areas that the private sector is not capable of implementing; - Accommodate school dropouts, the unemployed, the middle-aged, female job seekers, and other disadvantaged groups. 	<ul style="list-style-type: none"> (1) Coordination and Collaboration, (4) Best Practices, (7) Training, (9) Revitalizing, (10) Competency, (11) Capability

〈Table 2-14〉 Continued

TVET CoE	Main Roles	Refocus and Readjustment Functions	Core CoE Functions
<p>Human Resources Development Service of Korea (HRD Korea)</p> <p>(Established in 1982 as the Korea Vocational Training Management Corporation)</p>	<ul style="list-style-type: none"> - Established with the purpose of fostering industrial human resources and the efficient management through the supply and demand of human resources. - Supporting lifelong education for workers. - Conducting training programs for skills development. - Authorizing qualifications. - Implementing skills and development projects. - Promoting employment. 	<ul style="list-style-type: none"> - HRD Capability Development Support (HRD-Net); - Work-Learning Dual System Support (BIZHRD Net) [Government Project]; - Building a Local Community Customized Workforce Cultivation System [Government Project]; - Qualifications and Test Execution Agency (Q-Net); - Employment Support (Work Net); - Foreign Workforce Employment (EPS); - NCS Development; - Skills Development and Skills Competitions (“WorldSkills Korea”). 	<ul style="list-style-type: none"> (1) Coordination and Collaboration, (2) Change Initiatives, (3) Leadership, (4) Best Practices, (6) Support, (8) Standards, (9) Revitalizing, (10) Competency, (11) Capability
<p>Korea University of Technology & Education (KoreaTech)</p> <p>(Established in 1991)</p>	<ul style="list-style-type: none"> - A university dedicated to fostering highly competitive human resources through practical-training-oriented engineering education - Fostering TVET teachers and HRD experts 	<ul style="list-style-type: none"> - Fostering skilled engineers. - Training TVET teachers with industrial competencies. - Training HRD professionals. - Working as a hub of retraining and reskilling in industries 	<ul style="list-style-type: none"> (1) Coordination and Collaboration, (4) Best Practices, (5) Research, (6) Support, (7) Training, (9) Revitalizing, (10) Competency, (11) Capability
<p>Korea Research Institute for Vocational Education and Training (KRIVET)</p> <p>(Established in 1996)</p>	<ul style="list-style-type: none"> - A national research institute affiliated with the Prime Minister’s Office that was established to vitalize TVET and enhance the public’s vocational competencies. 	<ul style="list-style-type: none"> - Performing tasks related to skills development - Conducting policy research and development in the field of education and employment. 	<ul style="list-style-type: none"> (1) Coordination and Collaboration, (2) Change Initiatives, (3) Leadership, (4) Best Practices, (5) Research, (6) Support, (8) Standards, (9) Revitalizing, (10) Competency, (11) Capability

Source: Websites of KOPO, HRD Korea, KoreaTech, and KRIVET, 2017.

In the Republic of Korea, the government recognized its need to nurture industrial manpower in the early stages of economic growth, and thus, it created a strong initiative. There were demands to solve the problem of the rapidly increasing demand for industrial manpower through the establishment and operation of related TVET CoEs with policy demands and the main functions and roles. The government assigned professional staff and provided appropriate compensation, preferential treatment, and budget support to drive this policy. However, overlapping and conflicts between functions and roles occurred among these TVET CoEs due to the duplication of similar TVET CoEs within relevant departments. In the 1990s, efforts to reconcile and cooperate with such overlaps and conflicts between functions and roles were inadequate until the 1990s, but efforts were made to overcome them afterwards. In the case of the Republic of Korea, the governments' main TVET policies have been developed and evaluated through these TVET CoEs.

4. Policy Recommendation for the Establishment of TVET CoEs to Strengthen TVET Systems in Senegal

In the book *Management of Portfolios*, Stephen Jenner, the Office of Government Commerce, and Craig Kilford mention how CoE has a coordinating function that ensures that change initiatives are delivered consistently and well through standard processes and competent staff. A center of excellence (CoE) is a team, a shared facility, or entity that provides leadership, best practices, research, support, and/or training for a focus area. The focus area might be a technology, business concept, skill, or broad area of study. A CoE may also aim to revitalize stalled initiatives. Within an organization, a CoE may refer to a group of people, department, or shared facility. It may also be known as a competency center or capability center. The term may also refer to a network of institutions that collaborate with each other to pursue excellence in a particular area. The key functions of CoEs are summarized as (1) Coordination and Collaboration, (2) Change Initiatives, (3) Leadership, (4) Best Practices, (5) Research, (6) Support, (7) Training, (8) Standards, (9) Revitalizing, (10) Competency, and (11) Capability, in a particular area.

Efficiently establishing CoEs and performing their functions properly allows them to effectively solve many of the TVET problems and challenges that face Senegal and PASET countries. Thus, we propose approaching strategy and methods for the establishment of PASET TVET CoEs, and suggest and recommend some important strategic points for the establishment and utilization of PASET TVET CoEs to improve and reengineer Senegal's skills and TVET systems.

4.1. The National Approach to TVET CoEs

Senegal's government is driving with highest priority to (1) improve the economy's productivity and the youth population's qualifications; (2) ensure better matches between TVET programs and the needs of the economy and industry; (3) reinforce the institutional framework to manage the jobs agenda; (4) incentivize the creation of enterprises; and (5) implement a labor market information system (LMIS) to monitor the labor market and employment trends under poverty reduction strategies through refocusing, restructuring, and readjusting TVET systems. In Senegal, urgent objectives include refocusing, restructuring, and readjusting national TVET systems to be strengthened by establishing CoEs that can perform important roles and functions as in Korea's experience to carry out critical national projects through PAQUET under PSE. We recommend a strategic approach to the establishment of national TVET CoEs with the following strategies and actions under objectives:

- Objectives: (1) The establishment of TVET Centers of Excellence (CoEs) to Strengthen Senegalese TVET Systems
(2) Driving Refocusing, Restructuring, and Readjustment by the Establishment of TVET Centers of Excellence (CoEs).

Strategy 1: Choice and Concentration

(Action Step 1-1) Based on the strategy of choice and concentration, the first step is to build a CoE Network using five ISEPs (Bignona, Diamniadio, Matam, Richard-Toll, and Thies) and ENSEPT-Dakar that operate well. Each province should eventually have at least one established CoE, as shown in [Figure 2-7].

(Action Step 1-2) The second step is to functionally allocate the CoEs that will carry the following key roles to the CoE Network built with five ISEPs (Bignona, Diamniadio, Matam, Richard-Toll, and Thies) and ENSEPT, and gradually assign additional roles to the CoEs that are installed in each province.

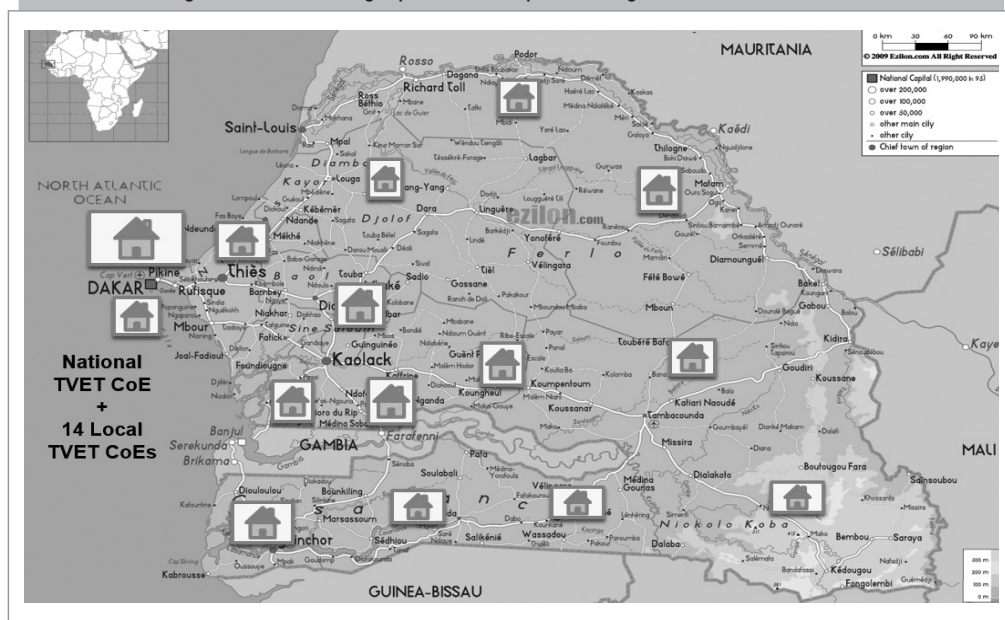
- Vocational Qualification and Certification Business Promotion Center
- TVET Teachers' Training and Capability Building Management Center
- Workers Lifelong Learning Support Center
- Occupational Skills Standards Development Center
- Career Guidance and Start-up Support Center
- Standard Curriculum Development Center
- Curriculum and Educational Contents Development Support Center

(Action Step 1-3) Let the Master Agency of the CoE Network, the organization

that will function as the head office of the HRD Service of Korea and Korea Polytechnics in Republic of Korea, perform the following important roles and carry out integrated governance and mission management for the CoE Network. If possible, this organization should be placed under the Prime Minister's office, as KRIVET is in Korea.

- TVET Regional and Global Cooperation Division
- Regional Accreditation Body
- Technology Transfer Project Development Division
- National and World Skills Competitions Promotion Agency

[Figure 2-7] The Geographical Concept of Senegal's TVET CoE Network



Strategy 2: Strengthening the Research Function

(Action Step 2-1) Similar to KRIVET in the Republic of Korea, one of the CoEs in the CoE network conducts research and development functions that promote overall policy research and development, system improvement research and research, skills and jobs research and development, and develop career guidance programs for TVET systems.

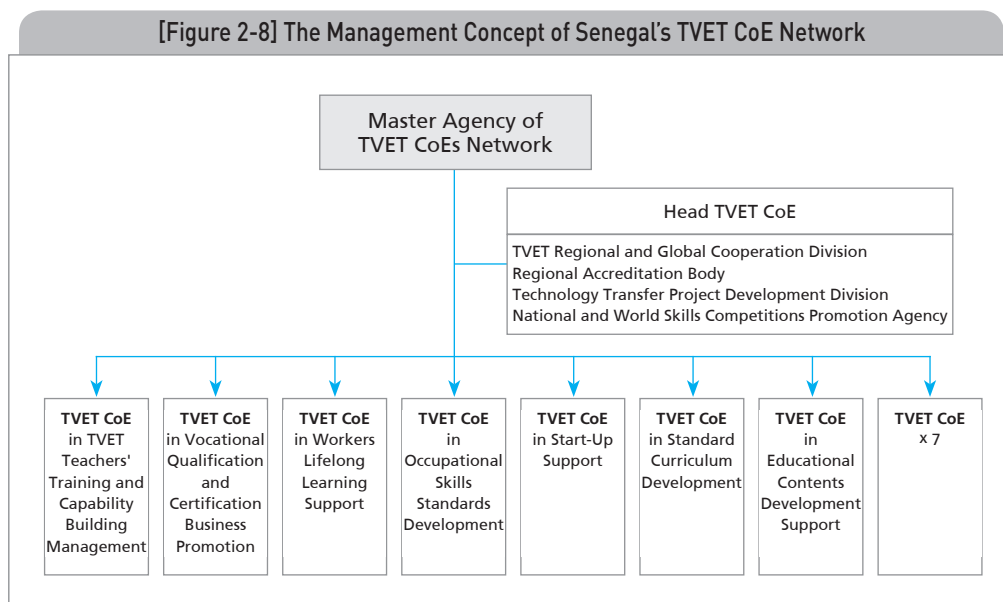
(Action Step 2-2) The assigned CoE will conduct additional research and development functions such as the accumulation of experience, statistics maintenance, and the sustainable development of TVET systems.

(Action Step 2-3) It is necessary to unify labor market information for TVET and employment as a nation-based project and to plan for building the LMIS (Labor Market Information System) through the collection, classification, processing, and storing of data as a future-oriented framework and carrying out research accordingly.

Strategy 3: One Flow and One Frame Management

(Action Step 3-1) Establishing CoEs, enacting related laws, promulgating enforcement ordinances, and repairing related systems so that all control and management functions can be maintained in one flow.

(Action Step 3-2) The management of the responsibilities and obligations of CoEs should be built in one frame to encourage organic cooperation with all relevant departments, agencies, and institutions to carry out tasks without confusion as depicted in [Figure 2-8].



Strategy 4: Standardized and Competent TVET Systems

(Action Step 4-1) Under the leadership of CoEs, a research team of CoEs should develop a standardized job description via job analysis and occupational skills standards for all occupations and skills in collaboration with Senegal's industries.

(Action Step 4-2) Using occupational skills standards, a standardized TVET

curriculum should be developed in collaboration with industries, standardized TVET facilities, and equipment plans; these should be disseminated to various TVET institutions.

(Action Step 4-3) Under the leadership of CoEs, competencies should be analyzed and developed, and competency-based training programs should be developed during job analyses and the development of occupational skills standards for all occupations and skills in Senegal.

4.2. The Regional Approach to the PASET TVET CoEs Network

Among policy makers in most African countries including Senegal, there is a real awareness of the master key role that TVET can play in national development. The absolute and explosive interests of African governments on TVET are efforts to resolve the poverty problem and secure economic and social stability to achieve national economic development. Most African governments work in collaboration and cooperation with international organizations such as the World Bank, AfDB, UNESCO, ILO, African Union, etc. and international cooperation agencies such as KOICA, USAID, CIDA, etc. to expand TVET Projects and Programs and make every effort to develop policies and strategies for TVET. It is within this framework that the PASET-KSP is spearheading the development of a new strategy to revitalize TVET in PASET Sub-Saharan Africa through the establishment of a PASET TVET CoE Network in Senegal and other PASET countries.

We recommend a strategic approach to the networking of these PASET TVET CoEs with the following strategies and actions as objectives:

- Objectives: (1) The establishment of a PASET TVET CoE Network to revitalize, modernize, and harmonize regional TVET systems to transform it into a mainstream activity for skills and occupations development in PASET countries;
- (2) A PASET TVET CoE Network that takes a leading role as a vehicle for regional cooperation and the integration of TVET systems in PASET countries.

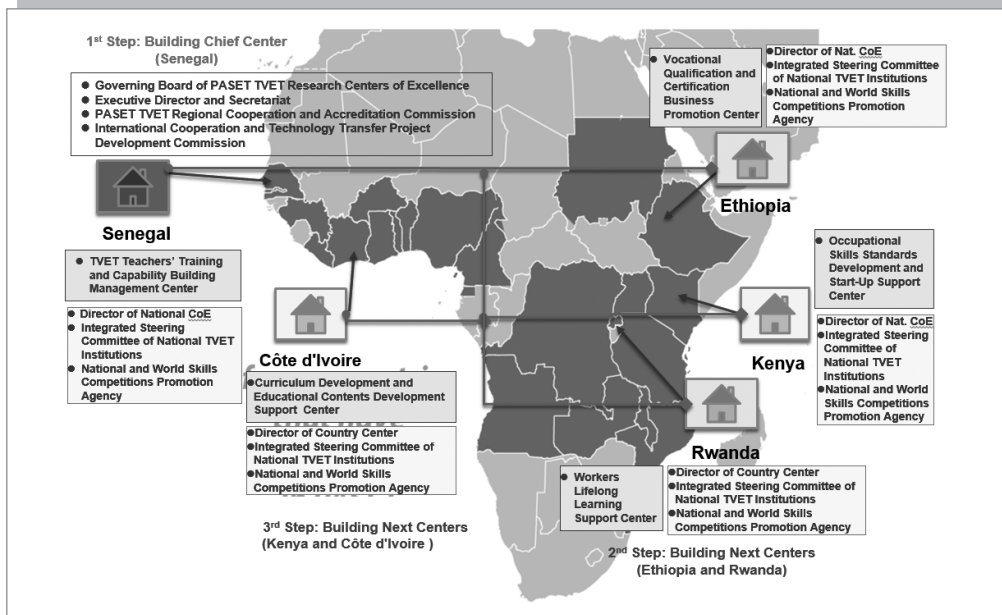
Strategy 5: Harmonized and Recognized TVET Systems in PASET Countries

(Action Step 5-1) Under mutual agreements among PASET countries, a PASET TVET CoE Network should be established as planned while keeping the harmonious functions and roles as shown in [Figure 2-9].

(Action Step 5-2) Under the leadership of the PASET TVET CoE Network, reposition and refocus TVET systems towards future-oriented labor markets as vehicles for regional cooperation and integration in PASET countries

(Action Step 5-3) Under the leadership of the PASET TVET CoE Network, all stakeholders should be mobilized in a concerted effort to create synergies and share responsibilities through the harmonization and mutual recognition of TVET support systems in PASET countries.

[Figure 2-9] Fundamental Establishment Concept of a PASET TVET CoE Network (example)



Strategy 6: Accredited and Certified TVET Systems according to the Regional Accreditation Commission

(Action Step 6-1) Under the leadership of the PASET TVET CoE Network, PASET regional occupational skill standards will be developed, along with instruments, manuals, and handbooks for the establishment of a Regional Accreditation Commission.

(Action Step 6-2) Under the leadership of the PASET TVET CoE Network, establish and manage the PASET Regional Accreditation Commission to solve pressing problems. These include (1) the many non-accredited and uncertified TVET institutions, (2) non-equivalent qualification systems, (3) unrecognized qualifications, (4) lack of occupational skills standards, and (5) lack of harmonized qualification systems against workforce mobility with labor market openings.

5. Conclusions and Remarks

Senegal's government has the ambitious aim of creating 300,000 jobs over the next five years to reduce the unemployment rate from 31.3% to 6.0%, even though Senegal has many pressing problems in the TVET sector. Senegal plans to achieve this goal by assigning the highest priority to improving economic productivity and the youth population's qualifications; ensuring better matches between TVET programs and the needs of economy and industry; reinforcing the institutional framework for the management of the jobs agenda; incentivizing the creation of enterprises; and implementing a labor market information system to monitor the labor market and employment trends under poverty reduction strategies. Therefore, key initiatives of TVET sectors in Senegal and other PASET countries are the establishment and operation of TVET CoEs for TVET infrastructure building as Korean TVET systems experienced. This should be followed by networking these TVET CoEs as vehicles for regional cooperation and integration of TVET systems through the harmonization, recognition, and equivalence against workforce mobility with labor market openings in PASET countries.

Efficiently establishing CoEs and allowing them to perform their functions properly can effectively solve many of the problems with TVET and the challenges facing Senegal and other PASET countries. Therefore, we propose approaching strategies and methods for the establishment of PASET TVET CoEs, and suggest and recommend important strategic points and action steps for the establishment and utilization of PASET TVET CoEs to improve and reengineer skills and TVET systems in comparison with Korean TVET experiences and wisdom via the following strategies:

Strategy 1: Choice and Concentration

Strategy 2: Strengthening Research Function

Strategy 3: One Flow and One Frame Management

Strategy 4: Standardized and Competent TVET Systems

Strategy 5: Harmonized and Recognized TVET Systems in PASET Countries

Strategy 6: Accreditation and Certification of TVET Systems by a Regional Accreditation Commission

It is desirable to develop action plans in accordance with each action step of the strategy for the establishment of TVET CoEs and PASET TVET CoE Network in Senegal and other PASET countries.

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2016/17 Knowledge Sharing Program with PASET:
National HRD Strategy to Support the Social and
Economic Transformation of PASET Member Countries
with Focus on Senegal

Chapter 3

Strategic Plan on STI Governance System of PASET Champion Countries Located Sub-Saharan Africa

1. Introduction
2. STI Governance System of Senegal
3. Korean Experience in STI Governance System
4. Conclusions and Policy Recommendation

Strategic Plan on STI Governance System of PASET Champion Countries Located Sub-Saharan Africa

Sang Hyon LEE (Korea Institute of S&T Evaluation and Planning)

Summary

The Senegalese government has demanded a diagnosis of the current state of the Senegalese STI system and its governance in consideration of major actors such as ministries, research institutions, and associated agencies, and institutions such as laws, regulations, and regulatory frameworks. This demand is the same requirement of several countries located in sub-Saharan Africa in the similar conditions to that of Senegal in terms of social, economic, and human development, which are pursuing S&T promotion as a useful national development tool.

The diagnosis has revealed that Senegal has an unstable STI governance system, particularly its research governance system, even though there is an administrative framework for S&T. MHER/DGR does not have the authority for budget allocation according to the S&T/R&D policies that they formulated, but just keeps closed communication with the relevant ministries and organizations. These roles are based on the presidential leadership, not on laws or legislation. Therefore, the current governance of S&T/R&D for STI could not be continuously guaranteed. Thus, it is very difficult to get complete information of S&T/R&D-related affairs from relevant ministries and organizations, and it is consequently difficult to both set priorities for S&T/R&D promotion areas and targets and to coordinate the national budget in a top-down strategy to support PSE. However, there is no national body for S&T/R&D evaluation based on the monitoring of PSE enforcement status. Each institution evaluates its own research programs, so it is difficult to conduct

national-level diagnosis to gain a clear understanding of the status of S&T/R&D promotion programs and to decide budget modifications according to evaluation results in consideration of the PSE phase goals. Another problem is the lack of S&T manpower to manage the STI system. Moreover, the eradication of illiteracy and vocational education remain key challenges for S&T promotion. This deficiency is a main cause of the unsatisfactory capacity of S&T/R&D planning and implementation for establishing an efficient and effective STI system in a high-level STI governance system.

S&T promotion at the national level was the key success factor of Korean economic development in the professional manpower training that was demanded by industrial fields. Another was the accomplishment of domestic procurement systems for S&T through the establishment of administrative governance for S&T, government R&D systems, and national R&D projects. This harmony of institutionalization, legislation, and self-reliance of S&T could ensure that national development was fully supported by S&T at the national level. Another one is the positive change in people's perception of S&T through science learning campaigns and national S&T promotion.

Several practical lessons can be gleaned from the development history of the Korean STI governance system, including that the consolidation of STI systems is an essential engine for national development and societal, cultural, and economic innovation. Sophisticated mapping between national-level S&T promotion plans and national economic development plans is the first priority to harden the foundation for STI governance systems. Since the mapping was well matched, the improvements of S&T legislation and administration were directly followed to support the implementation of S&T promotion stably and continuously. The improvements could contribute to the coordination of S&T policies, R&D programs, and their national-level budget allocation. This means that decision-making authority on S&T-related matters was centralized into one specific administrative system in terms of STI governance systems. The roles of STI principal bodies, the government, GRIs, universities, and enterprise research institutes were clearly divided at the national level in response to changes of circumstance in the implementation of S&T promotion. When national-level R&D evaluation systems were added, the Korean STI governance system was finally consolidated.

The in-depth consideration of the current state of STI governance system of Senegal and its main problems, practical discussions of the strengths and weaknesses of Senegalese STI governance systems, and practical lessons from the building progress of Korean STI governance systems led to applying an Eliminate-Reduce-Raise-Create (ERRC) Action Framework to draw a direction for improving Senegal's STI governance system. The ERRC elements that could be offered as

examples for desirable STI governance systems are proposed. In conclusion, policy recommendations are offered as strategic plans and a list of urgent working-level implementations is suggested with which to develop the Senegalese STI governance system.

1. Introduction

1.1. Research Background

PASET champion countries located in sub-Saharan Africa require active industry promotion with core technological developments for sustainable growth in social and economic sectors. Professional manpower training is essential for the promotion; in particular, S&T-driven industrial manpower can be effectively trained under a Science and Technology Innovation (STI) system that has been adapted to local conditions. In addition, that STI system can be efficiently operated with a well-designed STI governance system in accordance with their national-level plan of technology development and industry promotion.

As a PASET champion country, Senegal also needs to promote competitive and high added-value technologies and industries to ensure sustainable growth. S&T promotion with professional manpower training is a useful tool for the development of technology and industry, particularly in the early stages of economic development. The Korean experience of rapid and efficient economic development with S&T promotion and internalization is a very good example with which to create a benchmark. Korea has established a well-designed S&T and R&D governance system while also shaping the linkage system to its own national development strategy, and Korea could develop its own STI governance structure through the experience of managing an S&T and R&D governance system.

Regarding STI structure (i.e., STI governance), there is no clear definition in the explanation of OECD. However, many advanced countries have established and developed their own STI policies and STI governance systems with which they have coordinated their national development and S&T. Meanwhile, in the result of country responses to the OECD S&T and 2012 Industry Outlook policy questionnaire, “National strategies and visions” is the most important aspect for coordinating innovation policies for national development. The second most important is “Dedicated innovation agency or ministry” in terms of the authority for budgeting and the enforcement for implementation with laws and legislation. The third is “Policy evaluation and reviews.”

From the start of this study, the Senegalese government has demanded a diagnosis of the current status of Senegalese STI systems and its governance in consideration of major actors such as ministries, research institutions, associated agencies, and institutions such as laws, regulations, and regulatory frameworks. Senegal wants objective overall insights about whether it is proper to promote S&T for national development based on its own national development plan, the Senegal Emerging Plan. This demand is the same requirement of several countries located in sub-Saharan Africa that are in a similar condition to Senegal in terms of social, economic, and human development, which pursue S&T promotion as a useful tool for national development.

For the diagnosis, Senegal's Ministry of Higher Education, Research and Innovation(MHERI) has agreed with the Korean research team based on mutual and constant in-depth communication, to focus on the following research objectives and procedures to understand the current status and determine the challenges in its development.

1.2. Research Objectives and Procedures

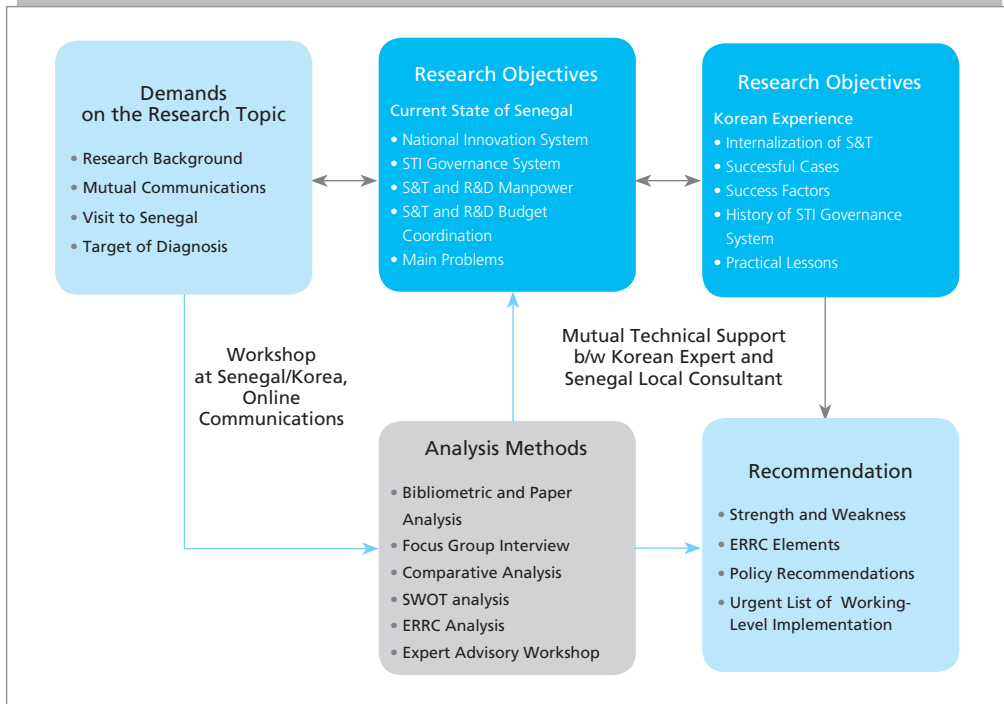
In accordance with the demands and to understand the current state of Senegal's STI governance system, the current statuses of S&T promotion, the STI governance system, S&T manpower, and S&T budget coordination were all analyzed. Since the budget allocation process is a key factor in the STI governance system, the analysis was focused on authorization bodies and acting bodies in the process of implementing budget allocation in Senegal.

Then, Korean experiences with STI governance systems were comparatively analyzed with those of Senegal. The practical lessons that Korea had learned that had enhanced the efficiency and effectiveness of STI from the progress of establishing an STI governance system were also understood.

Based on the comparative analysis, the strengths and weaknesses of Senegal's STI governance systems were determined to consider proper strategies and policy recommendations for its development. In succession, an urgent list of working-level implementations was also suggested for the development of Senegalese STI governance systems including Elimination, Reduction, Raising, and Creation (ERRC) elements.

The suggestions were discussed and reviewed with Korean experts and the Senegalese working-level officials who were in charge.

[Figure 3-1] Research Objectives and Procedure



2. STI Governance System of Senegal

2.1. The Current State of the National Innovation and STI Governance System

Unfortunately, there is currently no national program for STI innovation. However, it should be noted that several other initiatives, programs, and projects were born that favor the innovation. In the political plan, there is no certain policy document for innovation, but the orientations and objectives of development were defined in the documents of the Strategy of Reduction of the Poverty DSRPI (2001–2005), DSRPII (2006–2010) and quite recently in the national Strategy of Economic and Social Policy (2013–2017).

The letters of sectorial politics (industries, SME, microcomputing finances, peach and fish farming) were developed and adopted by the parliament, and since 2007, an accelerated growth strategy (SCA) has been implemented. The letter of the sectorial politics of development in the industry that is dedicated to the Politics of Industrial Restructuring (PRI) has established an important step forward in the implementation of a shared vision to build a strong branch of industry, the

foundation of a developing economy. The PRI articulates two main strategic axes: i) the upgrade and ii) the endogenous industrial development.

The upgrade is a strategy that consists of raising the degree of companies' performance to allow them to reach the standards and requirements of competitiveness within the framework of aggravated competition, at both the level of internal markets and of overseas markets. The elaboration of the Program of Upgrade operationalized by the Office of putting level (BMN) since 2004 allowed, during the period from 2006 until 2009, to press 148 companies a total of 205. Following-up with 15 of them revealed their significant evolutions in terms of the average turnover growth rate, which resulted from the process of upgrading Senegalese companies with striking elements that are relative to technological innovation and the development of new products and places on market services.

Endogenous industrial development is a strategy that consists, through the impulse of the internal dynamics of the optimal valuation of national resources, of correcting the low integration of local industry through the ascent of sectors and in promoting viable industrial activities that are directed toward both national and international markets. The programs and projects that are introduced in this frame could be executed with considerable results. However, the decentralization of industrial activities remained insufficient because the Dakar region contains 90% of the country's industrial companies.

The institutional plan contains many aspects, examples of which are below.

- (1) The implementation of a Presidential Council on the investment and creation of a national agency in charge of the promotion of investments and big works (APIX) is the outcome of a process of rationalization of the institutional plans of support for investors. This translates the strong political will of the Senegalese authorities to develop a strategy of attracting private investments and launching big construction sites for infrastructure that support production.
- (2) The implementation of a Permanent Secretariat for the Committee of Orientation and the Follow-up of the Accelerated Growth strategy accelerates growth by qualitatively improving its structure to make it more effective in the struggle against poverty, and diversifying its sources to secure and perpetuate it.
The Agency of the Computing of the State (ADIE) was created with the mission of driving the Administration's modernization by appropriating New Information technologies and Communication within the framework of good governance policies.
- (3) Technological innovation is being promoted with the creation of the Senegalese Agency of Technological Innovation (ASIT), which has the remit of

- favoring the protection of innovation and technology transfer to strengthen the capacities and competitiveness of SMEs & SMIs.
- (4) The creation of the Senegalese Agency for Industrial Property and Technological Innovation (ASPIT) has arisen from the fusion of industrial property services, the national structure of connection with the African Organization of the Intellectual property, and the ASIT.
 - (5) The promotion of normalization and certification in production and service sectors with the aim of increasing the competitiveness of companies by setting up the Senegalese Association of Normalization (ASN) in 2001, thanks to the private partnership of the state with the private sector, the general mission of which is to coordinate normalization and certification. Its current result is 281 elaborate Senegalese standards have been adopted in the domains of the food processing industry, electrotechnics, chemistry, solar energy, domestic energy, and the environment.
 - (6) The promotion of industrial property, through industrial property services by the membership of Senegal in the African Intellectual Property Organization (OAPI), offers important support for the development of innovation in the branch of industry; for that purpose, 14 treaties and 8 agreements were ratified by Senegal.
 - (7) The creation of The Agency of Development and Supervision of Small- and Medium-Sized Enterprises (ADEPME) welcomes and informs the promoters and the operators about the various support services available to companies. It offers them a set of practical information on the creation and/or the development of companies, the local and international financial sources of funding, and intermediation accessible to the MPEs & SMEs, etc.
 - (8) The implementation of a legal and statutory reliable framework concerning e-commerce, cybercrime, personal data protection, and cryptology, accompanied with the various application decrees.
 - (9) The creation of the Agency of Regulation of Telecommunications and the Broadcasting Stations (ARTP) to endow the telecommunications sector and post offices with an effective and transparent regulatory framework – favoring competition for user loyalty to the advantage of the users of networks and departments of telecommunications. as well as the creation of jobs directly or indirectly connected to sectors – and to insure any mission of public interest that could be assigned to it by the government in telecommunications sectors and broadcasting stations.
 - (10) The promotion of subcontracting and partnerships between large companies and SMEs & SMIs with the creation of the National Stock Exchange of Subcontracting and Partnership (BNSTP) in November 2000, thanks to the partnership state–private sector, to allow forging of strong inter-company links. This facilitates integration of the national industries and strengthens capacities of SMEs/SMIs to allow them to satisfy the needs

for subcontracting expressed by large companies.

- (11) The promotion of the program quality UEMOA executed in two phases, the second of which should have ended at the end of December 2010, was extended until the end of December 2011. This program allowed the certification of certain companies in the standard ISO 9001 and work on implementation of accreditation bodies and the equipment of the laboratories of metrology on the scale of the member states of the UEMOA.
- (12) The project of implementation of the National Monitoring Center of Digital Technology (ONN), including the objectives of the monitoring center of the ICTS, tested competitiveness indicators at the level of the ARTP, and the wishes of the economists to measure the impact of ICTS on the economic development. THE ONN is going to lean on its participative information system to map indicators and facilitate the help to the decision-making.

In addition, the points of the infrastructures plan are as follows:

- (1) The existence of several infrastructure and structuring equipment programs (big works, road and railroad infrastructure programs, programs for construction of industrial estates and rehabilitation and arrangement of industrial domains, etc.).
- (2) The opportunity offered within the framework of the Millennium Challenge Account (MCA) for the construction of roads.
- (3) The extension of the governmental intranet within the administrative intranet.
- (4) The implementation of the Incubator CTIC of Dakar,¹⁾ which suggests accompanying ICTS companies that need support in terms of services and infrastructures but also the project leaders, in the phases of creation, development, and growth.
- (5) The rehabilitation and the arrangement of industrial parks realized by the Agency of Arrangement and Promotion of Industrial Sites (APROSI), created in 2002.
- (6) The National Program of Multifunctional Platforms (PN-PTFM), operating since 2002 and aiming to contribute to the struggle against poverty, mainly in rural areas, including the installation of 1000 multifunctional platforms on the horizon by 2014, with 155 already realized by December 31, 2009.

On the other hand, the points below should be underlined in the context of the economic plan:

- (1) The existence of a dynamic informal sector that masters the local resources

1) www.cticdakar.Com

- has an adapted technology and turns gradually to a modern economy, by leaning on a network of micro-finance sources that emerge.
- (2) The existence of a fund for the promotion of companies.
 - (3) The implementation of the Fund for Development of the Universal Service (FDSU).
 - (4) The definition of the modalities and conditions for fair trade.
 - (5) The opening of particular African overseas markets thanks to the opening due to liberalization of the exchanges and from the integration with regional markets.
 - (6) Easy access to the market of the UEMOA and the ECOWAS.
 - (7) Access to the American market by means of the AGOA.

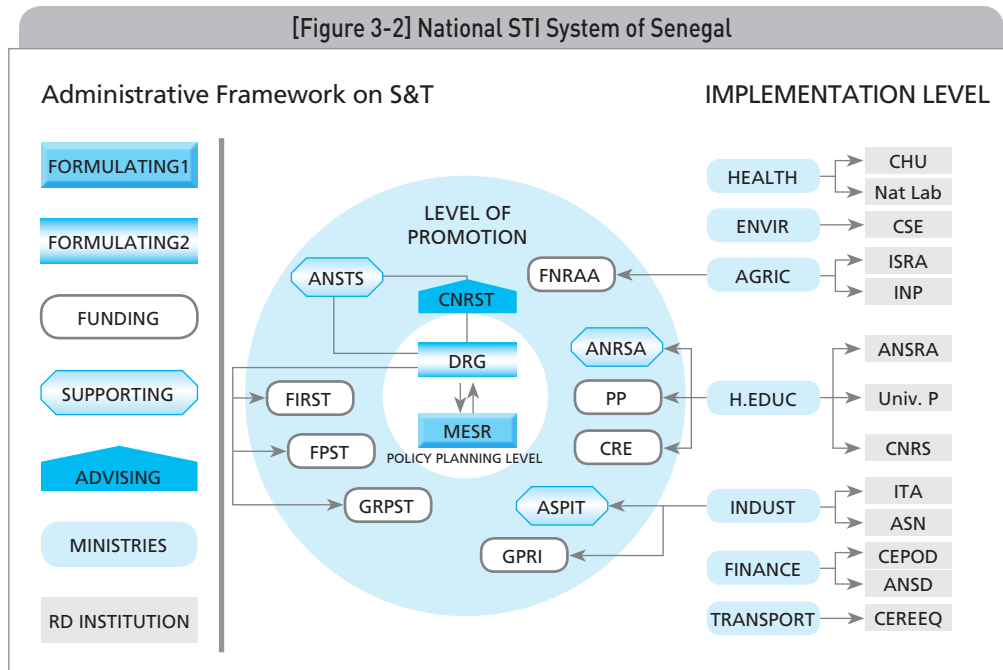
Finally, the contents in the plan of R&D and training are as follows:

- (1) The adoption of the system LMD by the parliament.
- (2) The existence of institutes of research and development and universities active in all the branches of production of the branches of industry (food-processing industry, mechanics, chemistry, electronics, etc.).
- (3) The existence of funds for the technical staff training of companies.
- (4) The incubator of the University Sheik Anta Diop (UCAD).
- (5) The domain of initiative and economic innovation (D2IE) of the University Gaston Berger of Saint-Louis.
- (6) The project of support for the operators of the food-processing industry with the training and the equipment of several micro-companies of the food-processing industry.
- (7) The supervision of SMEs with the ADEPME, which allowed training and supervising of 500 more SMEs of the primary, secondary, and tertiary sectors in 2008.
- (8) The project of support for the industrial valuation of farm produce, which has for its objective establishment of five business incubators in the regions of Saint-Louis, Ziguinchor, Kolda, Matam, and Thiès in partnership with local authorities, the private sector, and universities, and research centers with the aim of bolstering the new business start-ups for the industrial transformation and the valuation of farm produce, halieutics, and non-ligneous foresters.

The policy of the country regarding STI is defined by the Head of State through a mission letter sent to the Secretaries in charge of the concerned domains. Then, the Secretaries submit a letter of sectorial policy and/or a document of policy to the parliament.

In policy formulation, the main governing body of the scientific and technological policy is the Ministry of Higher Education, Research and Innovation

(MHERI). The MHER is a transverse ministry that coordinates the research on a national scale. However, the structures of research do not depend necessarily on its guardianship. It defines the national priorities regarding scientific and technological research and its finances through diverse funding sources.



Source: Diaby N., STI in Senegal (presentation ppt.), kickoff seminar, High level demand survey & pilot study, 2016/17 Knowledge Sharing Program with PASET, Korea Development Institute (KDI) (2016).

The outlines of several major principal bodies in the administrative framework on S&T are explained below.

(1) The Ministry of Higher Education, Research and Innovation (MHERI) was founded in 1966. The MHER assures the preparation and the implementation of the policy in the domains of higher education and scientific research. As such, it is in charge of the management of higher education. It establishes and develops the national university map by monitoring the harmonious and fair distribution of universities, schools, and university centers throughout the nation. It ensures the control of universities and institutions of higher education placed under its authority, as well as private structures of higher education. It monitors the development of the basic and applied research in universities, regional university centers, superior institutes, and national schools of training, and, in connection with the concerned ministries, monitors the use of the results of research to the advantage of national development. The MHER reports all the policies concerning STI undertaken

within the framework of its mission to the Prime Minister and to the President of the Republic. The MHER coordinates all the activities regarding STI led in the structures of higher education and the institutions of research that are under its authority. It controls the action of the executive managements of higher education and research institutions. The MHER works in association with the ministerial departments that coordinate other structures of STI (for example, Ministry of Agriculture, Ministry of Industry, Ministry of the Environment, etc.), the private sector, and the non-state actors.

(2) The Directorate General for Research (DGR) was created in 2014 under the authority of the MHER. The DGR is in charge of assuring the coordination and harmonization of research and innovation activities as well as the mutualization of their resources. It assists the MHER in the implementation of the research and innovation policy. Within the framework of its missions, the main objectives of the DGR are to assure the strengthening of the links between the various components of the national system of research to favor the synergies, to favor the diffusion of the research results and their valuation, to assure the promotion of research, to contribute to the implementation of a financing system of research activities and to the diversification of sources of funding, and to assure the promotion of the scientific and technical culture. In addition, the directions of STI in the framework of its missions are the direction of the strategies and the planning of the research; the direction of the innovation, the valuation, the intellectual property, and the technological transfer; the direction of the financing of the scientific research and the technological development; and the direction of the promotion of the scientific culture.

(3) The National Agency of Applied Scientific Research (ANRSA) was created in 2008 and its responsibilities are to coordinate the national applied scientific research by careful monitoring of the discoveries realized in basic research in the economic world, in particular in the agricultural and industrial world. The roles of the ANRSA are to spread and make accessible the scientific information, to develop a real scientific culture, and to favor the understanding of the scientific developments, the technological choices, and their implications on the redundancy, ethical, and economic plan. The ANRSA operates in connection with the Presidency of the Republic and the set of the structures of search belonging to all the ministries. It also operates in connection with the public bodies of implementation of the STI activities and has a transverse collaboration with all the institutions having activities of applied scientific research.

(4) The Senegalese Agency for Industrial Property and Technological Innovation (ASPIT) was created in 2009. The ASPIT is placed under the supervision of the

Ministry of Industry and Appearances. The ASPIT works with the association of the inventors of Senegal, researchers, craftsmen and small and medium-sized enterprises. At the same time, the ASPIT works with the other national directions of the supervisory ministry but also with all the structures that handle questions of STI. The missions of the ASPIT are as follows: to favor the definition and the elaboration of a national politics regarding industrial property and regarding technological innovation and to participate in its implementation, to promote invention and technological innovation in Senegal, to identify, to estimate, and to spread the potential of the inventions and exploitable innovations in Senegal, to favor the protection of the inventions and innovations while encouraging the valuation of creations and the results of the search, and to create a synergy between innovation and technology transfer to develop an industrial fabric of job creation, more particularly in the sector of SMEs.

(5) The National Academy of the Sciences and Techniques of Senegal (ANSTS) was created in 1999. The ANSTS is placed under the supervision of the Ministry of Scientific Research and deals with all the structures of training and or the research in sciences and technology to put at their disposal their experiences. The ANSTS includes 56 members specialized in the SIT. Its responsibilities are as follows: to assist and to advise the Senegalese State and Public and Private institutions within the framework of the definition and of the implementation of the National Policy regarding Science and of Technology, to encourage scientific research, to introduce, to foster, and to develop programs in the domains of Science and Technology, to contribute to the promotion and to the valuation of the results of research, to arouse scientific vocations among young people and women, to facilitate exchanges with similar bodies, to award prizes and scholarships to people who particularly distinguished themselves by their works, and to contribute to the development of the scientific culture and to the forge links between science and society.

On the other hand, Senegal has not had a national body responsible for R&D program evaluation until recently. Each institution evaluated its own program. However, the National Quality Assurance Authority has modified its text to take responsibility for this issue.

2.2. The Current State of the S&T and R&D Manpower Promotion

Currently, in the field of vocational and technical training as well as in the field of elimination of illiteracy and the informal education, the granted efforts remain insufficient. The results of the vocational and technical training show important regional disparities; the region of Dakar always draws the majority of students (62.5%) and includes the majority of the private higher education institutions (79.3%). The regions of Louga, Matam, and Fatick have the fewest students. The higher education is marked by the fast growth of the number of students. The number of new holders of high school diploma went from 29,908 in 2010, to 43,850 in 2013, 40.9% of whom were girls. The enrollment of these new students in public universities is still a very difficult issue, in spite of the contribution of the private sector of higher education. Public higher education does not yet meet the demand.

However, the government of Senegal, within the framework of the initiative PASET, targets the skills in the ASET for specific priority sectors to fill the gaps and optimize the national and international return on investment in these sectors. In pursuing this goal, Senegal can cite the following public training institutions: College for Science and Technology (FST), National Higher School for Vocational and Technical Training (ENSTEP), Higher Polytechnic School (ESP), Polytechnic School of Thies (EPT), Network of Higher Institutes of Vocational Training, Polytechnic Institute of Saint-Louis (PSL), College for Applied Sciences (SAT), and several Technical and Vocational High Schools (TVETs) under the Ministry for Vocational Training. There are also some research institutes in the ASET such as the Senegalese Institute for Agricultural Research (ISRA) and the Research Institute for Food Processing (ITA).

In a general way, in Senegal, the educational levels and competence are still relatively low and are too limited in coverage of domains. This follows from its weak productivity because of poor control and of a weak degree of application of science and technology. What leads to the use of techniques of production being left at a rudimentary level? According to the statistics pulled by the last survey of poverty in Senegal (ESPS-2011), 72.4% of household heads have no academic degree (ANSD 2011). Senegal's weak productivity is especially stressed by the fact that the low academic levels are not compensated with an in-service training, which is almost non-existent both on the side of the government as well as on the side of the private enterprises, which do not practically invest in the renewal of knowledge of their staff. As this shows, there is a lack of the skills needed to satisfy the needs for the industries evolving in terms of R&D and S&T.

However, in August 2013, the presidential council on higher education and

scientific research decided to reorientate the system of higher education toward the sciences, technology, short vocational training. In addition, to give a new impetus to the research and innovation, the government set up a voluntary policy in the field of the higher education with the systematic grant for all the students of the third cycle, the increase of bonuses for researchers, and financing of study trip for academics. It is also necessary to add the creation of doctoral courses by universities and open up to the non-Senegalese staff, which was always a strong option of Senegal.

In axis two of the Plan Senegal Emergent (Human Resources, Social Welfare, and Sustainable Development, PSE-P 2014 and ANSD 2011), the choice of the government is to emphasize sciences and technology in the fundamental cycle and in the high schools as well as on the professionalization of the sectors in particular through public-private partnerships. It is in this context that Senegal should consider the creation of new specialized professional high schools, with sectors better articulated in terms of the economic potentialities of localities. In higher education and research, the government will give priority to sciences and technology, engineering sciences, and to the applied research in order i) to reach 50% of holders of scientific high school diplomas and ii) to improve effectiveness of vocational training by 50%. The alignment of the offer of training based on economic needs is beginning to work.

2.3. The Current State of the S&T and R&D Budget Coordination System

The S&T and R&D budget is mainly checked by the government: the Ministry of Economy, Finances, and Planning (MEFP). It is submitted to the National Assembly for voting, as included in the final budget proposals of the Ministry of Higher Education, Research and Innovation (MHERI) and other ministries. The ministries invest in infrastructures and equipment; consequently, the running budget is transferred to universities and research institutes.

The government remains the man lessor of the research and innovation institutions in Senegal via national funds or regional programs allocated to sectors of research and under the technical and administrative supervision of the concerned ministries. The presidential council predicts in its directives 10 and 11 improvement of the management of the budgets and the proper resources of universities and investment in the MHER. The financing of research is assured for various research structures (public universities, establishments of a scientific character, colleges) under forms of scholarships of the third cycle. Competitive funds are also offered, such as the Fund of Impulse for Scientific and Technical Research (FIRST), which will be replaced by the National Fund of Research and Innovation (FNRI) managed by

the MHER, the Fund of Scientific and Technical Publication (FPST) and the National Fund of Agricultural and Food-Processing Research for Senegal (FNRAA) managed by the Ministry of Agriculture (MOA).

The additional resources that allow universities and certain institutions of research to finance research activities come from links to and agreements of cooperation with international institutions. The Program of Agricultural Productivity in Western Africa (WAAPP/PPAAO) finances research projects for the improvement of the regional agricultural productivity. Moreover, the West and Center African Council for Agricultural Research and Development (CORAF/WECARD) proposes competitive funds for research projects. The participation of the private sector in the financing of research is to be promoted by encouraging companies to express needs for which research bodies could bring solutions. Companies could thereby bring financing for the realization of certain activities of research and innovations that interest them particularly.

On the other hand, there are some independent funding entities, as listed below.

(1) The Fund of Impulse for Scientific and Technical Research (FIRST) was created in 1973 by the Ministry of Scientific Research as a tool (now merged with the MHER) to support economic growth by research. It aims at encouraging, at facilitating, and even at amplifying the initiatives of research. FIRST mobilizes credits of intervention, which are assigned by the government, to the Ministry of Scientific Research (now the MHER). It is at the same time an element of financing of projects and an instrument of support and structuring of the sector of the search. The Ministry of Scientific Research (now the MHER) considers the area of its mission in the numerous and diverse domains of research and identifies and defines the priority themes of research on an annual basis concerning the vital sectors of the development of the life of the nation to monitor the state of agriculture, health, education, the economy, food sciences, the environment, social sciences, etc. The projects subjected after call to application are examined by the scientific and technical commission and selected according to precise criteria. The objective of this fund is to promote fundamental research and is applied by the financing of research projects introduced by Senegalese researchers. The specific objectives of the instrument are (A) Stimulate the production of new endogenous scientific knowledge, (B) Strengthen the infrastructure of research laboratories in the public and private sectors, (C) Human resources for research, innovation, and strategic planning, and (D) Capacity building, education, and training of human resources specialized for the production of new scientific knowledge, the development of new technologies, the

promotion of the innovation in systems of production and services, and the management of the company of the knowledge, (E) Strengthen the social appropriation of the aforementioned scientific knowledge and new technologies and (F) Development of strategic technological domains and new products and high value-added highly specialized services. Promotion and development of the innovation is in the production of the goods and the services. Promotion of "startups" ("young persons", "young shoots") is focused in high-technology domains. The annual budget was 711 million FCFA (1.422.000 US \$) in 2013. The FISRT began to be executed only in 2008.

(2) The National Fund of Agricultural and Food-Processing Researches (FNRAA)

was created in 1999. The FNRAA is an association in the public interest that seeks to finance, with the available resources, agricultural and food-processing research projects considered as priority by the government and the National System of Agro-Sylvo and Pastoral Research (SNRASPP), which are the development partners and the users of the research results. The FNRAA is submitted, within the limits of the measures of its statutes, to the administrative guardianship of the MEFP and to the technical guardianship of the Ministry of Agriculture. The vision of the FNRAA is to create the conditions of a diversified and sustainable financing of the Senegalese agricultural and food-processing research. For that purpose, the fund develops a policy i) of promotion of its activities with the development partners and ii) of the valuation of the quality results in the direction of the users of the products of the research.

(3) The National System of Agro-Sylvo and Pastoral Research (SNRASPP)

In spite of their monopolies of right or de facto, the main national structures of search, in the current context, do not have the sufficient human, financial, and physical resources to meet the multiple challenges facing Senegalese agriculture. Its creation in November 2008 and its launch in June 2009 should allow proper synergy, organization, and systematization of cooperation between all the structures having skills and capacities of research in the agricultural and food-processing domains and place the national research in a context of globalization.

(4) The Fund for Scientific and Technical Publication

is a fund intended on one hand to support the scientific and technical publications existing in institutions and on the other hand to finance the regular publication of scientific journals edited under the aegis of the Ministry of Higher Education, Research and Innovation. The specific objectives of the instrument are as follows: to stimulate the production of new endogenous scientific knowledge and to promote and to support the scientific publication in Senegal. It

benefits all domains, disciplines, and sectors, with an annual budget of 35 million FCFA (70,000 US \$).

(5) Grand Prix of the President of the Republic for Sciences and Technology (GPPRST) is a national distinction aimed at rewarding the researchers who have particularly distinguished themselves by the creativity, the importance, or the originality of their works. The specific objectives of the instrument are as follows: (A) the stimulation of new endogenous scientific knowledge, (B) human resources for research, innovation, and strategic planning, (C) capacity building, education, and training of human resources specialized for the production of new scientific knowledge, the development of new technologies, and the promotion of innovation in systems of production and services, and (D) development of strategic technological domains and new products and high-value-added highly specialized services. Promotion and development of the innovation is in the production of properties and services. Promotion of "startups" is in the high-technology domains. Horizontal instruments confer their benefits to all domains, disciplines, and sectors. The prize includes a medal, a diploma, and a financial envelope (50 million for the GPPRST and 25 million for each of the special prizes). Eligibility requirements are as follows: to be a Senegalese researcher living in Senegal or abroad or to be a foreign researcher living in Senegal. Since its launch in 1990, Grand Prix was awarded six times and the special prize nine times, with an annual budget of 200 million FCFA (400,000 US \$).

2.4. Main Problems in the STI Governance System

Senegal has a long-term national development plan, the Plan Senegal Emergent (PSE, reformed 2014), which pronounces the following vision: (1) To achieve an inclusive sustained growth and to maintain sustainable growth, (2) To be the gateway to West Africa, and regional leader, (3) To be a model of balanced development (economic, social, human), by mainly increasing employment, social development, and enhancing foreign direct investment. As enablers of the PSE, six areas—energy, business, infrastructure, human capital, ICT, and finance—were focused on with 27 flagship projects. The PSE is a national comprehensive plan considering five main sectors: central ministries, social sector, private sector, technology policies, and local governments.

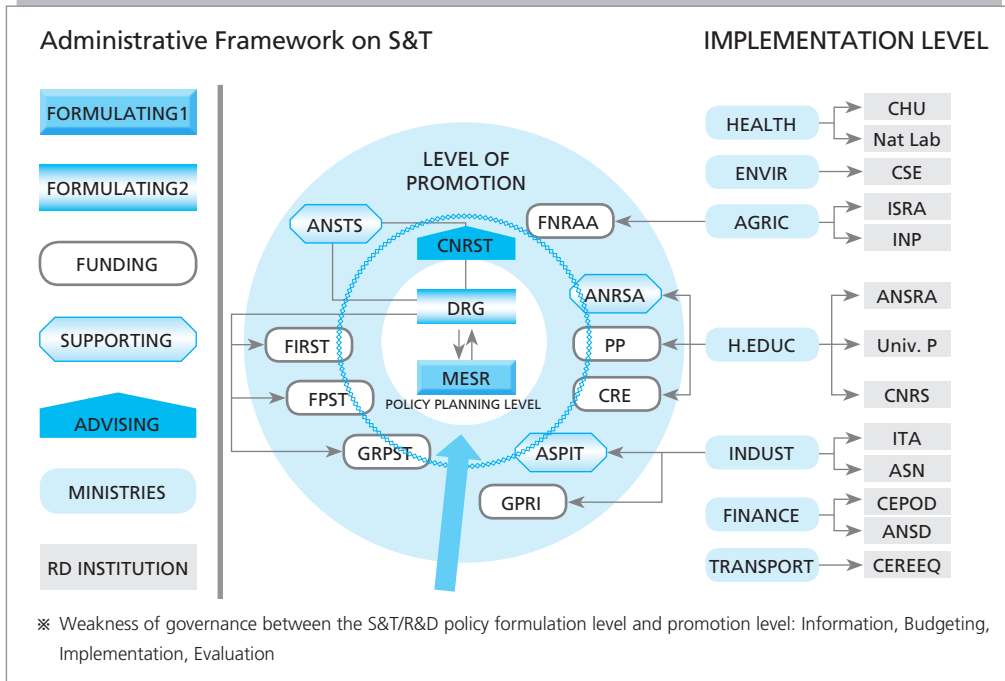
STI policies remain sectoral, although they are generally integrated within the framework of higher education policies. Economic and sectoral policy documents take account of STI: The National Strategy for Economic and Social Development (SNDES 2013–2017) aims to accelerate economic growth and improve productivity. One of the objectives, The Program for Improving Quality, Equity, and Transparency

(PAQUET 2013–2025), is the training of competent human resources in line with the requirements of the sustainable development plan for the development of higher education and research (PDESR 2013–2022). This aims to implement priority reforms in higher education and research in Senegal. PSE, with a very long perspective, is a good landmark allowing definition of a strong STI policy. The fact that PSE takes into account various sectors and establishes clear objectives implies a framework that will be shared by sectorial policies.

However, unfortunately, Senegal has an unstable STI governance system, especially its research governance system, even though there is an administrative framework for S&T. MHER/DGR takes the role of a headquarters for S&T-related policy formulation with the relevant ministries and organizations. However, the priority setting of the S&T promotion and R&D areas/targets and their budget coordination are not decided by the MHER/DGR but by each ministry in its related research area. This means that the MHER/DGR does not have the authority for budget allocation according to the S&T/R&D policies that they formulated themselves, merely keeping a closed communication with the relevant ministries and organizations.

This kind of role of the MHER/DGR on S&T policy formulation and promotion is based on presidential leadership, not on a law or legislation. Thus, the current governance of S&T/R&D for STI cannot be continuously guaranteed. For these reasons, the MHER/DGR struggles to get the whole picture of S&T/R&D-related affairs from the relevant ministries and organizations. Consequently, it is not easy to set the priority of S&T/R&D promotion areas and targets, nor is it easy to coordinate the national budget in a top-down strategy to support PSE.

[Figure 3-3] Weakness of Administrative Framework for S&T of Senegal



Source: Lee S.H., Science and technology innovation governance system development (presentation ppt.), interim reporting and policy practitioners' workshop, 2016/17 Knowledge Sharing Program with PASET, Korea Development Institute (KDI) (2016).

On the other hand, there is no national body for S&T/R&D evaluation based on the monitoring of PSE enforcement status. Each institution evaluates its own research programs, so it is not easy to conduct national-level diagnosis for clear understanding of the state of S&T/R&D promotion programs or to decide budget modification according to the evaluation result considering the phase goals of PSE.

Another problem is the lack of S&T manpower to manage the STI system. Thus, the Senegal government is actively involved in PASET and focuses on S&T manpower training for S&T promotion. Nevertheless, the eradication of illiteracy and vocational education are still the key challenges for S&T promotion. This deficiency is a major cause of the unsatisfactory capacity of S&T/R&D planning and implementation for establishing an efficient and effective STI system and maintaining a high-level STI governance system.

3. Korean Experience in STI Governance System

3.1. Internalization of S&T for National Development

3.1.1. Introduction and Success Factors

Korean S&T development strategy was characterized by government-led policy formulation and the internalization of S&T in company with linking to the national development strategy and plan. In general, S&T internalization is a long-term and very high-cost strategy for developing countries with low-level S&T activities, so it is very hard for them to push ahead with the S&T strategy.

Notwithstanding this challenge, Korea stood firm to implement self-reliance in science education and technology, which were imported from the advanced countries such as the US, Germany, and Japan during the 1960s to the 1980s. The S&T strategy was divided into three major sections, expounded below.

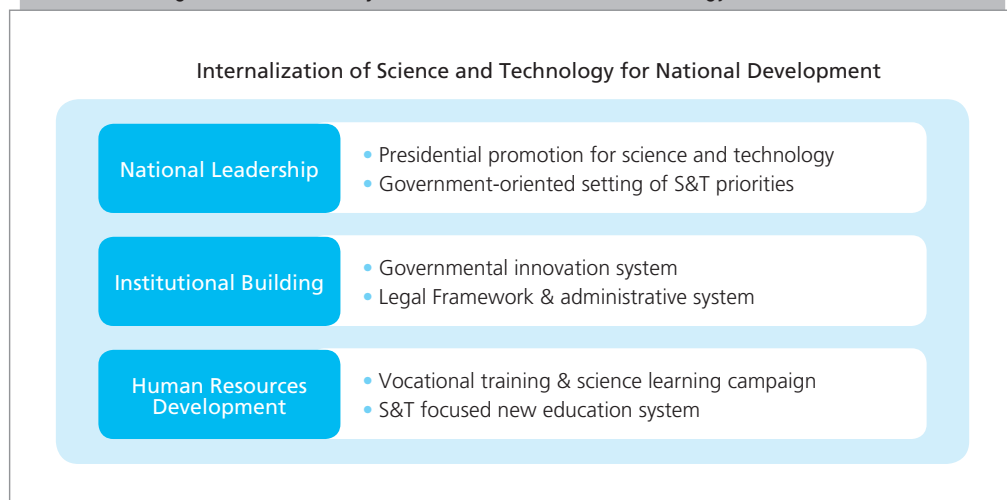
One is the national leadership that conducted the S&T internalization, adapting to the domestic situation, with a critical diagnosis including government-oriented setting of S&T priority. This national leadership led the evolution of S&T and drove S&T into the direct support of national development rather than purist of academic or scientific curiosities. The Korean government pushed ahead the S&T promotion because it was concluded that S&T internalization is the essential for increasing national capacity of economic development. This decision allowed complete support of S&T promotion at the national level and carried over into the establishment of a national S&T system and, in the long run, a national STI system.

Another section is institutional building, developing the S&T innovation ecosystem, including the legislation of S&T promotion and industrial regulations. The Korean government's innovation system was also developed through the construction process of a legal framework and administrative system. In the 1960s, there was no legal framework specifically for S&T promotion, but the Korean government valued S&T as a useful tool for economic development from its earlier stage. Thus, the legislation for S&T such as Science and Technology Promotion Act (1967) and Technology Development Promotion Act (1972) was accomplished by the government in parallel with the building of S&T infrastructure such as government-funded research institutes (GRIs such as the Korea Institute of Science and Technology (KIST, 1966), Ministry of Science and Technology (MOST, 1967), and Daedeok Science Town (1974)). This meant that the core elements of the national S&T system, such as administrative governance of S&T, governmental R&D system,

and national R&D projects, were established in careful coordination.

The other section is the human resources development with the S&T-focused education system. The policy enforcement of vocational training for labor manpower and of the science-learning campaign for the young people induced them to work at the target industry fields. Without particular discernment and support for S&T manpower training at the national level, it was very difficult to implement self-reliance in science education and technology. This is necessary in practical terms, especially for the countries that are limited in natural resources. In terms of social and cultural development, on the other hand, the better treatment of scientific and engineering personnel had changed the people's perception from contempt to preference for technical works, and consequently the industry structure evolved from agriculture-based to manufacture-based. As a result of S&T-based education projects concentrated on young people, many young people were trained as S&T workers, and they selected their jobs in the manufacturing industry fields that were targeted for intensive promotion by the government.

[Figure 3-4] Three Major Sections of Korean S&T Strategy (1960s–1980s)



Source: Ministry of Strategy and Finance (MOSF), Republic of Korea, KDI School of Public Policy and Management, The internalization of science and technology in the earlier stage of economic development in South Korea (2013).

As evaluated in the reports on the success factors of Korean economic development, S&T promotion at the national level was the key success factor, including professional manpower training demanded by industrial fields. The effect of the S&T promotion was proved when Korea entered the high-tech industry in the 1980s and maintained competitiveness and economic growth thereafter.

Another key success factor was the accomplishment of domestic procurement system for S&T through the establishment of administrative governance of S&T, governmental R&D system and national R&D projects in the 1970s. This harmony of institutionalization, legislation, and self-reliance in S&T, made it possible that national development could be fully supported by S&T at the national level.

Another is the positive change of people's perception of S&T through a science learning campaign and S&T promotion at the national level. This perceptual change motivated young people to go into the fields of S&T and industry. In other words, the cultural climate in which the learning and training of technical skills and technologies was perceived as making people's life better was built in the 1960s and the 1970s when there was no hope but poverty, especially for the young people after the Korean War (1950–1953).

However, the differences of political, economic, social, and cultural backgrounds in that period between Korea and Senegal should be considered.

3.1.2. Successful Case for Industry: Promotion of the Steel Industry

To increase economic development, the Korean government created the national development strategy, the Export-Oriented Industrialization Strategy, and the series of Five-Year Economic Development Plans from 1962. As this strategy and the first and second plans were implemented well, the substitution of import and industrialization were accelerated, and the steel demand increased rapidly in parallel.

However, in the 1960s, South Korea was import-dependent at about 40% for steel products and 100% for high-quality steel products. Thus, the government planned the construction of a modernized and integrated iron and steel mill to ensure a stable supply of steel products, which were essential for economic development. However, it was not easy because the steel business was subject to economy of scale and it is a typical equipment industry characterized by a need for intensive capital. Therefore, a massive investment is needed to satisfy the required conditions and facilities, and a stable demand is also needed to maintain the operation rate of facilities with economic feasibility, for steel industry promotion. On the other hand, the output of crude steel of South Korea was insignificant, just 372 thousand tons in 1968, compared with 66.89 million tons in Japan (global output was 528 million tons).

Regardless of the difficulties, the plan of an integrated iron and steel mill construction was not abandoned, and help was continuously sought from countries such as the US, West Germany, United Kingdom, France, and Italy. As a result of

that effort, the Korean International Steel Association (KISA) was launched with five countries and eight companies in 1966, and Pohang Iron & Steel Company Ltd. (POSCO) was officially founded in 1968. However, the World Bank in 1969 reported that Korea was not mature enough for the construction of an integrated iron and steel mill and that the project lacked economic feasibility. Then, the KISA finally rejected the offer of a development loan for its construction and it came to naught.

The government changed the route of necessary funding for the mill's construction to Japan. The government decided to divert the fund of Korea's property claims against Japan to a consistency steel mill construction (equipment and facilities) that was planned to invest into the agricultural field. After the persuasion toward and the approval from Japan, the Korean government decided that everything from the equipment installation plan and purchase to the introduction of technology should be conducted by the private sector. This principle supported the conclusion of the Korea–Japan Framework Convention on the Construction of an Integrated Iron and Steel Mill in 1969. The groundbreaking ceremony of POSCO was held in 1970, and the construction plan of an integrated iron and steel mill eventually came true in 1973 (first construction phase, 1970.4–1973.7).

In parallel, the government had legislated for the development of the steel manufacturing industry (the Steel Manufacturing Industry Promotion Act, 1970; abolished, 1986). It was based on loose regulation to help support the steel manufacturing industry as the national strategic industry. The practical matters were furnished by this law to initiate the settlement of a steel manufacturing industry in which the private sector played a main role, such as (1) financial and administrative support for foreign capital introduction with long-term low interest, purchasing raw materials, supplying equipment and material, harbor facilities, water facilities, power facilities, and road and railway construction, (2) a discount on public utility charges (freight and water charges up to 30%, harbor dues and power rates up to 50%, and gas rates up to 20%), and (3) expense support for institutes of research and technical training. This law remarkably contributed to the growth of Korea in poor surroundings of capital, technology, and manpower as a powerful nation of steel. This meant that it succeeded in meeting the steel demand from private sectors in the earlier stage of economic growth of Korea (1960s–1970s) when the substitution of import and industrialization were accelerated.

On the other hand, for the first phase construction of POSCO (1970.4–1973.7), the cost was 251 USD per ton of iron mold, only around 40% of the cost of Taiwan (667 USD, Chins Steel Co.) or Japan (626 USD, Ogishima Steel Co.). This economically efficient construction was attributed to the painstaking effort of construction workers, staff members, and executives of POSCO, who strived all day and night for the construction with a strong sense of mission.

In addition, POSCO strategically focused on purchasing and installing modern equipment and facilities at the lowest price by using the competition among Japanese general trading companies, which desired to secure a bridgehead for the Korean market of the steel manufacturing industry. This strategy of the best equipment purchase with cost reduction practically contributed to the takeoff of POSCO as a powerful steel manufacturing company with world-class competitiveness in a short period. The Korean government's strategy of authorization transfer to the private sector and the legislation also formed a critical background for the construction and operation of the integrated steel mill.

〈Table 3-1〉 Construction Phase of POSCO

Phase	1	2	3	4-1	4-2
Period	1970.04– 1973.07	1973.12– 1976.05	1976.08– 1978-12	1979.02– 1981.02	1982.01– 1983.05
Construction Workers	3,421,269	3,211,537	5,050,577	4,278,517	1,146,095
Crude Steel Production (million tons)	1.03	2.60	5.50	8.50	9.10
Localization Rate of Facilities (%)	12.5	15.5	22.6	35.1	41.5

Source: POSCO, 25-year history of POSCO (1993).

3.2. History of the STI Governance System

The Korean government has chosen the S&T as a strategic tool for national economic development. To understand the establishment of STI governance system for the S&T promotion, the building process of the administrative framework for S&T and the series of economic development plans are summarized here in the 10-year time period from the promoting period of technology learning (1960s–1970s) to the developing period of R&D capability (1980s–1990s).

3.2.1. STI System of the 1960s

The Korean government began to break from dependence on US's economic aid by establishing and implementing the first Five-Year Economic Development Plan (1962–1966). The first plan mainly aimed at (1) the increase of agricultural productivity, (2) the expansion of energy source suppliers, such as of coal and crude petroleum, (3) the expansion of key industries such as chemicals and electric

power, and the fulfillment of social overhead capital (SOC), (4) the utilization of idle resources, (5) the improvement of international balance of payment by export enhancement, and (6) S&T promotion. In terms of industrial sectors, it covered from the modern industrial fields, such as cement, fertilizer, and oil refining, to the manufacturing industrial fields (intermediate goods) such as fabric, petrochemicals, and machine parts. The enrichment of S&T promotion covered the technology supply policy and the strategic industrial technology development for gratifying the technologies demanded from the industrial sectors.

To take charge of the economic policy, the Economic Planning Board was officially launched in 1961 and it set up the Technology Management Bureau in 1962 for stimulating development investment from private sectors, advanced foreign technology introduction, and technology cooperation with advanced countries. The bureau was the first administrative body that exclusively took charge of the S&T, and it became MOST in 1967. The bureau prepared the second Five-Year S&T Promotion Plan (1967–1971) in 1966 and implemented it in parallel with the second Five-Year Economic Development Plan (1967–1971). At the same time, the bureau also prepared the second Five-Year Human Resource Development Plan (1967–1971) and coordinated it with the second Five-Year Economic Development Plan, which mainly aimed at (1) food self-support, reforestation, and marine development, (2) the development of industry and the increase of industrial output in the industrial fields of chemistry, iron & steel, and machinery, (3) the achievement of 7 trillion USD in exports, (4) population control by encouraging family planning, (5) the increase of national income, and (6) the development of human resources.

In the result, one of the principal bodies of STI (the government, GRIs, Universities, and Enterprises), KIST (established, 1966), was fully supported by the government with the S&T policies and legislations to develop technologies and to train the manpower necessary for advancement of the industrial fields. The government (the Ministry of Science and Technology) managed the GRIs and the national S&T policy making and implementing in earnest and efficiently.

3.2.2. STI System of the 1970s

The principle strategy of national economic development was high growth by intensive promotion of capital and the technology-integrated heavy chemical industry. The main target industrial fields were machinery, shipbuilding, electronics, steel, and chemical engineering, which were selected as the five national strategic industries. Therefore, the urgent challenge was to supply the professional manpower and to meet the levels of technologies demanded to support the intensive promotion of these five national strategic industries.

The Korean government began to build up the foundation for industrial technology development to support the third Five-Year Economic Development Plan (1972–1976), which mainly aimed at (1) strong economic development, (2) the heavy chemical industrialization, (3) S&T promotion, and (4) stable national equilibrium. However, at this time, the GRIs and universities were not yet sufficiently mature to satisfy the demands from the third Five-Year Economic Development Plan and the industrial fields in terms of the research funding, equipment/facilities, and capability. Enterprises did not carry forward full-scale or a self-reliable technology development because of small capital and weak recognition of R&D, but they mostly depended upon foreign technologies.

Therefore, the MOST formulated the basic direction of S&T promotion policy: (1) the establishment and development of S&T infrastructure, (2) the strategic development of industrial technologies adapted to the third Five-Year Economic Development Plan, and (3) the enhancement of S&T culture. In addition, this basic direction of S&T promotion was unswervingly maintained in the 1970s. During the implementation of S&T promotion policies, the Science and Technology Promotion Act (Revised, 1972) made it possible that scientists and engineers could be involved in public service as governmental officers. Furthermore, the resident S&T officer system was launched in cooperation with the Ministry of Foreign Affairs (MOFA) to promptly collect new technology development information from abroad. Scientists and engineers could be sent for that to the advanced countries such as the US, Japan, and France.

The national-level coordination of S&T-related policies and programs among ministries was begun by establishing (1972) and operating (1973) the General Science and Technology Council (GSTC) under the Prime Minister's Office. The GSTC carefully reviewed the major S&T promotion plans at the national level, such as the Construction Plan of Daedeok Science Town, The Long-Term Strategy and Plan of Manpower Supply and Demand, Public S&T Learning Campaign Plan, and the R&D Program Implementation Plan. From the middle of the 1970s, GRI establishments were started in earnest at developing the target industrial technologies, and they led national research and development activities. The Support of Specific Research Institutes Act (1973) legally and stably supported the establishment of GRIs and their R&D activities.

The S&T/R&D activities of GRIs mainly contributed to the fulfillment of the fourth Five-Year Economic and Social Development Plan (1977~1981), which was mainly aimed at (1) a growth system established by Korea's own capability, (2) enhancement of national equilibrium by social development, (3) technology innovation, and (4) an increase of efficiency. Korea achieved 10 trillion in exports in 1977, referred to around the world as the Miracle on the Han River.

(Table 3-2) Main Events in STI System in the 1960s–1970s

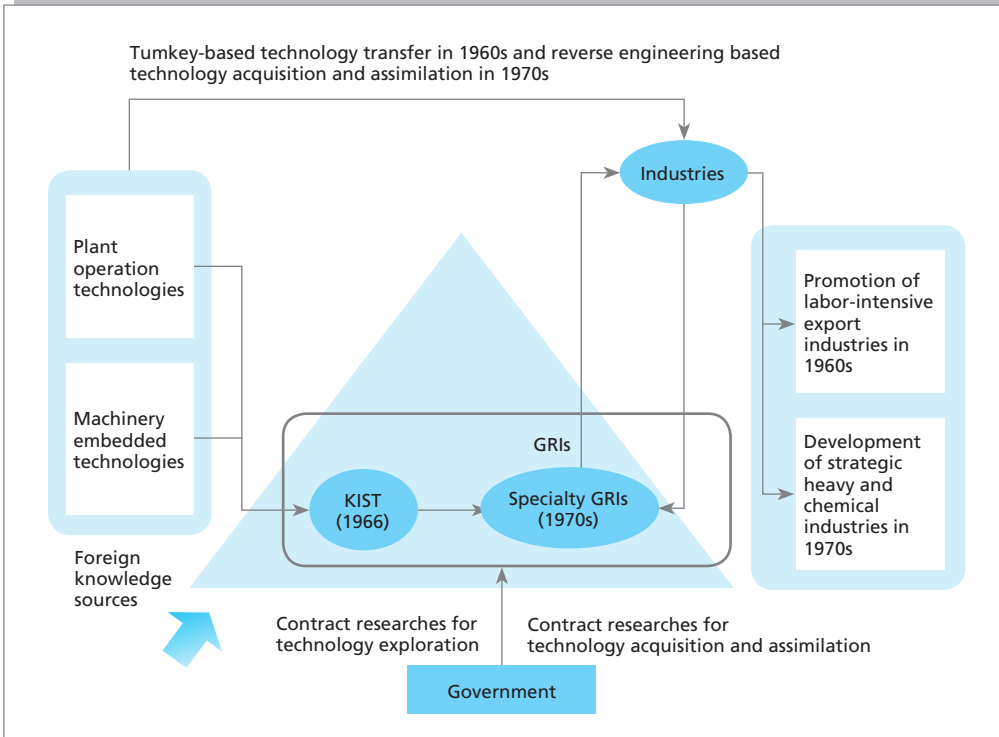
STI System	Main Events
National Innovation	<ul style="list-style-type: none"> • The 1st Five-Year Economic Development Plan (1962–1966) • The 2nd Five-Year Economic Development Plan (1967–1971) • The 3rd Five-Year Economic Development Plan (1972–1976) • The 4th Five-Year Economic and Social Development Plan (1977–1981)
S&T Policy	<ul style="list-style-type: none"> • Introduction of advanced technologies from abroad • Internalization of the imported technologies • Promotion of export-oriented light industry and heavy chemical industry • Establishment of S&T infrastructure <ul style="list-style-type: none"> - The 1st Five-Year Science and Technology Promotion Plan (1962–1966) - The 2nd Five-Year Science and Technology Promotion Plan (1967–1971) - The 3rd Five-Year Science and Technology Promotion Plan (1972–1976) - The 4th Five-Year Science and Technology Promotion Plan (1977–1981) - The 1st Five-Year Human Resource Development Plan (1962–1966) - The 2nd Five-Year Human Resource Development Plan (1967–1971) - The 3rd Five-Year Human Resource Development Plan (1972–1976) - The 4th Five-Year Human Resource Development Plan (1977–1981) - Construction of Daedeok Science Town (1974–1992)
S&T Legislation	<ul style="list-style-type: none"> • Science and Technology Promotion Act (1967) <ul style="list-style-type: none"> - Science and Technology Promotion Fund (1967) • Act on the Promotion for Technology Development (1972) <ul style="list-style-type: none"> - Technological Development Reserves (1972) • Support of Specific Research Institutes Act (1973) • Research Foundation Act (1976) • Polytechnic College Act (1977) • The Academic Promotion Act (1979)
S&T Administration	<ul style="list-style-type: none"> • The Technology Management Bureau (1962) • The Ministry of Science and Technology (MOST, 1967) • General Science and Technology Council (GSTC, 1973) • Korea Foundation for Technology Promotion (KFTP, 1974) • Korea Science and Engineering Foundation (KSEF, 1977) • The Information Industry Bureau (1975)
GRIs	<ul style="list-style-type: none"> • Leading industrial technology development needed for national development • Korea Atomic Energy Research Institute (KAERI, 1959) • Korea Institute of Science and Technology Information (KISTI, 1962) • Korea Institute of Science and Technology (KIST, 1966) • Korea Ocean Research & Development Institute (KORDI, 1973) • Korea Astronomy & Space Science Institute (KASI, 1974) • Korea Research Institute of Standards and Science (KRISS, 1975) • Korea Institute of Geoscience and Mineral Resources (KIGAM, 1976) • Korea Research Institute of Chemical Technology (KRICT, 1976) • Korea Electrotechnology Research Institute (KERI, 1976) • Korea Institute of Machinery and Materials (KIMM, 1976) • Electronics and Telecommunications Research Institute (ETRI, 1976) • Korea Institute of Energy Research (KIER, 1977)

(Table 3-2) Continued

STI System	Main Events
Enterprise Research Institute	<ul style="list-style-type: none"> • Encouraging technology self-reliance • Legislation for technology development support • Liberalization measure for technology introduction
University	<ul style="list-style-type: none"> • Korea Advanced Institute of Science and Technology (KAIST, 1971) • Beginning of polytechnic college establishment (1970s)
Representative Performance	<ul style="list-style-type: none"> • Import substitution of fertilizers (1960s) • Production of nylon yarn, polyester yarn and raw cotton (1960s) • Polyester film manufacturing technology (1970s) • Design and building technology of a combat ship (1970s) • Success of test-firing a guided weapon (1970s) • Construction of integrated iron and steel mill (POSCO) (1970s) • Development and dissemination of the high-yield rice cultivar, "Tong-il" (1960s–1970s)

Source: MOST, 25-year history of S&T administration (1987), 30-year history of S&T (1997).

[Figure 3-5] Dynamic Structure of Korean Innovation System: Incubation Stage (1962–1979)



Note: 1) The arrow indicates the innovation triangle.

Source: Shin T., Hong S. and Kang J., Korea's strategy for development of STI capacity: A historical perspective, Science and Technology Policy Institute (STEP) (2013).

3.2.3. STI System of the 1980s

The government focused on reducing the difference of technology level compared with that of advanced countries, especially in industrial fields such as machinery, parts, and materials. In response to the government's policy, GRIs supported reorganization of the industrial structure into high-value and technology-integrated industry by focusing the development of cutting-edge industrial technology as a means of macroscopic technology innovation. The global industrial structure had begun to be moved into technology and information integrated industries such as telecommunications, transportation, genetic engineering, and new materials industries in the era of the computer-based high-information society. Therefore, the government concentrated to consolidate the global competitiveness of domestic industry by introducing the market economy principle. In addition, the keyword, "growth" was dropped from the fifth Five-Year Economic and Social Development Plan (1982–1986), which chose stability, efficiency, and balance as strategic keywords and so basically aimed at (1) the price stability and the globalization, (2) the vitalization of the market economy, and (3) the development of the provinces and the alienated sectors.

In 1980, the government integrated 19 GRIs into 12 GRIS and transferred their management authority under the MOST as part of the improvement plan for the R&D system itself and its management. As a result, the internal stability of GRIs was ensured by unifying the management and supervision (administrative operational processes).

The Enlarged Council for Technology Promotion was launched in 1983. In the meetings (11 times, 1983–1986), all the ministers and the representatives from academia, research, and industry sections attended and discussed the 1980s' technology development strategy and its policy direction at the national level. The subjects discussed in the meetings included technical manpower training, fund expansion, taxation support, government purchase, and new technology integration. The reported and discussed main S&T/R&D-related policies in the meetings were directly reflected in the government policies for implementation with the strong administrative support. The Technology Promotion Commission was launched in 1984, comprised of 17 standing commissioners, including the minister of the MOST (chairman), the vice-minister of the Economic Planning Board (EPB), the vice-minister of the Ministry of Finance (MOF), and the presidential chief secretary of economy, and several non-standing commissioners from the private sectors. In the meeting of the commission (13 times, 1984–1986), 37 agendas were discussed and passed. The steering session of the commission was comprised of the general directors of S&T-related ministers, the experts from private sectors, and the presidential secretary of S&T (chairman). Its main functions covered (1) analysis and

assessment of technology level and technology development trend, (2) coordination of technology innovation policies such as S&T manpower development, S&T investment promotion, and S&T system improvement, (3) pre-reviewing and ex post-monitoring of the reporting agendas for the enlarged council and their implementation situation, and (4) management of the presidential instructions for technology innovation.

Based on this administrative support, the national R&D programs had started in earnest in the 1980s, since GRIs began to conduct the specific R&D programs launched by the MOST. The specific R&D programs mainly aimed at (1) the incubation of national S&T capability and (2) the enhancement of core industrial technologies, and they were divided into two categories: (1) the government-oriented R&D programs, which were fully funded by the government in the subjects that are high-risk for investment but carry high public benefit, and (2) the enterprise-oriented R&D programs, which were jointly funded by the government and enterprise in subjects that are high competitive and cutting-edge for industrial technology development. The international cooperation R&D programs were also launched and contributed to overcoming the domestic limitation of professional manpower and technology level, and the technology protection policy of advanced countries. The specific R&D programs by the MOST played a role of pioneer for the advancement of the national R&D system and provided a role model for national R&D programs to other ministries. The evaluation of R&D projects also began to manage them in terms of input-output efficiency (start from 1982).

In the middle of the 1980s, the global economy entered into a long-term depression, and Korea was under economic recession following the overinvestment in the heavy chemical industry. In that circumstance, the sixth Five-Year Economic and Social Development Plan (1987–1991) aimed at (1) the advancement of the economy and (2) the improvement of national welfare under the strategic keywords of efficiency and equilibrium.

On the other hand, the global and domestic economic recession pushed Korean enterprises to concentrate on cost saving and gentrification of products with technology-oriented management strategies. The government also pushed the technology-drive policy for technology innovation. In addition, many benefits for the enterprise research institutes, such as various tax exemptions for special consumption tax of research-purpose samples, local tax of the building and land, and special import permission for research-purpose articles, were also provided. In the result, the number of enterprise research institutes was remarkably increased (53 institutes in 1981 over 1,000 in 1991). The revision of the Act on The Promotion for Technology Development (1981) that allowed the enterprise research institutes to be involved in the specific R&D programs was also one of the drivers for

establishing of enterprise research institutes. This environment change for S&T and R&D promotion changed the role of STI principal bodies. Enterprise research institutes began to play major roles for industrial technology development while GRIs began to focus more on public-purpose research subjects from the end of 1980s.

Fortunately, the level of the Korean economy and technology had grown to a point sufficient for it to hold the Seoul Olympics (24, 1988).

3.2.4. STI System of the 1990s

The decade of the 1990s was an era of cutting-edge technologies with high competition in the fields of such as semiconductors, telecommunications, and fine chemistry. GRIs with national R&D programs, enterprise research institutes with their own R&D projects, and research consortiums among academia, research, and industry with joint R&D programs led the core and original technology development in the globally competitive fields. The government launched multi-ministry and large joint national R&D programs in an effort to secure original technologies, such as a guidance technology development program, a bioengineering technology development program, and a space technology development program. The type of national R&D program was diversified based on the technology area, the character, and the purpose of the program. The management style also began to be changed to goal-oriented management, and this change altered the basic characteristics of national R&D system into not only cooperation but also competition among ministries.

In response to the change of circumstance, the seventh Five-Year Economic and Social Development Plan (1992–1996) mainly aimed at (1) the intensification of enterprise's competition, (2) the enhancement of social equilibrium, (3) balanced development, (4) the open door and globalization, and (5) basic preparation for unification of Korea (South and North) under the strategic keywords of autonomy and competition.

The government decided on the permanent establishment of the Presidential Advisory Council for Science and Technology (PACST) in 1991, and PACST contributed to organizing the voice of S&T fields and to inspiring the attention of the President and politicians for S&T promotion. In parallel, the President attended the Enlarged Council for (Science and) Technology Promotion from 1989, and the government stated their strong will for S&T innovation and for acceptance of extensive opinions from the public, including the representatives of S&T-related fields and non-S&T sectors such as the media and the financial community. In the meeting of the enlarged council (6 times, 1989–1993), the pending issues of

S&T promotion and their solutions were discussed in depth and this meaningful activities basically and continuously supported the S&T development. In 1990s, the meeting of the GSTC was held multiple times as the S&T policies and R&D programs were diversified into various ministries and the GSTC reviewed the Overall Plan of Next Year Implementation for S&T Promotion, including ministries, cities, and provinces, and coordinated their S&T-related policies and programs from 1992. The steering committee of the GSTC practically coordinated them by reflecting the coordination result in the budget allocation of the following fiscal year.

In addition, the Science and Technology Ministers' Conference was organized in 1996 especially for integrated coordination of the national R&D programs, of which the number was explosively increased. The steering committee practically coordinated the national R&D programs among the ministries that were implementing them by the direct reflection of its coordination result in the budget allocation of the following fiscal year. The Special Act for Science and Technology Innovation (1997) supported the role of the Science and Technology Ministers' Conference in substance.

At the end of the 1990s, the MOST launched new national R&D programs to secure core and origin technologies from future-oriented and basic research fields, mainly with universities, such as the originality research program, national research laboratory program, and 21C frontier program (1999). These national R&D programs were conducted in a principle researcher-based operation style in contrast with the institute-based operation style of the existing national R&D programs.

On the other hand, the number of enterprise research institutes exceeded 2,000 in 1995 and 2,600 in 1996 in the main research fields of electric, electronics, machinery, chemistry, and bioengineering. In step with the increase in its numbers, the number of its overseas office was also increased to secure a base of international R&D in response to globalization.

During the 1990s, the advancement of the STI system had been progressed satisfactorily with the S&T administrative organizations and the proper legislation for S&T promotion together. In addition, the STI governance also had been matured and worked in substance with the authorization of S&T-related budget allocation based on the S&T legislation. The evaluation of GRIs had also begun to manage them in terms of the technology development strategy based on their own missions (experiment 1992–1998; start from 1999). The evaluation of national R&D programs was demonstrated to manage them under the national-level S&T/R&D strategy (experiment 1997~2004; start from 2005).

(Table 3-3) Main Events in STI System in the 1980s–1990s

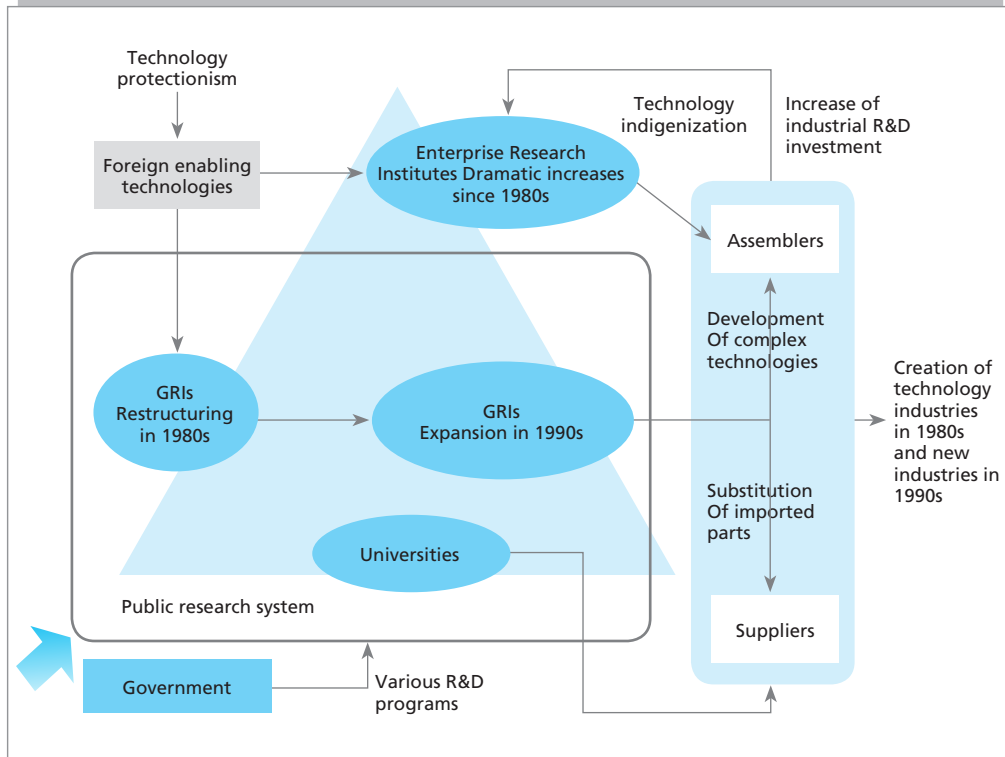
STI System	Main Events
National Innovation	<ul style="list-style-type: none"> • The 5th Five-Year Economic and Social Development Plan (1982–1986) • The 6th Five-Year Economic and Social Development Plan (1987–1991) • The 7th Five-Year Economic and Social Development Plan (1992–1996) - The New Economy Five-Year Plan (1993–1997)
S&T Policy	<ul style="list-style-type: none"> • Expansion of technology development capability for enterprises • Promotion of technology-intensive industry for high value • Industrialization of cutting-edge technology and enhancement of technology innovation • Development of S&T/R&D capability <ul style="list-style-type: none"> - The 5th Five-Year Science and Technology Promotion Plan (1982–1986) - The 6th Five-Year Science and Technology Promotion Plan (1987–1991) - The 7th Five-Year Science and Technology Promotion Plan (1992–1996) - The 5th Five-Year Human Resource Development Plan (1982–1986) - The 6th Five-Year Human Resource Development Plan (1987–1991) - The 7th Five-Year Human Resource Development Plan (1992–1996) - Start of national R&D programs (1982) - Start of national R&D program evaluation (1999)
S&T Legislation	<ul style="list-style-type: none"> • Korea Technology Development Corporation Act (1981) • Act on the Promotion for Software Development (1987) • Daedeok Science Town Management Act (1993) • Special Act for Science and Technology Innovation (1997) • Technology Transfer Promotion Act (2000)
S&T Administration	<ul style="list-style-type: none"> • Korea Foundation for Academy Promotion (KFAP, 1981), National Research Foundation (NRF, 2009) • The Enlarged Council for Technology Promotion (Meeting, 11 times, 1983–1986), The Technology Promotion Commission (Meeting, 13 times, 1984–1986) • Beginning of R&D project evaluation (1982) • Reorganization of MOST (1983) <ul style="list-style-type: none"> - Office of Science and Technology Policy (1985) • Beginning of GRI evaluation (1999) <ul style="list-style-type: none"> - Demonstration of GRI evaluation (1992–1998) • Demonstration of R&D programs (1997–2004) • Presidential Advisory Council for Science and Technology (1989) • Science and Technology Ministers’ Conference (1996) • National Science and Technology Council (NSTC, 1999) • Korea Institute of S&T Evaluation and Planning (KISTEP, 1999, independence from STEPI)
GRIs	<ul style="list-style-type: none"> • Leading the development of basic and cutting-edge industrial technologies for the next growth engine • Mainly playing a role as the chief deputy of government R&D programs • Korea Technology Development Corporation (1981) • Korea Institute of Civil Engineering and Building Technology (KICT, 1983) • Korea Research Institute of Bioscience and Bioengineering (KRIBB, 1985) • Korea Food Research Institute (KFRI, 1987) • Science and Technology Policy Institute (STEPI, 1987)

(Table 3-3) Continued

STI System	Main Events
	<ul style="list-style-type: none"> • Korea Basic Science Institute (KBSI, 1988) • Korea Polar Research Institute (1987) <ul style="list-style-type: none"> - Antarctic King Sejong Station (1988) • Korea Aerospace Research Institute (KARI, 1989) • Korea Institute of Industrial Technology (KITECH, 1989) • National Science Museum (1990) • Korea Institute of Oriental Medicine (KIOM, 1994) • Korean Academy of Science and Technology (1994) • Korea Railroad Research Institute (KRRI, 1996)
Enterprise Research Institute	<ul style="list-style-type: none"> • Beginning of government contribution (1981) • The Enlarged Council for Technology Promotion (1982) • Increasing the number of enterprise research institutes (1990s) • Establishing the private-leading technology innovation system (1990s)
University	<ul style="list-style-type: none"> • Korea Institute of Technology (1983) • Beginning of basic research in earnest (1980s) • Beginning of master and doctoral course by academy-research-industry cooperation (1991) • Enhancement of universities' research capability (1990s)
Representative Performance	<ul style="list-style-type: none"> • 64K DRAM (1983), 254K DRAM (1984), 1M DRAM (1986), 4M DRAM (1989), 64M DRAM (1993), 256M DRAM (1994), 1G DRAM (1996) • 8 bit small-size computer for education (1984) • Electronic switching system "TDX-1" (1986), "TDX-10" (1991) • 32 bit UNIX computer (1987) • A domestic host computer for administrative computer network, "TICOM" (1991), High speed medium-size computer "Host Computer III" (1994), "Host Computer IV" (1998) • Satellite "KITSAT-1" (1992), "KITSAT-2" (Technology self-reliance) (1993) • Science rocket "KARI KSR-1", "KARI KSR-2" (1993) • Synchronous international mobile telecommunication system, "IMT-2000" (1999)

Source: MOST, 25-year history of S&T administration (1987), 30-year history of S&T (1997), 40-year history of S&T (2008).

[Figure 3-6] Dynamic Structure of Korean Innovation System: Expansion Stage (1980–1999)



Note: The arrow indicates the innovation triangle.

Source: Shin T., Hong S. and Kang J., Korea's strategy for development of STI capacity: A historical perspective, Science and Technology Policy Institute (STEP) (2013).

3.3. Practical Lessons for STI Governance System

From the history of the development of the STI governance system, several practical lessons can be revealed for the consolidation of the STI system as an essential engine for national development and innovation of a society, culture, and economy.

The sophisticated mapping between the national-level S&T promotion plan and the national economic development plan is the first priority to harden the basis for the STI governance system. After the formulation of the first Five-Year Economic Development Plan, the Korean government always established the S&T promotion policies together with the S&T promotion plans and the human resource development plans in response to the economic development plans.

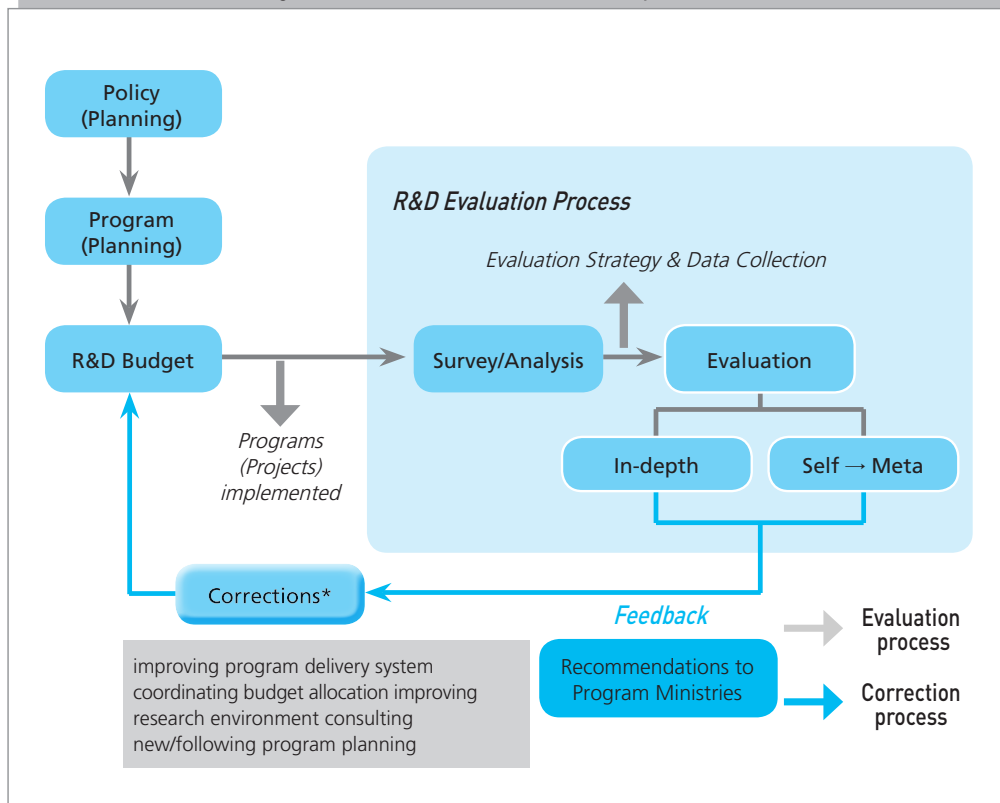
Since the mapping was well matched, the improvements of S&T legislation and administration were directly followed to support the implementation of S&T

promotion stably and continuously. The improvements of S&T legislation and administration could contribute to coordinate the S&T policies, the R&D programs, and their budget allocation at the national level. This means that the decision-making authority on S&T-related matters was centralized into one particular administrative system in terms of STI governance system.

In the implementation of S&T promotion, the roles of STI principal bodies, the government, GRIs, universities, and enterprise research institutes were clearly divided at the national level in response to changing circumstances. In the 1960s–1970s, the government and GRIs played the main roles for industrial technology development and S&T manpower training, while universities and enterprise research institutes were premature in doing so. However, in the 1980s, universities began to play a role in basic research and S&T human resource development and enterprise research institutes began to develop cutting-edge industrial technologies while the government and GRIs began to change their main role into public-purpose research and technology development. From the 1990s, universities concentrated on future-oriented basic research and enterprise research institutes focused on core & cutting-edge technology development, while the government and GRIs were fully responsible for public-purpose research and large research infrastructure construction.

When the STI governance system was expected to get into a frame, the R&D evaluation system at the national level was added into it, and the STI governance system was finally consolidated by the end of the 1990s. However, it should be considered that this R&D evaluation system was introduced after the national R&D program launched (1982) to evaluate them.

[Figure 3-7] National R&D Evaluation System (1999)



Source: Lee S.H., Science and technology innovation governance system development (presentation ppt.), interim reporting and policy practitioners' workshop, 2016/17 Knowledge Sharing Program with PASET, Korea Development Institute (KDI) (2016).

4. Conclusion and Policy Recommendation

4.1. Strength and Weakness of the STI Governance System of Senegal

For the national long-term plans for S&T development, Senegal does not yet have S&T policy documents developed specifically. The direction of strategy and research planning is concerned with policy formulation. However, explicit measures for the development of S&T are implemented or scheduled under the Plan for the Development of Higher Education and Research (PDES 2013–2022). as the detailed goals of the plan include (1) to develop a national strategic plan for research, innovation, science, and technology, (2) to create a National Research and Innovation Council, (3) to establish a National Research and Innovation Fund to ensure the implementation of the priority research, (4) to institutionalize research

evaluation by the National Quality Assurance Authority (ANAQ), (5) to implement the special program for equipment of higher education and research institutions laboratories initiated by the President of the Republic, (6) to implement the National Centre of Scientific and Technical Research (CNRST) that will allow pooling of Human Resource and Heavy Equipment (PATRIE), and (7) to improve access to Information Resource and Library Reception Capacity (CNDST).

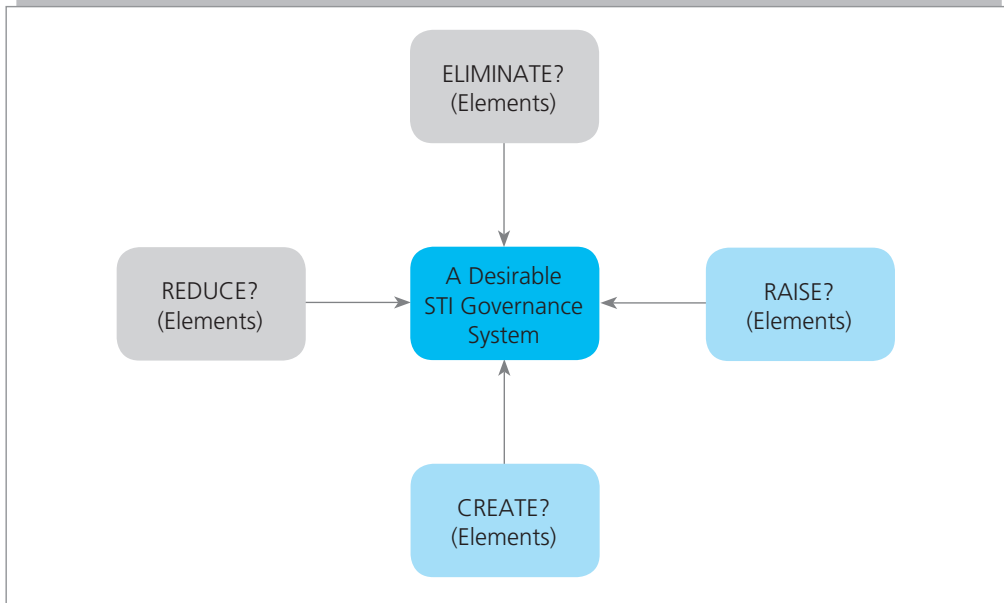
Therefore, when the current state of the STI governance system of Senegal was considered, there are several weaknesses identified: (1) inexistence of a clearly formulated STI policy, (2) compartmentalization of research globally and particularly of the STI, (3) weak attention given to the STI during the budgetary discussions, (4) weak statute for researchers and (5) weak perception of the impact of STI on the development from an S&T perspective. In addition, the fact that there is resistance to change and the private sector perceives great economic risks from a social and economic perspective should be seriously considered.

However, when political stability, new industrial development (industrial parks), and PSE are considered there are solid strengths: (1) commitment at the highest level (reform in MHER and PDESR 2013–2022), (2) high public investment for infrastructure, (3) good quality of human resources in STI, (4) development of ICT, (5) existence of universities, research centers, and other STI promotion agencies, and (6) new governance from an S&T perspective.

4.2. Eliminate-Reduce-Raise-Create (ERRC) Elements to Improve the STI Governance System of Senegal

The Eliminate-Reduce-Raise-Create (ERRC) Action Framework is usually practical to draw a blue ocean strategy through the answering process on four important questions to set a new value curve in a business. In this report, the four concepts (ERRC) of the questions are borrowed, and the elements (ERRC elements) from the concepts for formulating a desirable STI governance system are offered as examples. The modified four questions are as follows: (1) what elements should be eliminated for formulating a desirable STI governance system in the current situations, which are presumed as natural?, (2) what elements could be reduced for formulating a desirable STI governance system in the current situations, which should be eliminated but could cause abrupt confusion if eliminated immediately?, (3) what elements could be raised for formulating a desirable STI governance system in the current situations, which are practically needed to support or strengthen right away, continuously and in phase?, and (4) what elements should be created for formulating a desirable STI governance system in the current situations, which are fundamentally needed but not prepared yet?

[Figure 3-8] ERRC Action Framework for a Desirable STI Governance System



Source: Modified, Kim W.C. and Mauborgne R., Blue ocean strategy, Kang H.G. translation, Kyobo Book Center, Korea (2005).

Based on the in-depth consideration of the current state of STI governance system of Senegal and its main problems, and with the practical discussions on the strengths and the weaknesses of Senegalese STI governance system and the practical lessons from the building progress of the Korean STI governance system, the ERRC Action Framework was applied to draw a direction for improving the STI governance system of Senegal. The ERRC elements that could be offered as examples in the mid and long term for a desirable STI governance system are proposed below.

(Table 3-4) ERRC Elements for a Desirable STI Governance System of Senegal

Eliminate Elements	Reduce Elements
Compartment among ministries	Illiteracy Dissatisfied quality or irrelevance of vocational education Severance for integrated S&T/R&D budget coordination at the national level
Raise Elements	Create Elements
Investment of government and private S&T/R&D administration S&T/R&D priority setting S&T/R&D manpower and its quality S&T/R&D monitoring and evaluation system STI governance (research governance) Clear role allocation (government, GRIs, university, enterprise research institute) Research capability (GRIs, university, enterprise research institute) Statute for researchers Presidential leadership in S&T promotion Attention on S&T promotion for national development	STI policy A national research and innovation council (NRIC)* A sophisticated mapping between S&T promotion and PSE at the national level S&T/R&D legislation The full authority of S&T/R&D budget allocation ¹⁾ National body for S&T/R&D evaluation with S&T/R&D information reporting system

Note: Transfer the full authority of S&T budget allocation to a particular organization such as NRIC* and MHER.

4.3. Policy Recommendation for STI Governance System Development of Senegal

The main S&T issues noted by the Senegal government are as follows: (1) development of human resources – current state: only approximately four researchers per 10,000 inhabitants and around 20% with PhDs (2011), (2) development of international-class infrastructure and scientific equipment – current state: lack of heavy scientific equipment, (3) organizational and institutional capacity – current state: lack of synergy between research institutes falling under different ministries, (4) uptake of research results and technology transfer – current state: very weak and not enough transformation of research results into innovation, (5) funding mechanisms and sources – current state: mainly reliant on public funding, which is insufficient, and (6) scientific culture promotion – current state: no policy and no infrastructure.

On the other hand, in reference to the issues above, the recent measures to tackle the challenges in S&T development are as follows: (1) increase the density

and the level of qualification of researchers by creation of new positions at the universities (210 new positions in 2016) and enhancement of the researchers statute at Senegalese research institutions (e.g., ISRA) to make research more attractive, (2) presidential program to equip scientific laboratory (30 million USD) and project of the knowledge city with a shared research platform, such as a center for electronic microscopy, molecular genetic platforms, intensive parallel computers, etc., (3) project to set a multi-stakeholder National Council for Research and STI, (4) creation of a directorate in charge of research uptake and technology transfer - creation and strengthening of support structures for business creation (incubators in several universities, etc.) and support of innovative projects by the Ministry of Higher Education, Research and Innovation and the Senegalese Agency for Industrial Property and Technologic Innovation, (5) new governance of universities involving private sector - transformation of the national research impulse fund to a National Fund for Research and Innovation to attract other resources and taking advantage of new funding opportunities at regional and international level, and (6) construction of a "Maison de la Science (Home of the Science)" including, for example, a planetarium, aquarium, and science demonstration area.

In addition to the recent measures, a strategic plan on the STI governance system of Senegal could be suggested to develop it at the national level. This strategic plan is drawn from the delicate consideration on the ERRC elements for a desirable STI governance system of Senegal. In conclusion, the policy recommendations comprising the strategic plan are offered here:

- (1) The strategic roadmap between S&T policies and PSE should be defined. As shown in the practical lessons of Korean experience and at the Create elements, the sophisticated mapping between the national-level S&T promotion plan and the national economic development plan is the first priority to harden the basis for the STI governance system.
- (2) The centralization of authority for decision making and budget allocation on S&T and research activities should be seriously considered. This authority centralization with open communication could result in more efficient and effective coordination of S&T policies, research activities, and budget allocation at the national level.
- (3) The aforementioned authority centralization has to be done in parallel with proper legislation, if not it would probably cause an argument among the principal bodies of STI such as ministries, GRIs, universities, and enterprise research institutes. The legislation of S&T and research activities could contribute to stable and continuous implementation of S&T promotion.

- (4) Formation of a national body for S&T/R&D evaluation at the national level with S&T/R&D information reporting system should be strategically considered. The evaluation system could consolidate the STI governance system significantly by monitoring and modifying the S&T policies and research activities through evaluation feedback and corrections. This evaluation system at the national level could help to increase the definition of the strategic roadmap through its periodic readjustment.

On the other hand, if the centralization strategy for STI governance system suggested above is accepted, it could be adopted that a select and concentration strategy for STI policy. The strategies for STI governance and policy could be implemented at the working level for the STI governance system development of Senegal in the following order:

- (1) Sorting S&T-related and research activities out from PSE by an authorized organization (named "A");
- (2) Vesting the authority to A to collect all information of the S&T-related and research activity sections sorted previously, one by one;
- (3) Establishing S&T/R&D policies in one STI policy at the national level and adjusting them to PSE by A, on a short-term basis;
- (4) Sorting the private's roles in the S&T-related and research activity sectors sorted previously for establishing a good public-private partnership;
- (5) Vesting the authority to A to coordinate and allocate the budget of S&T-related and research activity sections sorted previously at the national level, step by step - it could be started by allowing A to ask funding agencies of research institutes to discuss the priority setting of research subjects at the national level according to the S&T/R&D policies, which are adjusted to PSE;
- (6) Vesting the authority to A to assess and evaluate the performances of S&T-related and research activities in each sector, which are sorted previously, systematically, in a mid-term base.

All the working-level implementation procedures suggested as a strategic plan for developing a desirable STI governance system with the centralization strategy should be executed in parallel with careful consideration of the ERRC . In particular, compartment among ministries is the root of the barriers to S&T/R&D coordination and of the ministerial division of the S&T and innovation portfolio at the national level.

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