



**KINGDOM OF CAMBODIA**  
NATION | RELIGION | KING

**Royal Government of Cambodia**

# NATIONAL RESEARCH AGENDA 2025



Endorsed by



National Council of Science,  
Technology & Innovation

Prepared by



Ministry of Industry, Science,  
Technology & Innovation



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# **National Research Agenda**



*Endorsed by:*  
**NATIONAL COUNCIL OF SCIENCE,  
TECHNOLOGY & INNOVATION**



*Prepared by:*  
**MINISTRY OF INDUSTRY, SCIENCE,  
TECHNOLOGY & INNOVATION**

## Foreword

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The Kingdom of Cambodia has successfully advanced from the low-income to the lower-middle-income status and now aspires to become an upper-middle-income economy by 2030 and a high-income economy by 2050. These ambitious Vision 2030 and 2050 mean that the country has to embolden its structural transformation, specifically the transition from low productivity and labor-intensive economic activities to higher productivity and skill-intensive activities which are the core characteristics of a knowledge-based society. Such a society rests upon research and development (R&D) to build human capital, identify societal problems and tackle them, and develop innovative methods and products, among many others, all leading to robust, inclusive, and sustainable socio-economic development.

Moving forward necessitates the country to strategize and plan for emerging internal and external megatrends that the country is facing. The global COVID-19 pandemic, complex geopolitics, environmental degradation, climate change, energy and food insecurity, and market accessibility are major challenges that have taken their toll on the country on many fronts. Meanwhile, enhanced multilateralism, increased trade liberalization, and rapid scientific and technological advancement brought by the Fourth Industrial Revolution present new opportunities for the country to tap into. It is in this regard that quality and mission-oriented research becomes more important than ever for the national development. The country needs to continue strengthening and standardizing the national research ecosystem and ensures its alignment with the national development context and directions.

This National Research Agenda (NRA) 2025 is indeed timely relevant. It is a high-level guidance that aims to incentivize and promote R&D and innovation so as to humbly contribute to the implementation of pertinent policy frameworks, including the Cambodia's Science, Technology & Innovation Roadmap 2030, in addition to the realization of the Vision 2030 and 2050. The guidance determines five research bottlenecks; eight research missions for local food, energy supply, education, electronic and mechanical spare parts, cloud-based services, electricity and portable water, carbon neutrality, and digitally-enhanced health; key stakeholders; and four pathways for these actors to address the bottlenecks and achieve the missions' targets via dynamic collaboration for the next decade. I have absolute confidence that the NRA will bring about a more favorable research ecosystem crucial and suitable for the country's further development.

As the Prime Minister, I highly encourage all the involved stakeholders, including line ministries, other government agencies, universities, research institutes, private sector, and development partners to closely work together in accordance with this NRA under the leadership of the National Council of Science, Technology & Innovation (NCSTI) and the coordination of the



Ministry of Industry, Science, Technology & Innovation (MISTI). I have no doubt that, with our joint commitment and efforts, we will succeed in implementing the NRA together.

I would like to congratulate on the outstanding leadership of **His Excellency Kitti Seththa Pandita CHAM Prasidh**, Senior Minister, Minister of MISTI, and Chairman of NCSTI, for leading the General Department of Science, Technology & Innovation to develop this significant document. I would also like to express my sincere appreciation to the United Nations Economic and Social Commission for Asia and the Pacific for their support throughout the formulation process of the NRA.



Phnom Penh, 18 January, 2023



**Samdech Akka Moha Sena Padei Techo HUN SEN**

## Preface

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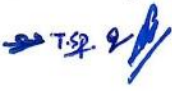
The Royal Government of Cambodia (RGC), under the leadership of **Samdech Akka Moha Sena Padei Techo HUN SEN**, Prime Minister of the Kingdom of Cambodia, understands that STI will be fundamental for Cambodia to achieve its ambitious vision to transform the nation and become a high-income country by 2050. To support the missions, the Ministry of Industry, Science, Technology & Innovation (MISTI) has been entrusted to coordinate and execute initiatives to strengthen scientific research, technological development, and innovative capacity in the context of the fourth industrial revolution.

To comply with the decision of the royal government and fulfill the assigned tasks successfully, MISTI has developed National Research Agenda 2025 (NRA) which serves as the national strategic document that guides the efforts of line ministries and other key stakeholders toward creating a research ecosystem suitable for the ambitions of Cambodia's Vision 2030 and 2050. Additionally, NRA is one of the essential tools to enforce the implementation of Cambodia's Science, Technology & Innovation Roadmap 2030 launched in 2021.

The NRA has been produced with active support from the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and substantial contributions from our key relevant stakeholders. It integrates evident-based inputs and advice from relevant key human resources from 12 line ministries, 12 leading higher education institutions and research centres, and 8 relevant private sectors.

The NRA is built on eight missions and each mission has explicit targets to be committed on until 2030. The first mission seeks to ensure that 70 percent of Cambodia's food consumption is produced locally. The second mission is to ensure that 90 percent of the energy consumed in Cambodia is generated domestically. The third mission seeks to strengthen Cambodia's education to meet international quality and standards. The fourth mission seeks to ensure that Cambodia exports 70 percent of the electronic and mechanical spare parts produced in the country. The fifth mission seeks to ensure that Cambodia's cloud-based services development is on par with ASEAN. The sixth mission seeks to secure that Cambodia provides reliable electricity and potable water are provided for all. The seventh mission seeks to realize a carbon-neutral country. Last but not least, the eighth mission seeks to ensure that all Cambodians have access to digitally-enhanced health services.

I commend and endorse the splendid efforts of all who worked together to develop this national research agenda document for the country. The NRA will be an essential strategy to realize Cambodia's Vision 2050 through its co-created missions by enabling a more efficient allocation of funds and building synergies between the research efforts of researchers, the private sector, and policymakers.

As Senior Minister, Minister of MISTI , and the Chair of NCSTI, I commit to promote these eight missions for the sustainable and inclusive growth of Cambodia. 

Phnom Penh, 28 December 2022

**Senior Minister  
Minister of Industry, Science, Technology  
& Innovation  
and Chair of National Council of Science Technology  
& Innovation**



**Kitti Settha Pandita CHAM Prasidh**

## Acknowledgment

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This National Research Agenda was produced by the Ministry of Industry, Science, Technology & Innovation (MISTI), under the supervision of H.E. Dr. Hul Seingheng, Head of the Secretariat of NCSTI and Director General of the General Department of Science, Technology & Innovation (GD/STI); and with the assistant of the Trade, Investment and Innovation Division of the Economic and Social Commission for Asia and the Pacific (ESCAP).

An initial blueprint was conceptualised by Ms. Francie Sadeski, Mr. Matthieu Lacave, Ms. Laura Rennie, and Ms. Teresa Moreno Martos from Technopolis Group; with the support of Mr. Rafael Torquato Cruz, Project Officer, Technology and Innovation Section (ESCAP), and under the supervision of Ms. Marta Pérez Cusó, Economic Affairs Officer (ESCAP).

The document incorporates insights gathered during the process of co-creating this National Research Agenda, a process endorsed by MISTI, and duly managed by Dr. Srun Pagnarith, Director of Department of Science, Technology & Innovation Policy, with the support of the following people in the department of STI policy:

- |                      |  |
|----------------------|--|
| - Dr. Siev Sokly     | Deputy Director                                      |
| - Dr. Seng Touch     | Deputy Director                                      |
| - Mr. Khorn Sokheng  | Chief of Office of Policy and Regulation Development |
| - Mr. Ith Hunly      | Chief of Office of Policy Data                       |
| - Mr. Yang Monyoudom | Officer  |
| - Mr. Lim Seavmeng   | Officer  |
| - Ms. Meun Rathana   | Officer  |
| - Ms. Van Chhorye    | Officer  |

A special appreciation to all departments of GD/STI, MISTI, for their valuable contribution the support in this NRA development process.

## Executive Summary

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The development of national research capabilities can benefit virtually all sectors of the Cambodian economy and society. This requires a self-reliant national research ecosystem, with solid institutional support and that encourages dynamic collaborations between the public and private sector, universities and research institutes, civil society and development partners. The National Research Agenda (NRA) guides the efforts of these stakeholders toward creating a research ecosystem suitable for the ambitions of Cambodia's Vision 2030 and 2050.

The NRA defines the priority themes to be explored by Cambodian researchers and the necessary policy instruments to support them in the next decade.

The NRA has identified eight research missions that will be at the centre of research investments and activities:

- **'Local food'**: 70 percent of Cambodia food consumption is produced locally
- **'Reliable Energy Supply'**: 90 percent of energy consumption is generated locally
- **'Quality Education'**: Education meets international quality standards
- **'Electronic and mechanical spare parts'**: Cambodia exports 70 percent of the electronic and mechanical spare parts produced in the country
- **'Cloud-based services'**: Cambodia's cloud-based services development is on par with ASEAN
- **'Electricity and potable water'**: All Cambodians have access to reliable electricity and safe potable water
- **'Carbon neutrality'**: Cambodia becomes a carbon neutral country
- **'Digitally-enhanced health'**: All Cambodians have access to digitally-enhanced health services

These missions were co-created through a multi-stakeholder process and focus on research activities and resources on the achievement of national developmental goals, including those stated in the Rectangular Strategy Phase IV, the National Strategic Development Plan (NSDP) 2019-2023, and the Cambodia Sustainable Development Goals (CSDG) Framework for 2016-2030.

Currently, Cambodia's research system faces five major challenges: underinvestment in R&D; limited alignment between research activities and national challenges, private sector activities and policymaking needs; limited research capacity in the public and private sectors; a weak research infrastructure; and limited academia-industry linkages.

To address these challenges and achieve the eight research missions, the NRA has proposed four complementary pathways:

1. **Investing in research to support the eight research missions.** This will include establishing a national research foundation and a national research fund to support investments in research and guide such investments towards the eight research missions.
2. **Strengthening the role and capacities of public research institutions** through the establishment of a national research system, national research fund, centers of excellence in research, and a national research publication platform.
3. **Supporting research careers.** This will require recognising the research profession, introducing a research career framework and establishing an attractive system of incentives for researchers to support research careers in the public and private sectors.



4. **Incentivising research activities and collaboration.** This will require enhancing coordination among research promoting institutions, setting up an adequate research management system; incentivising industry-academia-government and international collaborative research; building the absorptive capacity of firms and their ability to conduct R&D and innovation activities; establishing key infrastructure to support technology transfer and adoption; exploring means to incentivise R&D investments through tax incentives; and supporting greater enforcement of intellectual property rights.

Promoting research is a long-term strategic investment in the future of the country and requires the participation of a wide range of national stakeholders, including line ministries, public research institutions, universities, private sector, and international development partners, in the design, financing and implementation of the envisaged instruments.

To ensure that the NRA delivers its promise, a monitoring and evaluation system will be established to monitor the implementation of the NRA and to evaluate the impact of the measures implemented.

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## Abbreviations

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ASEAN	Association of Southeast Asian Nations
CADT	Cambodia Academy of Digital Technology
CICP	Cambodian Institute for Cooperation and Peace
CSDGs	Cambodian Sustainable Development Goals
ESCAP	Economic and Social Commission for Asia and the Pacific
GDP	Gross Domestic Product
HEI	Higher Education Institution
ICT	Information and Communications Technology
MAFF	Ministry of Agriculture, Forestry and Fisheries
MCFA	Ministry of Culture and Fine Arts
MEF	Ministry of Economy and Finance
MFAIC	Ministry of Foreign Affairs and International Cooperation
MISTI	Ministry of Industry, Science, Technology & Innovation
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MLVT	Ministry of Labour and Vocational Training
MME	Ministry of Mines and Energy
MoC	Ministry of Commerce
MoD	Ministry of National Defence
MoEYS	Ministry of Education, Youth and Sports
MoH	Ministry of Health
Mol	Ministry of Interior
MoP	Ministry of Planning
MPTC	Ministry of Post and Telecommunications
MPWT	Ministry of Public Works and Transport
MoWRAM	Ministry of Water Resources and Meteorology
NCSTI	National Council for Science, Technology & Innovation
NRA	National Research Agenda
NRF	National Research Foundation
NSDP	National Strategic Development Plan
OECD	Organisation for Economic Cooperation and Development
R&D	Research and Development
RGC	Royal Government of Cambodia
RMS	Research Management System
RS-IV	Rectangular Strategy Phase IV
RTO	Research and Technology Organisation
SME	Small and Medium-sized Enterprises
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovation
SWOT	Strengths, Weaknesses, Opportunities and Threats

## Definitions

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**Research** comprises the creative and systematic work undertaken to increase the stock of knowledge – including knowledge to serve socio-economic development, humankind, culture and society – and devise new applications of available knowledge

**Researchers** are professionals engaged in the conception, creation of new knowledge or innovation. They conduct scientific research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods.

**Knowledge** encompasses the established facts, concepts, ideas and theories about certain aspects of the world. Knowledge usually includes theoretical concepts and ideas as well as practical understanding based on research, scientific experiments and the experience of having performed certain tasks. Disciplinary knowledge includes subject-specific concepts and detailed content, such as that learned in the study of mathematics and language. Interdisciplinary knowledge involves relating the concepts and content of one discipline/subject to the concepts and content of other disciplines/subjects. Epistemic knowledge is the understanding of how expert practitioners of disciplines work and think. This knowledge helps students find the purpose of learning, understand the application of learning and extend their disciplinary knowledge. Procedural knowledge is the understanding of how something is done, the series of steps or actions taken to accomplish a goal. Some procedural knowledge is domain-specific, some is transferable across domains.

**Innovation**, as defined by the Oslo Manual 2018, refers to 'a new or improved product or process (or combination thereof) that differs significantly from the unit's<sup>1</sup> previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)'. Therefore, materialization of knowledge from research in the form of serving market or process changes with socio-economic development is the foundation of innovation. Innovation is conducted by users, suppliers and consumers everywhere – in government, business and non-profit organizations, and across borders, sectors, and institutions. The manual identifies eight broad types of activities that can be undertaken in pursuing innovation: 1. research and experimental development (R&D) activities; 2. engineering, design and other creative work activities; 3. marketing and brand equity activities; 4. IP-related activities; 5. employee training activities; 6. software development and database activities; 7. activities related to the acquisition or lease of tangible assets; and 8. innovation management activities.

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<sup>1</sup> The unit can be a firm, government unit, a non-profit institution or a household.

# 1. Introduction

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To realize the Vision 2050 of transforming Cambodia into an inclusive and sustainable high-income economy, the Royal Government of Cambodia (RGC) has formulated overarching strategies such as the Rectangular Strategy Phase IV (RS-IV), the National Strategic Development Plan (NSDP) 2017-2023 and the Industrial Development Policy 2015-2025. Together with the Cambodian Sustainable Development Goals (CSDGs) Framework, they set the path for enhancing national socio-economic development.

In December 2019, **Samdech Akka Moha Sena Padei Techo HUN SEN**, Prime Minister of Cambodia, approved the **National Science, Technology & Innovation Policy 2020-2030** (National STI Policy). The policy seeks to harness science, technology and innovation (STI) to support inclusive and sustainable development in line with the national priorities embedded in key national strategic documents and the 2030 Agenda for Sustainable Development. The implementation of the National STI Policy is supported by **Cambodia's Science, Technology & Innovation Roadmap 2030** (STI Roadmap 2030), approved in July 2021.

**One of the critical actions identified in the roadmap is formulating a shared national research agenda (NRA).**

**Research is the generation of new knowledge.** Frontier scientific developments in research have clear value in creating new knowledge. However, when they are absorbed and implemented beyond the laboratory, research outcomes can solve problems, enable innovation, increase productivity and added value and enhance competitiveness, contributing to socio-economic development, national security and interest, and global and regional integration.

Investing in research is paramount for developing frontier technologies that will reshape industry, healthcare and communications and provide urgently needed solutions to global challenges like climate change<sup>2</sup>. Moreover, public funding has been crucial for developing many advanced technologies driving growth today, from the digital economy to genomics.

Cambodia's NRA **sets the direction** for research to be conducted over the next five to ten years. It is overarching as it **defines the core research themes and the policy mix to support research activities**. It is a high-level guide to help achieve a leap in scientific research in the upcoming challenging future. Cambodia's NRA will be implemented by relevant institutions, including concerned line ministries and research and academic institutions, and will seek to encourage research among private sector organisations, particularly in priority research areas. The NRA will be implemented under the coordination of the Ministry of Industry, Science, Technology & Innovation (MISTI), and under the leadership of the National Council of Science, Technology & Innovation (NCSTI). The NRA will be further specified through the development of sectoral research agendas under the cooperation with line ministries and through the development of institutional research agendas under the remit of research institutes and universities.

Setting research priority goals is key to achieving Cambodia's Vision 2050, as it enables a more efficient allocation of funds and building synergies between the research efforts of researchers, the private sector, and policymakers. A mission-oriented research methodology was used to establish the goals of the NRA. This methodology follows a systemic, outcome-focused and bottom up approach to formulate research policy<sup>3</sup>. Mission-oriented research can enhance

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<sup>2</sup> OECD 2017.

<sup>3</sup> European Commission 2018, p. 14-15.

the impact of research by harnessing the collective capabilities and interests of the national and global research community. It leads to bottom-up solutions and has a clear endpoint, focusing on achieving a specific goal related to improving societal welfare. It is not only about conducting research at the scientific frontier but also about enabling knowledge absorption and application. It leverages both applied and fundamental research without prioritizing one over the other.

Mission-oriented research is focused on a concrete outcome; therefore, it has greater potential to generate an immediate and visible impact on society and the economy. It encourages researchers to reflect from early stages on how their research could be translated into practical applications to address broader societal challenges. Moreover, consultations with relevant stakeholders provide researchers with a more comprehensive understanding of what is relevant to a broader ensemble of interested groups, guiding both the research questions and outcomes towards producing more immediate impacts. The institutional framework of mission-oriented research is built upon a set of policy instruments that take into account both supply and demand considerations. Such instruments must be coherent with pre-existing horizontal policies (such as policies related to promoting education, skills, training, research and innovation) and vertical policies (thematic policies such as health, environment and energy).

“Mission-oriented research seeks to provide a **systemic approach towards achieving a specific goal**, using a solution-based, outcome-oriented approach.”

An extensive assessment of Cambodia's national research ecosystem and current developmental challenges was conducted to inform the design of this NRA, which included: (1) a literature review of strategic documents and academic research papers; (2) a questionnaire survey with government officials, universities and research institutions, and the private sector; and (3) direct interviews with key stakeholders. Based on this assessment, a background report has been prepared to serve as the analytical basis for defining the priorities of this NRA.

Eight research missions are at the centre of Cambodia's NRA. To ensure alignment with Cambodia's national development strategies. These missions focus on research that Cambodia shall commit until 2030 in the prioritized areas, and have been co-created through a multi-stakeholder process and approved by the **Inter-Ministerial Working Committee for the Development of the National Research Agenda**<sup>4</sup>.

These missions are namely:

- ***'Local food': 70 percent of Cambodia food consumption is produced locally***
- ***'Reliable Energy Supply': 90 percent of energy consumption is generated locally***
- ***'Quality Education': Education meets international quality standards***
- ***'Electronic and mechanical spare parts': Cambodia exports 70 percent of the electronic and mechanical spare parts produced in the country***
- ***'Cloud-based services': Cambodia's cloud-based services development is on par with ASEAN***
- ***'Electricity and potable water': All Cambodians have access to reliable electricity and safe potable water***

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<sup>4</sup> See Appendix A for the full membership of Inter-Ministerial Working Committee for the Development of NRA.



- ***‘Carbon neutrality’: Cambodia becomes a carbon neutral country***
- ***‘Digitally-enhanced health’: All Cambodians have access to digitally-enhanced health services***

Specific research topics associated with each of the eight research missions were identified through consultation workshops and a mapping exercise of research activities in Cambodia.

The NRA outlines several policy measures and the rationale for their inclusion. Enabling policy measures were selected based on input from consultation workshops with government officials, universities, research institutions, and the private sector. The successful operationalization of the measures proposed by this NRA will require the development of specific and concrete policy actions to be implemented through appropriate frameworks, plans and strategies, based on further consultation with key stakeholders where necessary.

This policy document is structured as follows: Section 2 describes the overarching goals of the agenda and the commitment to increase investment in research which is required to achieve said goals. Section 3 provides an overview of the state of research and innovation in Cambodia. Section 4 describes the actions that need to be taken by NCSTI and MISTI (in partnership with relevant ministries and other actors) to enhance research and innovation activities further. Section 5 provides key elements to consider for the implementation of the NRA.

## 2. Goals of the National Research Agenda

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***The agenda's overarching goal is to realize Cambodia's Vision 2030 and 2050 by incentivising and promoting research, development and innovation.***

The strategic prioritisation of research will help address the challenges faced by Cambodia as it stimulates endogenous responses to critical issues and encourages the development of new products, services and processes that support the achievement of national goals. Under this assumption, the eight research missions have been defined collectively to provide direction to national research, ensuring that resources and research capabilities are efficiently harnessed to support national development goals.

There is consensus among all relevant ministries, higher education institutions (HEIs), research institutions, and the private sector that **Cambodia must be ambitious in its development goals and that research plays a decisive role in contributing to these goals**. Furthermore, the scientific and international communities recognise **the importance of research in supporting the transition towards a knowledge-based economy**, creating wealth and employment, and addressing developmental challenges.

Cambodia's research ambitions can only be achieved with the support of an equally ambitious financial commitment. Quality research requires adequate framework conditions, such as: appropriate funding levels and funding mechanisms; a research system framework and a research career framework; adequate human capital and physical infrastructure; and enhanced research coordination. **Investments must be made to develop and strengthen national research capacities and infrastructure**. Cambodia has set as a target to achieve by 2030 a combined public and private investments in STI of 1 percent of gross domestic product (GDP), and that the public investments in STI by 2030 will be at least 0.5 percent of GDP.<sup>5</sup>

The NRA will support the achievement of various goals highlighted in flagship national development strategies and policies. The Rectangular Strategy for Growth, Employment, Equity and Efficiency, now in its fourth phase (RS-IV), is a long-term strategy to stimulate high growth, enhance competitiveness, improve the quality and quantity of jobs (particularly for youth), reduce poverty, and strengthen public institutions' capacity and governance. The RS-IV highlights, directly and indirectly, the importance of national research in all of its four rectangles. Under the human resources rectangle, the strategy seeks to improve research on teaching methods; enhance capacity-building and resources to support learning, teaching and research; increase research funds in higher education; and enhance research on health and diseases. The second rectangle seeks to foster economic diversification, notably readiness for the digital economy and the fourth industrial revolution, the third rectangle seeks to promote private sector development, modernisation of small and medium enterprises (SMEs), and employment. Finally, under the sustainable development rectangle, the strategy seeks to promote research in the agricultural sector to increase agricultural land's potential.

The National Strategic Development Plan (NSDP) 2019-2023<sup>6</sup> has been designed to contribute to the implementation of the RS-IV and achieve the CSDGs. The key policy priorities of the strategy include: (1) acceleration of governance reform: the core of the rectangular strategy, (2) human resource development, (3) economic diversification, (4) private sector and market development, and (5) inclusive and sustainable development. One of the critical actions of the strategy is to enable effective and efficient research at the national level. The strategy also advocates for the promotion of research, the transfer of technologies, and the creation of

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<sup>5</sup> MISTI 2021. (put full reference, STI roadmap?)

<sup>6</sup> Government of Cambodia 2019.

mandatory research funds. Moreover, it foresees the strengthening of research institutions, the implementation of research programmes, and the commercialisation of results.

The Cambodian Sustainable Development Goals (CSDGs) Framework for 2016-2030 has been used, together with the RS-IV, as the base for the NSDP. The framework establishes 18 Cambodian sustainable development goals – the 17 global Sustainable Development Goals and an additional one related to de-mining and remnants of war. It also contains 105 targets, two of which have an explicit research component. One of the targets aims to enhance scientific research, increase the number of researchers, and promote public and private research to achieve the CSDGs 9: “Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation”. The second target aims to increase investment in agricultural research to “end hunger, achieve food security and improved nutrition and promote sustainable agriculture” (CSDGs 2).

In addition to these overarching national strategies, several specific sectoral policies also highlight research as an essential element to improve sectors such as education, health, ICT, industry, and agriculture. Two key policy documents related to STI emphasise the promotion of research: The National Policy on STI 2020-2030 and the Cambodia's STI Roadmap 2030. The National Policy on STI stresses that the efficiency and effectiveness of research and development can be improved by adapting technologies to meet Cambodian needs and by learning from technologies being developed abroad. The policy focuses on five domains including: agricultural yield, produce diversification, and agro-processing; modern production and engineering; health and biomedicine; material science and engineering; and services and digital economy, including artificial intelligence and space and spatial technology. The Cambodia's STI Roadmap 2030 was designed and approved in 2021 to support the implementation of the National Policy on STI. The Roadmap is built upon five pillars, each with a specific goal: 1) Improve national innovation system governance; 2) build human capital in STI; 3) increase research capacities and improve research quality in public and HEIs; 4) increase collaboration between main actors of the innovation system based on the triple helix model; and 5) develop an ecosystem which facilitates investment in STI and builds absorptive capacities in the private sector.

Overall, Cambodia has a nascent research system, and there is a shared vision on the importance of developing it further. The following section details some of the primary challenges in strengthening Cambodia's research system.

### **3. Challenges of the National Research and Innovation System**

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#### **3.1. Challenge 1 – National underinvestment in R&D and limited policy support to promote research**

Gross domestic expenditure on R&D in Cambodia is low, at just 0.12 percent of GDP (as of 2015). Furthermore, this investment has not been properly governed and institutionalised. Investment in research must be drastically increased to reach the goal of at least 1 percent of GDP by 2030 that has been set out in the Cambodia's STI Roadmap 2030. Currently, 35 percent of Cambodia's research funding comes from abroad (the highest proportion in all the ASEAN countries), and only 24 percent is provided by the Government (the second-lowest proportion among ASEAN countries). The remainder comes from non-profit organizations (22 percent) and businesses (19 percent)<sup>7</sup>.

The proportion of business-funded research is one of the lowest in ASEAN, and Cambodian businesses rarely conduct R&D activities. The insufficient funding negatively impacts the amount of research carried out, hindering national research from reaching its full potential. Moreover, the disproportionate amount of funds coming from abroad results in excessive external influence over the research topics pursued domestically – international donors generally favour specific topics such as agriculture and health – and may shorten the period over which research projects are funded<sup>8</sup>.

There are also barriers to accessing available research funds. The funding system is overly complex and difficult to navigate, essentially making it inaccessible to time-constrained research staff (see section 3.3). In addition, international donors often require that research proposals be written in English, limiting access for most Cambodian researchers.

The policy framework to support research remains underdeveloped. A few policies and plans have been formulated in the last decade to promote research. However, their implementation has been drastically hampered by insufficient funding. Moreover, the national-level research policies that do exist (e.g., Policy on Research and Development in the Education Sector, approved in 2011; 2011-2015 Master Plan for Research Development in the Education Sector; specific subsections of the Annual Operational Plan 2018 of the Educational Congress; specific reforms in the Education Strategic Plan 2019-2023) are not clearly understood, or even known, by researchers.

#### **3.2. Challenge 2 – Limited alignment between research activities and national challenges and insufficient contribution of academic research to private sector innovation activities and policymaking**

While there is a good alignment across Cambodia's different strategic documents regarding which developmental challenges must be addressed, these challenges are poorly reflected in the subjects taught and researched by academic institutions. For example, 'ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all' (CSDG 4) has been highlighted as a fundamental development challenge by seven strategic documents; yet research areas that could contribute to achieving this goal, such as pedagogical studies, are not prominently featured among the subjects taught and researched at Cambodian universities.

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<sup>7</sup> United Nations Educational, Scientific and Cultural Organisation (UNESCO) 2021, p. 680.

<sup>8</sup> Cambodian Institute for Cooperation and Peace (CICP) 2016, p. 15-16.



In general, higher education in Cambodia suffers from a low level of academic relevance and a lack of graduates in STEM. Subjects perceived by students to lead to better employment and job condition, such as economics, business and ICT, are offered more broadly, whereas STEM subjects are deemed less attractive and offered by fewer institutions. Low enrolment in STEM subjects could also be related to the unavailability of research equipment, on which STEM subjects are reliant to a greater extent. Moreover, the preferences of international donors and private investors may also influence beneficiary institutions' curricula and research programmes, as they often prefer business and agriculture-related research over STEM<sup>9</sup>.

Overall, the contribution of academic research to policymaking is limited in Cambodia, indicating broad and deep structural challenges. On the supply side, this limitation can be attributed to inadequate research capacity, low relevance of research outcomes to policy needs, and poor dissemination of research results<sup>10</sup>. On the demand side, policymakers need to enhance the capacity, inclination or motivation to integrate research findings into the design of evidence-based policies, especially research findings that might be politically disadvantageous (a problem that is not unique to Cambodia)<sup>11</sup>.

Finally, the contribution of academic research to private sector activities is limited. In general, Cambodian enterprises conduct limited R&D, and when they need research services they tend to look for research expertise abroad as the research capacity and services offered by universities in Cambodia often do not meet their needs.

### **3.3. Challenge 3 – Limited research capacity in the public and the private sector**

Cambodia's public and private institutions face many constraints to conduct research. There are less than 500 full-time researchers in Cambodia, and university staff has a hefty workload. To supplement their low salaries (around 300 USD per month as of 2017<sup>12</sup>), university staff takes on extra teaching roles at other institutions, leaving them little time to engage in research activities. One of the main reasons university staff has a low research output is the lack of time.

Research capacity across Cambodian universities is also limited by the modest percentage of university teaching staff holding PhDs in Cambodia. In the 2015-2016 academic year, just 7 percent of university teaching staff held a PhD degree, while a majority (70 percent) held a Master's degree<sup>13</sup>. The low percentage of teaching staff holding PhDs is detrimental to the quality of research and the ability of university staff to transfer research skills to students. The number of doctoral students remains low, although enrolment has been trending upwards (from 78 students in 2013-2014 to 1,349 in 2017-2018). Ensuring these students are adequately equipped with the skills to pursue a career in research will be essential, albeit challenging, to increase Cambodia's research capacity.

Currently, all university teachers in Cambodia are known as lecturers, with the distinction between 'lecturer' or 'senior lecturer' generally depending on age and seniority. The Ministry of Education, Youth and Sports (MoEYS) has proposed the standardisation of professorial rankings across universities. Different levels of research staff (including assistant professor, associate professor and full professor) will be put into practice and awarded mainly based on the number of scientific articles they published. The peer-reviewed publication requirements

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<sup>9</sup> CICIP 2016, p 7.

<sup>10</sup> CICIP 2016, p. 116-119.

<sup>11</sup> CICIP 2016, p. 94-95.

<sup>12</sup> As reported by the International Institute for Asian Studies (2017).

<sup>13</sup> Un, L. & Sok, S. 2018, p. 9.

will provide an impetus for Cambodian academics to pay more attention to academic research and publication.

Cambodia's research output is increasing but still lags behind some of its neighbours. Research output in the form of scientific articles is mainly concentrated in universities and public research institutions; this production is dynamic and follows an upward trend, from little to no publications before 2000 to nearly 600 publications a year in 2020.<sup>14</sup> Nevertheless, Cambodia has the second-lowest rate of publications per inhabitant in the ASEAN region, after Myanmar.<sup>15</sup> Moreover, the majority of Cambodia's research publications are conducted in collaboration with international partners, which may not always be aligned with the nation's specific developmental needs and priorities.

### 3.4. Challenge 4 – Research institutions need strengthening and resources

Institutions producing research in Cambodia do not follow a standardised categorisation. There are 125 HEIs in Cambodia, 48 of which are public and 77 are private. In addition, Cambodia has other research institutes, including Center for Khmer Studies, Greater Mekong Research Center, Cambodian Organisation for Research, Development and Education, Cambodia Development Resource Institute, Institute for Research and Advanced Studies, Asian Vision Institute, Cambodian Agricultural Research and Development Institute etc. Civil society organisations, non-governmental organisations (NGOs) and think tanks also produce some research. Out of all these institutions, only a few have a written research strategy.

The research infrastructure of Cambodia is underfunded, as a large proportion of the budget of HEIs is spent on salaries, leaving very little for investing in equipment and improving the research infrastructure. There has been no structure and investment in the form of **National Research Fund**. Basic research facilities, such as libraries and laboratories, are present in most universities. However, university staff from public and private universities remain unsatisfied with the quality and availability of laboratories, experimental equipment, computers, libraries, and other equipment. Internet is generally available, but access is limited, and speed may be slow. Moreover, few universities offer access to specialized academic databases and journals, which are essential tools in the research process.

New organisational and economic models for research have yet to be implemented in Cambodia. Funding and research models (private, public, development partner and hybrid) for public research institutions should be clarified. Their research portfolio, role in research (funding or conducting research), and type of research (fundamental and/or applied) should be defined.

Data quality and research ethics also need strengthening in Cambodia. Research suggests that institutional attention to data quality is weak at HEIs, and there is limited awareness of ethic codes at both the institutional and national levels<sup>16</sup>. Ensuring that research data is of high quality and collected according to ethical guidelines is essential to publishing in peer-reviewed journals.

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<sup>14</sup> United Nations Economic Commission for Asia and the Pacific (ESCAP) 2021, p. 25.

<sup>15</sup> Based on SCOPUS analysis, see Background Report on Research in Cambodia 2022, MISTI/UNESCAP (to be added once available)

<sup>16</sup> CICI 2016, p. 93-94.

### **3.5. Challenge 5 – A need for stronger university-industry linkages and sustainable international collaborations**

Research needs to be leveraged through university-industry collaborations to support broader economic development. Some national universities have implemented measures to increase university-industry collaboration, such as university-industry linkage offices, incubators, technology platform, and start-up centres. Initiatives such as business competitions, start-up simulators for students, start-up boot camps and working spaces also encourage entrepreneurial activities among university students and pave the way for future collaboration. Businesses are also interested in collaborating with universities to access cutting-edge research knowledge, research infrastructure and services, develop in-house capabilities or identify potential future employees. However, there is less evidence of these types of high value university-industry collaborations. Improving the research infrastructure such as centres of excellence, technology platforms in Cambodian research institutions and the quality of research conducted would foster more collaboration with the private sector.

Ministries are enhancing the national innovation system through policy changes and incentives that facilitate university-industry collaborations. In 2018, the Government introduced tax breaks for SMEs and, in 2019, different laws were adjusted to promote e-commerce and improve consumer protection<sup>17</sup>. Some of the incentives include technical support, R&D and capacity building funds, and tax exemptions for HEIs. However, the incentives for university-industry collaboration are still limited.

A strategy to leverage international research collaboration is fundamental to, among others, support quality research. A sensible strategy that balances local and international research is essential to ensure a sustainable research system. Cambodian research already benefits from international collaboration, as evidenced by the high proportion of research outputs created in collaboration with researchers from other countries. However, international collaboration beyond joint research projects remains limited. There are few schemes to support researcher mobility (such as the provision of 50 percent salary when on research leave<sup>18</sup>), but awareness regarding such schemes remains low among researchers. Moreover, researchers who gain experience abroad tend to leave the country permanently, resulting in a brain drain.

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<sup>17</sup> ESCAP 2021, p. 26.

<sup>18</sup> Background Report on Research in Cambodia 2022, MISTI/UNESCAP (to be added once available)

## 4. Establishing Eight National Research Missions

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The RGC has set ambitious development vision for 2030 and 2050. As underlined in the core national strategic frameworks, research activities and outcomes will be fundamental to achieve national development goals. The first essential factor for research investments and activities to contribute to national development goals is to ensure alignment between research priorities and capacities and the country's developmental needs. The NRA establishes eight missions that align research efforts with national development priorities.

The eight research missions identified have the potential to transform the country's socio-economic development and ensure its sustainability.

As discussed in section 1, the process of identifying the research missions included: a thorough stakeholder mapping; a survey of stakeholders to explore what topics to be researched for the advancement of Cambodia's agenda and the state of the research ecosystem; the drafting of a background report and collective reflection on the strengths, weaknesses, opportunities, and threats (SWOT) of the research ecosystem; collective definition of research missions for Cambodia crafted on a workshop with representatives of all concerned ministries, as well as HEIs, research centres and think tanks.

Each research mission includes several research areas and sub-areas connected to Cambodia's current national policy frameworks and stakeholders' concerns. The missions, areas, and sub-areas should not be seen as restricting research activity but instead intended to guide research-active stakeholders and help define the focus of research investment. They shall be revised periodically by MISTI, under the guidance of the NCSTI. Such revisions should be informed by consultations with stakeholders and foresight analysis of future emerging research needs and new policy frameworks.

### 4.1. **'Local food': 70 percent of Cambodia food consumption is produced locally**

Cambodia's crops (rice, cassava, corn, soybeans, cashew, mango and coconuts) have not yet met their full production and export potential. Production of meat does not meet the local demand; the country spends USD 1 billion per year importing meat from neighboring countries. The agro-processing sector has great potential for turning Cambodia into an agro-food supplier. Only 10 percent of the country's agricultural outputs are processed locally, and in 2018, agro-food processing only represented 2.4 percent of the GDP, less than neighboring countries. As the need for food security grows<sup>19</sup>, it is essential to increase and diversify local food production, improve yields, and innovate in food processing. This mission aims to ensure that Cambodia produces 70 percent of its national food consumption needs by 2030.

This mission is relevant to the following national-level strategic goals in Cambodia:

- RS-IV: Rectangle 1 on human resource development (goal 3 on the enhancement of public health and nutrition); and Rectangle 4 on inclusive and sustainable development (goal 3 on promotions of agriculture sector and rural development).
- NSDP 2019-2023: Priority 6 on inclusive and sustainable development.
- CSDGs Framework: CSDG 2: Zero Hunger; CSDG 6: Clean Water and Sanitation; CSDG 8: Decent Work and Economic Growth; CSDG 9: Industry; Innovation and Infrastructure;

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<sup>19</sup> United Nations in Cambodia 2021.



CSDG 11 Sustainable Cities and Communities; CSDG 12 Responsible Consumption and Production; and CSDG 15: Life on Land.

To reach the mission of Cambodia producing locally 70 percent of its national food consumption needs by 2030, the country will have to focus not only on vibrant policy supports but also on the following key research areas:

1. Breeding: Crop and animal breeding, green algae for food production, drip irrigation/smart irrigation, land use, soil research, water security, sensor for agriculture and soil, boosting immunity in fish and livestock, agri-tech, fertiliser and pest control, ICT for productivity.
2. Storage: Raw material, post-harvesting conservation research.
3. Processing: R&D food product development, ICT for processing, food preservation research.
4. Distributing: Packaging research and tools to link farmers to markets.

To foster coordination of research efforts, table 1 identifies the key organisations conducting research relevant to the mission; and table 2 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 1** Key organisations producing research to accomplish the 'local food' research mission.

Institution type	Name
Ministries and governmental bodies	Ministry of Land Management, Urban Planning and Construction Ministry of Agriculture, Forestry and Fisheries Ministry of Commerce Ministry of Post and Telecommunications
Universities and research institutes	Royal University of Phnom Penh Institute of Technology of Cambodia Cambodian Agricultural Research and Development Institute Royal University of Agriculture Cambodia Academy of Digital Technology
International organisations	Asian Development Bank World Bank World Wildlife Fund Wildlife Conservation Society
Private sector	Palm oil processing companies Rice farming cooperatives

**Table 2** Policy instruments and measures to accomplish the 'local food' research mission.

<b>Instruments</b>	<b>No</b>	<b>Measures</b>	<b>Leading Institution*</b>	<b>Relevant Stakeholders</b>
Legal	1	Develop a detailed master plan/roadmap on research to achieve the mission	MAFF	MISTI, MoEYS, MEF
	2	Incentivising scheme for agricultural research activities/ local production	MEF	MAFF, MISTI
	3	Invest in R&D in food processing and market	MAFF	MISTI, MoEYS
	4	Invest in lab facility/equipment for the food sector	MAFF	MISTI, MoEYS
Financial	5	Increase salary/incentives for researchers	MEF	MoEYS, MAFF, MoH
	6	Promote contract farming with private sectors	MAFF	MEF, MoC
	7	Equip laboratory facilities for HEIs with cutting-edge technologies	MEF	MoEYS, MAFF, MoC, MoH, MISTI
	8	Improve transport and logistics	MPWT	MEF, MPTC
Infrastructure	9	Improve norms and standards for food safety and security	MISTI	MoC, MAFF
	10	Establish a coordinating body among all the agriculture actors	MAFF	MISTI, MEF
	11	Research on fertilizer to increase productivity	MAFF	MISTI, HEI
	12	Research on market and global trends for processed products and foods	MAFF	MISTI, HEI
Research and human resource	13	Increase human resources in food and agricultural sectors	MAFF, MoEYS	MEF, MISTI

\*NCSTI is the guiding body

## 4.2. 'Reliable Energy Supply': 90 percent of energy consumption is generated locally

Cambodia is currently dependent on imported fossil fuels and electricity. In 2017, 18 percent of annual power generation was imported (1,440 GWh of a total 8,073 GWh), primarily from Viet Nam, Thailand and Lao PDR, although this is decreasing as more power plants come online<sup>20</sup>. Supply can be unreliable, and electricity shortages and power outages are relatively common. As the industry continues to develop and the energy grid is deployed, there is a need to develop new local and sustainable sources of energy supply. This mission seeks to ensure that 90 percent of the energy consumed in Cambodia is generated domestically.

This mission is relevant to the following national level strategic goals in Cambodia:

- RS-IV: Rectangle 2 on economic diversification (improving logistics system and enhancing transport, energy and digital connectivity; developing key and new sources of economic growth).
- NSDP 2019-2023: Priority 4 on economic diversification (improving the logistics system and enhancing transport, energy, and digital connectivity).
- CSDGs Framework: CSDG 7: Affordable and Clean Energy.

The following research areas are crucial to ensure that 90 percent of the energy consumed in Cambodia is generated domestically.

1. Energy production: Renewable energy sources (including solar and hydro energy and their impact on ecosystem health and human capital), agro-energy and algae-based energy, biogas, coal, hydrogen, nuclear and producing energy from waste.
2. Energy storage: Battery and storage facility.
3. Energy distribution: Electricity tariffs and compensation mechanisms, smart grid technologies, distribution/transmission lines.
4. Energy consumption: Consumer behaviours regarding energy efficiency practices.

To foster coordination of research efforts, table 3 identifies the key organisations conducting research relevant to the mission; and table 4 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 3** Key organisations producing research to accomplish the 'Reliable Energy Supply' research mission.

Institution type	Name
Universities and research institutions	Royal University of Phnom Penh
	Institute of Technology of Cambodia
	National Polytechnic Institute of Cambodia
	National University of Battambang
Private sector	Fossil-fuel and renewable energy production companies

<sup>20</sup> Asian Development Bank 2018.

	Battery production companies Energy distribution companies
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**Table 4** Policy instruments and measures to accomplish the ‘Reliable Energy Supply’ research mission.

Instruments	No	Measures	Leading Institution*	Relevant Stakeholders
Legal and policy framework	1	Develop a detailed master plan/roadmap on research to achieve the mission	MME	MISTI, MoE
	2	Develop a research framework to promote energy sufficiency and saving practices	MME	MISTI, MoC
	3	Develop a legal framework to enable and incentivise HEIs to conduct quality research (Centres of Excellence)	MISTI, MoEYS	MAFF, MPTC, MoH
	4	Enable a suitable and attractive environment for investments on R&D in renewable energy (solar, wind, etc)	MME	MEF, MISTI, MAFF
Education and research system	5	Encourage government and higher education staff to pursue graduate education for research	MoEYS	MISTI, MPTC
	6	Reduce complicated administrative procedure for collaborative research in HEI (admin, procurement, fund, politic,tec)	MoEYS, MEF	MISTI, MAFF
	7	Set up guidelines for research in HEIs	MoEYS	MISTI, MAFF,
	8	Provide incentives to publish research	MoEYS	MISTI, MAFF, MLVT
	9	Develop senior and junior research network	MoEYS	MFAIC, MAFF, MoE, MISTI
Financial	10	Provide incentives and financial support to attract and retain talent in human capital	MoEYS/MISTI	MEF, MFAIC, MAFF
	11	Develop a public investment plan on R&D from the private sector and other key stakeholders	MEF/ MISTI	MoC, MAFF, MoH

	12	Prioritise funding on universities conducting quality research, particularly applied research	MoEYS/MISTI	MAFF, MLVT
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\*NCSTI is the guiding body

### 4.3. 'Quality Education': Education meets international quality standards

Despite increases in student enrolment, Cambodia still faces challenges regarding the quality and equity of education. Only 8 percent of students under 15 achieve the minimum level of proficiency in reading, 10 percent the minimum proficiency in mathematics<sup>21</sup> and only 28 percent of the population has attained at least Grade 7 by age 15. Moreover, opportunities to access education are also unequal. Disparities between rural and urban areas remain mainly in favour of the latter, as students in urban schools outperform students from rural schools in reading by a 42 score points difference.<sup>22</sup> This mission aims for Cambodia's primary/secondary/higher education to meet international quality and standards by 2030.

This mission is relevant to the following national-level strategic goals in Cambodia:

- RS-IV: Rectangle 1 on human resource development.
- NSDP 2019-2023: Priority 3 on human resource development (strengthening of the quality of education, science and technology).
- CSDGs Framework: CSDG 4: Quality Education.

To complete this mission, the following key research areas can be explored:

1. Skills and methods of teaching and learning: New teaching and learning methods in a post-Covid world, effectiveness of teaching and learning techniques (including e-learning), learning by design, learning management systems, and understanding the learner's context.
2. Standards: Conducting research into ASEAN education standards, enhancing the qualification network, translating international best practices to Cambodia.
3. Management of learning institutions: Teaching and learning assessments, school management, teachers' career pathways, job market connections, teaching organisation, and workforce planning.

To foster coordination of research efforts, table 5 identifies the key organisations conducting research relevant to the mission; and table 6 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 5** Key organisations producing research to accomplish the 'Quality Education' research mission

Institution type	Name
Ministries and governmental bodies	Ministry of Education, Youth and Sports
Universities and research institutions	Royal University of Phnom Penh

<sup>21</sup> MoEYS 2018, p. 5-6.

<sup>22</sup> Note: the gap is higher than expected scores students gain per year. See *ibid*



	National Institute of Education
Private sector	E-learning platforms

**Table 6** Policy instruments and measures to accomplish the 'Quality Education' research mission

Instruments	No	Measures	Leading Institution*	Relevant Stakeholders
Legal and policy framework	1	Develop a detailed master plan/roadmap for improving the quality of education to achieve the mission	MoEYS	MISTI, MEF, MLVT
	2	Improve the research quality for researchers to meet international education system	MoEYS, MLVT	MAFF, MoH, MISTI
	3	Develop legal framework (policy/standard/guidelines/strategies) for research	MoEYS, MAFF, MoH, MLVT	MAFF, MoH, MISTI
	4	Promote the industry-university linkage practices on R&D	MoEYS, MISTI	MAFF, MoH, MLVT, MEF
	5	Develop clear and evidence-based policy directives for education at all levels	MoEYS	MAFF, MoH, MISTI
	6	Develop research-oriented teaching and learning approach	MoEYS	MLVT, MISTI, MEF
Infrastructure	7	Expand infrastructure to support different educational purposes, especially STEM education	MoEYS, MEF	MLVT, MISTI
	8	Build more research institutions, including centres of excellence	MoEYS, MoEF	MISTI
	9	Develop a labour market information system (LMIS) that is digitalised, widely implemented, and user-friendly	MoEYS, MLVT	MISTI, MEF
Financial	10	Increase investment in education at all levels	MoEYS, MEF	MISTI, MLVT
	11	Set up a plan for investment in education that is more market-responsive	MoEYS, MoEF	MISTI, MLVT
	12	Provide incentives for teachers and researchers to carry out professional capacity development	MoEYS	MLVT/MEF

Research and human resource	13	Promote talent mobility and exchanges among HEIs and the private sector	MoEYS, MLVT	MISTI, MAFF, MoH
	14	Conduct research on market labor demand and supply to identify skill gaps/mismatch	MoEYS, MLVT	MISTI,MAFF, MoH
	15	Conduct research to develop a market-responsive curriculum	MoEYS, MLVT	MISTI, MAFF, MoH

\*NCSTI is the guiding body

#### 4.4. 'Electronic and mechanical spare parts': Cambodia exports 70 percent of the electronic and mechanical spare parts produced in the country

Electrical equipment exports, including machinery and mechanical appliances production, have expanded rapidly in Cambodia. In 2020, exports of electrical equipment and electronic components reached USD 755.34 million, 31.5 percent more than in 2019<sup>23</sup>. Companies in Cambodia have joined electronic and mechanical value chains, yet the trade balance of electronic and mechanical spare parts is still negative<sup>24</sup>. This mission aims to export 70 percent of electronic and mechanical spare parts produced in Cambodia. This shall be achieved by increasing the value-added in the electronic and mechanical spare parts.

This mission is relevant to the following national-level strategic goals in Cambodia:

- RS-IV: Rectangle 2 on economic diversification (development of key and new sources of growth); and Rectangle 4 on the private sector and job development (enhancing competition).
- NSDP 2019-2023: Priority 4 on economic diversification.
- CSDGs Framework: CSDG 8: Decent Work and Economic Growth; CSDG 9: Industry, Innovation and Infrastructure; CSDG 11 Sustainable Cities and Communities; CSDG 12 Responsible Consumption and Production.

The following are key research areas to support this mission:

1. **Raw materials**
2. **Production**
3. **Distribution**
4. **Global value chains**
5. **Absorptive capacities**
6. **Low cost**
7. **Customization**

<sup>23</sup> The Phnom Penh Post 2021.

<sup>24</sup> Observatory of Economic Complexity (OEC) 2020.

They are crosscutting to mechatronics, electronics, precision engineering, nanotechnology, nano and micro-fabrication, 3D printing, material sciences and engineering, robotics, extractive manufacturing, software, hardware.

To foster coordination of research efforts, table 7 identifies the key organisations conducting research relevant to the mission; and table 8 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 7** Key organizations producing research to accomplish the 'Electronic and Mechanical Spare Parts' research mission

<b>Institution type</b>	<b>Name</b>
Universities and research institutions	Royal University of Phnom Penh Institute of Technology of Cambodia National Polytechnique Institute of Cambodia Norton University
Private sector	Companies processing raw materials Companies on the global value chains of electronic and mechanical spare parts

**Table 8** Policy instruments and measures to accomplish the 'Electronic and Mechanical Spare Parts' research mission

<b>Instruments</b>	<b>No</b>	<b>Measures</b>	<b>Leading Institution*</b>	<b>Relevant Stakeholders</b>
Legal and policy framework	1	Develop a detailed roadmap on R&D for electronic and mechanical spare parts to achieve the mission.	MISTI	CDC, MOC
	2	Develop a policy on R&D for the manufacturing sector in that is aligned with the global and Cambodian SDGs	MISTI	CDC
	3	Establish sector research committee that brings together government, universities and the private sector	MISTI	MoC
	4	Promote exports of electronic and mechanical spare parts' to international markets	MoC	MISTI
	5	Promote the university-industry linkage in industrial education and research	MoEYS, MLVT	MISTI

Education and training	6	Foster market-oriented education and training in electronic and electrical sparepart sector	MoEYS, MLVT	MISTI
	7	Foster the spirit of innovative ideas among students from a younger age for startup	MoEYS, MLVT	MISTI, MEF
	8	Equip electronic and electrical lab with modern facilities	MoEYS, MLVT	MISTI
	9	Conduct a thorough market study to identify what electronic and mechanical spare parts are in high demand and what Cambodia can provide	MISTI	CDC
	10	Set up clear and efficient budget in R&D collaboration on electronic and electric with private investors	MEF, MISTI	MoEYS, MLVT
Infrastructure	11	Develop share lab infrastructure in collaboration with private investors	MISTI	MEF
	12	Establish digital platform to access to sharing lab facilities	MISTI	MEF

\*NCSTI is the guiding body

#### 4.5. ‘Cloud-based services’: Cambodia’s cloud-based services development is on par with ASEAN

The use of cloud services has enabled access to the latest technology capabilities, such as the Internet of Things, machine learning or artificial intelligence. Cambodian businesses want locally-developed platforms to build their digital capacities, and customers want their data to be stored locally.

This mission is relevant to the following national-level strategic goals in Cambodia:

- RS-IV: Rectangle 2 Economic Diversification (improving the logistics system and enhancing transport, energy, and digital; preparation for digital economy and fourth industrial revolution).
- NSDP 2019-2023: Priority 4 on economic diversification.
- CSDGs Framework: CSDG 8: Decent Work and Economic Growth; CSDG 9: Industry, Innovation and Infrastructure; CSDG 11: Sustainable Cities and Communities; CSDG 12: Responsible Consumption and Production.

**The following are key research areas to support this mission:**

1. **Infrastructure: Broadband, networks, servers.**
2. **Software: Apps for education and platforms, virtual desktops, delivery on demand, blockchain**
3. **Cybersecurity**
4. **Accessibility**

To foster coordination of research efforts, table 9 identifies the key organisations conducting research relevant to the mission; and table 10 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 9** Key organisations producing research to accomplish the 'Cloud-based Services' research mission

<b>Institution type</b>	<b>Name</b>
Universities and research institutions	Royal University of Phnom Penh Institute of Technology of Cambodia Cambodia Academy of Digital Technology Kirirom Institute of Technology
Private sector	Broadband Networks and servers companies Software producers Cybersecurity companies

**Table 10** Policy instruments and measures to accomplish the 'Cloud-based Services' research mission

<b>Instruments</b>	<b>No</b>	<b>Measures</b>	<b>Leading Institution*</b>	<b>Relevant Stakeholders</b>
Legal and policy framework	1	Develop a detailed roadmap/masterplan on R&D on cloud based services	MPTC	MISTI, MoI, MEF
	2	Formulate and implement talent development and talent attraction strategies	MISTI, MFAIC	MoEYS, MPTC
	3	Integrate cloud-based curriculum in education system from primary school	MPTC	MISTI
	4	Provide scholarships for information and communication technology studies (computer science, programming, ICT, artificial intelligence, machine learning, etc.)	MoEYS, MPTC	MLVT, MoH, MPTC, MISTI
Human resource	5	Promote human resources development programmes in ICT and relevant fields.	MoEYS	MLVT, MoH, MPTC, MISTI

	6	Provide sufficient supporting infrastructure on cloud-based R&D	MPTC	MISTI
Infrastructure	7	Ensure “one student one computer” program and access internet among teachers and students from primary school	MPTC	MISTI
Collaboration	8	Break the silos among relevant stakeholders on cloud-based technology R&D and management	MISTI	MPTC
	9	Encourage the collaborative research on cloud-based services	MPTC, MISTI	MFAIC

\*NCSTI is the guiding body

#### 4.6. ‘Electricity and potable water’: All Cambodians have access to reliable electricity and safe potable water

As of 2020, about 10 percent of the rural population of Cambodia does not have access to reliable electricity, and 15 percent of Cambodians do not have access to potable water and sanitation<sup>25</sup>. Ensuring that all Cambodians have access to these essential services is key to inclusive development. This mission aims for Cambodia to provide reliable electricity and potable water for all by 2030.

This mission is relevant to the following national-level strategic goals in Cambodia:

- RS-IV: Rectangle 2 on economic diversifications (Improving logistics system and enhancing transport, energy and digital connectivity); Rectangle 4 on inclusive and sustainable development.
- NSDP 2019-2023: Priority 6 on inclusive and sustainable development (sustainable management of natural resources).
- CSDGs Framework: CSDG 6: Clean Water and Sanitation; CSDG 7: Affordable and Clean Energy; CSDG 10: Reduced Inequalities.

The following are key research areas that would enable Cambodia to achieve this goal:

1. Water and electricity production: Satellite monitoring of soils, hydro-basin, hydropower production and its impact on ecosystem health and human capital, nano-materials research for electricity generation and distribution.
2. Water management: Smart water management, greywater recycling, water resource development on river basins, water allocation, water security, water storage for dry and wet season.
3. Water distribution: Sustainable use of water resources in 25 provinces, nano-material research for water treatment and destruction of pollutants, water and electricity management, energy efficiency of the transmission line.
4. Water consumption: Water saving and consumer behaviour relating to different water tariffs.

<sup>25</sup> World Bank 2022.



To foster coordination of research efforts, table 11 identifies the key organisations conducting research relevant to the mission; and table 12 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 11** Key organisations producing research to accomplish the 'Electricity and Potable Water' research mission

Institution type	Name
Universities and research institutions	Royal University of Phnom Penh Institute of Technology of Cambodia
Private sector	Water and electricity production and distribution companies Water management institutions and companies

**Table 12** Policy instruments and measures to accomplish the 'Electricity and Potable Water' research mission

Instruments	No	Measures	Leading Institution*	Relevant Stakeholders
Legal and policy framework	1	Develop a roadmap/masterplan on electricity and potable water R&D to achieve the mission	MME, MISTI	MEF, MPWT, MWRAM
	2	Promote the expanse of the R&D networks among private sector in electricity and water supply	MEF	MISTI, MME
Financial	3	Invest in R&D on prioritised areas and sub-areas	MEF	MME, MISTI
Infrastructure	4	Improve standards of electricity and water supply	MME	MISTI
	5	Provide sharing laboratory facilities and equipment for R&D activities.	MME, MISTI	MEF, MoEYS, MLVT
Human resource	6	Produce/increase human resources in the fields of electricity and portable water	MoEYS	MISTI, MLVT

	7	Increase the number of internship programmes in the private and public sectors	MoEYS	MISTI, MME, MLVT
	8	Increase scholarships for staff and students in the sectors	MoEYS	MEF, MLVT, MISTI, MME

\*NCSTI is the guiding body

#### 4.7. 'Carbon neutrality': Cambodia becomes a carbon neutral country

Cambodia is among the most vulnerable countries to climate change, with floods, droughts and weather unpredictability arising as a consequence of climate change. Cambodia has set a goal of reducing carbon emissions by 42 percent by 2030<sup>26</sup> and is developing a long-term carbon-neutral development strategy to promote low-carbon activities, climate resilience and environmental sustainability. The country aims to allocate 1 percent of the public expenditure to address climate change and integrate responses to the challenge into different national strategies.

This mission is relevant to the following national-level strategic goals in Cambodia:

- RS-IV: Rectangle 4 on inclusive and sustainable development (strengthening sustainable management of natural and cultural resources; ensuring environment sustainability and readiness for climate change).
- NSDP 2019-2023: Priority 6 on inclusive and sustainable development.
- CSDGs Framework: CSDG 7: Affordable and Clean Energy; CSDG 12: Responsible Consumption and Production; CSDG 15: Life on Land.

In order to achieve the goal of becoming carbon neutral by 2030, Cambodia will need to conduct further research in the following areas:

1. Decrease carbon production: Electric vehicles production and use, circular economy (e.g., solid waste management and recycling), public transport transformation and mobility, nuclear energy, new clean energy sources such as biofuel.
2. Re-use of CO2 or waste: Recycling industry organic waste for food production, regenerative agriculture, ethanol production from CO2.
3. Trapping CO2: Reforestation based on fast-growing species to expand land cover, CO2 filters, improving living standards of forest communities.
4. Land management policies

<sup>26</sup> General Secretariat of the National Council for Sustainable Development, Ministry of Environment 2020.

To foster coordination of research efforts, table 13 identifies the key organisations conducting research relevant to the mission; and table 14 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 13** Key organisations producing research to accomplish the ‘Carbon neutrality’ research mission

Institution type	Name
Ministries and governmental bodies	Ministry of Environment Ministry of Agriculture, Forestry and Fisheries Ministry of Industry, Science, Technology & Innovation Ministry of Land Management, Urban Planning and Construction Ministry of Post and Telecommunications
Universities and research institutions	Royal University of Phnom Penh Royal University of Agriculture Institute of Technology of Cambodia National University of Battambang
International organisations	Asian Development Bank Japan International Cooperation Agency World Wildlife Fund Wildlife Conservation Society
Private sector	Recycling companies Farmers Wood exploitation companies All industries

**Table 14** Policy instruments and measures to accomplish the ‘Carbon neutrality’ research mission

Instruments	No	Measures	Leading Institution*	Relevant Stakeholders
Legal and policy framework	1	Develop a detailed roadmap/masterplan on R&D to achieve the mission	MoE	MISTI, MAFF
	2	Develop a policy on transportation control research	MoE, MPWT	MISTI, MPTC

	3	Promote green energy research to substitute the fuel-based transportation	MPWT	MISTI, MPTC, MoC, MEF
	4	Promote sustainable urban planning and development research for sustainability, efficiency and reliability, self sufficiency and livability.	MLMUPC, MoE	MISTI, MPTC, MPWT MAFF
Education and research system	5	Provide laboratory facilities and equipment	MoEYS, MISTI	MEF, MLVT, MAFF
	6	Integrate awareness of climate change and carbon neutrality in the educational curriculum	MoEYS	HEIs, research centers, MISTI, MLVT, MAFF, MoE
Financial	7	Encourage financial support and incentives to promote tree growth	MEF, MoE	MISTI, MAFF
	8	Enhance financial support for education and training for government officials	MoEYS	MEF, MISTI, MLVT, MoE

\*NCSTI is the guiding body

#### 4.8. ‘Digitally-enhanced health’: All Cambodians have access to digitally-enhanced health services

Technology and digital solutions provide new opportunities for better healthcare systems, offering many options for health prevention, enhancing access to health care, decreasing costs for patients, and improving equity.

This mission is relevant to the following national-level strategic goals in Cambodia:

- RS-IV: Rectangle 1 on human resource development (strengthening of the quality of education, science and technology; enhancement of public health and nutrition); and Rectangle 2 on economic diversification (improving the logistics system and enhancing transport, energy, and digital).
- NSDP 2019-2023: Priority 4 on economic diversification and digital economy.
- CSDGs Framework: CSDG 3: Good Health and Well-being, CSDG 4: Quality Education, CSDG 8: Decent Work and Economic Growth, CSDG 9: Industry, Innovation and Infrastructure.

The following are key research areas for funding under this mission.

- Health education and prevention: Digital tools and mobile medical apps for health prevention and health education, health information-seeking behaviors, software facilitated health modelling to assess health risks (e.g. for people living nearby coal power plants).

- Diagnosis: Online health consultation services, remote diagnosis, AI-assisted diagnosis, computer-aided decision-making for health professionals, testing devices at the point of care (e.g. rapid tests).
- Medical treatment devices for patient monitoring: Health and wellness applications, telemedicine, data interoperability platforms, quality of care (especially in the clinical field).
- Accessibility, health administration and insurance: Health care of citizens in rural areas; unique identifiers for citizens (linked to biometric data) and its impact on health and the health system, digitalization of health system, blockchain technology in healthcare systems, online registry of health services and professionals.

To foster coordination of research efforts, table 15 identifies the key organisations conducting research relevant to the mission; and table 16 proposes strategic policy instruments and measures to be implemented by relevant actors and stakeholders.

**Table 15** Key organisations producing research to accomplish the 'Digitally-enhanced health' research mission

Institution type	Name
Ministries and governmental bodies	Ministry of Health
Universities and research institutes	University of Health Sciences University of Puthisastra
International organisations	World Health Organisation World Bank U.S. Agency for International Development
Private sector	Medical diagnosis and treatment production companies

**Table 16** Policy instruments and measures to accomplish the 'Digitally-enhanced health' research mission

Instruments	No	Measures	Leading Institution*	Relevant Stakeholders
Legal	1	Develop a detailed research roadmap/masterplan to achieve the mission	MoH	MPTC, MISTI
Human resource	2	Provide scholarships and grant funding for prioritized subject areas	MoEYS	MoH, MPTC, MISTI
	3	Provide training on digital health technologies	MoH, MLVT	MoEYS, MISTI

	4	Increase government investment in the digital health sector	MEF, MoH	MPTC, MISTI
Infrastructure	5	Build a centralized data centre for the health sector	MoH	MPTC, MEF, MoI, MISTI
	6	Ensure quality internet connection, data safety, and data security	MPTC	MoH, MISTI, MoI
Collaboration	7	Break the silos among relevant stakeholders	MISTI	MoH, MPTC, MoEYS, MLVT
	8	Encourage collaborative research among relevant stakeholders and management	MoH	MoH, MPTC, MoEYS, MLVT, MoFA

\*NCSTI is the guiding body



## 5. Achieving the eight national research missions

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To achieve the eight research missions, it is essential to strengthen research capabilities and have in place a well-structured and well-funded research system. To achieve this, the NRA proposes four complementary pathways:

1. Investing in research to support the eight research missions
2. Strengthening the role and capacities of public research institutions
3. Supporting research careers
4. Incentivising research activities, in particular collaborative ones

The following sections provide more details on the features of the four pathways envisaged under the NRA, and it identifies concrete instruments and actions to be put in place.

### 5.1. Invest in research to support the eight research missions

Spending on research shall be carried out through cooperation amongst different ministries, research actors from the private and public sectors, development partners and donors developing long-term partnerships, and the international research community. Moreover, decisions should be made by thinking coherently and creatively about different investment streams and in alignment with the eight missions to serve socio-economic development and national priorities.

#### 5.1.1. Set up a National Research Foundation

A National Research Foundation (NRF) will be established by RGC and governed by NCSTI to provide policy guidance for developing a scientific research system; promoting scientific research in industry, government institutions and society at large; and leveraging research to formulate evidence-based policies. In particular, the NRF's activities include, but not limited to, the promotion, guidance, and coordination of scientific research, specifically:

- To establish and oversee a national research system
- To promote the development of basic and targeted research
- To oversee the National Research Fund, ensuring that research financing is aligned with national development priorities
- To advice government on research policy issues
- To analyse trends in research activities, assess the impact of the allocated funds on scientific output, and assess the contribution of research to the realization of the eight missions in Cambodia
- To strengthen scientific cooperation across Asia and beyond and align NRF's work programme with other regional and international initiatives.
- Ensure the effective implementation of research ethics among researchers and HEIs to ensure the national interest and security.

#### 5.1.2. Establish a national research fund

A national research fund will be established to finance research activities, particularly in priority research areas. The national research fund will be guided/overseen by the NRF.

The national research fund will promote investing in research as a strategic national interest. While research does not necessarily yield results and returns in the short term, it creates value exponentially in the medium to long-term, as proven by the developed nations that have made such investments in the past.

Therefore, the national research fund will be designed as a long-term funding instrument for research activities that support national socio-economic development. It will be ambitious and seek to increase substantially national investments in R&D by public and private sector organisations.

The operation of the national research fund will be defined in a framework that consists of: its governance system; the funding instruments and its approach to launch and implement them; the grant management processes; and the monitoring and evaluation systems.

The investments in research will be strategically channelled to critical areas of potential impact for the country, and connections between the research conducted and the research beneficiaries must be maximized to optimize the potential application. Funding will be allocated based on the country's strategic priorities (see section 4.1), merit, and the potential to maximize social good efficiently. To increase transparency regarding funding allocation processes, the fund will be administered through a rigorous, open and competitive review processes managed by a committee of qualified specialists. A monitoring and evaluation system will be established to support accountability and learning. These principles and systems shall be continuously improved in consultation with key stakeholders and under the supervision of NRF.

Investments will be made in community-based, small-scale, and larger-scale research by considering the whole spectrum of research, from basic to applied research for market diffusion purposes.

### *5.1.3. Encourage the development of research partnerships*

The national research fund will encourage the strengthening of existing partnerships and the formation of new ones to leverage further investment in research capacity-building and research infrastructure.

The national research fund will also support the development of public-private partnerships and the development of partnerships with international research institutions. Matching funding grants can be used to encourage these partnerships.

## **5.2. Review and strengthen public research institutions' roles, mandates, and means to support capacity-building, technological development and innovation**

### *5.2.1. Establish efficient research system*

A research system that identifies different types of research Institutions<sup>27</sup>, including scientific research institutes, government laboratories and publicly funded research and technology organisations (RTOs), will be defined by NRF.

An in-depth review of the current capacities of research institutions in Cambodia shall be conducted to help inform the design of the research system and appropriate funding mechanisms for public research institutions. The new system shall provide the option of

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<sup>27</sup> For more information on different types of research information see Appendix B

developing several and define which government research institutions shall focus on 'capability/tech push' and which on 'market pull'.

### *5.2.2. Establish Centres of Excellence in Research*

Centres of excellence brings together researchers from different disciplines and provides shared facilities and resources. They can host PhD students and also allow researchers to gain credibility and visibility. The main functions of centres of excellence are:

- To support the development of innovative, high quality, collaborative research
- To promote effective of research results into policy and/or practice
- To foster and build capacity in the research workforce
- To provide opportunities to expand and enhance collaboration between research teams.

Centres of excellence will be identified by NRF in collaboration with MoEYS through competitive calls and equipped with sophisticated equipment and qualified staff, with particular attention to assuring adequate gender balance. Procedures for evaluating research progress and deliverables will be set up, including ethics research committees.

### *5.2.3. Set up national research publication platform*

A research publication and research communication platform will be set up to encourage domestic peer-reviewed publications, incentivise the establishment of national peer-reviewed journals to promote more publications, oversee the quality of scientific communication, and develop guidelines on national journal ranking systems to enhance the quality and standard of publications.

## **5.3. Supporting research careers in the public and private sectors**

### *5.3.1. Recognise research as a profession*

The profession of 'researcher' will be categorised and arranged based on an appropriate standard profiles descriptors, which are: first stage researcher (up to the point of PhD); recognised researcher (PhD holders or equivalent who are not yet fully independent); established researcher (researchers who have developed a level of independence); and leading researcher (researcher leading their area or field).

### *5.3.2. Create a larger pool of talented researchers*

Universities and other research institutions need to expand significantly in science, technology, engineering and mathematics (STEM) provision to generate a wider pool of research talents. This expansion needs to take place at both the undergraduate and postgraduate levels.

Postgraduate programmes (PhD and Master's programmes) in STEM should be adequately funded. Attention also needs to be given to quality STEM education and research. Funding should be targeted and provide equal opportunities to support underserved groups, such as women and rural communities.

A review of current PhD programmes will be carried out to identify areas that require further strengthening. Such review could be supported through the national research fund.

### *5.3.3. Introduce a research career framework and an attractive incentive system for researchers*

A research career framework standardising academic positions (e.g. professor, associate professor, assistant professor) and requirements to progress in the research career will be

established and overseen by MoEYS, with the support of NCSTI, to provide clarity on researchers' careers, provide incentives, and promote excellence. Alongside this framework, attractive pay and incentive systems will be introduced to ensure enough time devoted to research. The system may include access to grants, reward programs, job performance appraisals based on publications, academic promotions, and bonuses.

To incentivise the private sector to invest further in research activities, the RGC will invest further in the promotion of intellectual property protection and in grant schemes to support university-industry linkage in research.

## **5.4. Create a framework for promoting, motivating and incentivising research**

### *5.4.1. Enhance coordination*

The implementation of the NRA needs a strong coordination mechanism and support system. MISTI will coordinate the implementation of the NRA and support the relevant ministries responsible for implementing the NRA in their respective areas to promote research ethics, facilitate innovation, encourage the measuring of research impact, favor appropriate organisational structures, and encourage adequate research processes. The implementation will be overseen and guided by NCSTI.

### *5.4.2. Set up an adequate research management system*

The Research Management System (RMS) is a web-based system used by multiple agents to manage their research-grant-program processes for functions such as: submissions, assignment and assessment, rejoinders, announcement, offers and acceptance. The NRF will establish the RMS, taking stock of international best practices and considering the importance of collaboration, sharing and exchanging at a global level, and open access.

### *5.4.3. Incentivise industry-academia-government and international collaborative research*

Collaborative research can maximise outputs and impacts of research and attract funding. Combining expertise and resources allows for larger and more complex scientific questions to be tackled, such as the ones necessary to achieve the eight missions of Cambodia. Funding institutions and research organisations will prioritise industry-academia-government and international collaborations through their research and research funding activities.

International knowledge transfer is vital in the current stage of scientific development in Cambodia – for the private sector and organisations that support evidence-based decision-making (such as thinktanks, universities)<sup>28</sup>. The diffusion of foreign inputs and advanced technologies can be facilitated through different processes; some related to research, such as R&D internationalisation<sup>29</sup> and R&D collaboration<sup>30</sup>, and others unrelated, such as learning-by

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<sup>28</sup> Also named intermediate knowledge producers and brokers.

<sup>29</sup> The internationalisation process increases both firm's productivity and the likelihood that they will introduce innovations, and in turn increase competitiveness. In a context where local institutions are not able to support this process, R&D internationalisation is an effective option which attracts foreign talent, promotes collaborations between local and foreign actors and encourages international mobility.

<sup>30</sup> Arza and López (2011), on the other hand, through a case study of Argentina confirm the hypothesis that encouraging "local collaborations may perpetuate the innovation systems backwardness". Other papers provide evidence that participation in European scientific programmes produces R&D spillover and the production of patents (Di Cagno et al. 2016, The impact of relational spillovers from joint research projects on knowledge creation across European regions, Technological Forecasting and Social Change).

trade<sup>31</sup> and foreign direct investment.<sup>32</sup> In the case of research, for Cambodia, domestic and international R&D collaboration, within the value chain and for achieving the eight missions, is the most appropriate.

Industry-academia-government and international research collaboration will be strengthened. Concerning international collaborations, talent researcher attraction, retention and mobility schemes or mid-career transition schemes will be designed. An enabling environment to support visiting researchers will be created, which includes housing, high standard educational institutions for their children, and facilities and infrastructure to support their standard of living. The process of granting working permits to international researchers (and their spouses) shall be streamlined, and regulations shall be optimised to encourage the inflow of qualified researchers. Industry-academia-government and international collaborations will be funded by the National Research Fund.

#### *5.4.4. Build the absorptive capacity of firms and their ability to conduct R&D and innovation activities*

Building up the absorptive capacity<sup>33</sup> of firms and their ability to conduct R&D and innovation activities is a high priority. For minimum-capability companies that serve national interests (e.g. firms with one engineer), the focus is on building absorptive capacity by enabling enterprises to build and link internal capacity with external knowledge sources. For technology-competent companies (e.g. firms with multiple engineers), increasing companies' investment in R&D and innovation activities is also crucial. Here the focus is to encourage them to conduct R&D and innovation activities in collaboration with universities or participate in sophisticated international research networks<sup>34</sup>. MISTI and other line ministries will provide enhanced support for the development of the absorptive capacities of firms and of their R&D and innovation activities.

Collaborative R&D grants awarded for the achievement of the eight missions will be accompanied with capacity building measures aimed at firms, local knowledge providers and brokers.

#### *5.4.5. Set up key infrastructure to support technology transfer and adoption*

Building infrastructure to support technology transfer and adoption is key to promote innovation. MISTI will explore opportunities to establish a science, technology and innovation park to foster the use of scientific research and promote technology transfer between universities, R&D institutions, firms and markets. The science, technology and innovation park shall provide spaces, services and high-quality technology platforms for R&D development and technology transfer.

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<sup>31</sup> A local firm's network embeddedness with international firms influences its acquisition of complex and non-codified tacit knowledge (Fu et al., 2019, Multinationals, Local Capacity Building and Development, The role of the Chinese and European MNEs).

<sup>32</sup> Rising interest from foreign direct investment among Southern countries has been witnessed for a decade: similarly to multinationals investing abroad to acquire higher competences and capacities, local firms can do so. (Mohan, 2013).

<sup>33</sup> Absorptive capacity refers to "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends". Source: Cohen & Levinthal, 1990

<sup>34</sup> For SMEs with no meaningful technological capabilities, there is effectively no absorptive capacity and the main goal is to inject some interest in building technological capabilities and generate a process of learning and development. For companies which are competent (e.g. with research department or equivalent), they can easily cooperate with universities or participate in sophisticated international research networks.

#### *5.4.6. Incentivise R&D investments through tax incentives*

A review of current tax incentives for R&D will be conducted by MISTI and MEF; and, where appropriate, measures to provide tax incentives for companies investing in R&D aligned to the eight national research missions will be proposed by NRF, with the approval of NCSTI.

#### *5.4.7. Enforce intellectual property regime*

MISTI and line ministries, under the guidance of NCSTI, shall conduct a review of current intellectual property issues affecting public and private researchers and reinforce the intellectual property regime to ensure the protection the invention and creation of scientific products and promote the innovative activities through research and development.



## 6. Conclusion

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Cambodia's aspiration to become a high-income economy by 2050 demands an unyielding commitment to nurture the country's research potential and direct it towards the achievement of national development goals.

The NRA encapsulates and operationalises such commitment, enshrining the needs and hopes of Cambodian researchers at its core. It provides strategic mechanisms to empower current and upcoming researchers to explore solutions for pressing societal challenges and national ambitions.

Promoting research is a long-term strategic investment in the future of the country. The eight research missions and supporting policy instruments described here provide the focus necessary to direct investments towards such long-term strategic research interests.

The successful implementation of the NRA will require the participation of a wide range of national stakeholders, including line ministries, public research institutions, universities, private sector and international development partners, in the design, financing and implementation of the envisaged instruments.

Finally, to ensure that the NRA delivers its promise, a monitoring and evaluation system will be established by MISTI to monitor and evaluate the implementation of the NRA, and NRF will review and assess the impact of the measures implemented. This will enable the identification of shortcomings, the introduction of actions to address these, and the finetuning of the NRA as needed.

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**ព្រះរាជាណាចក្រកម្ពុជា  
ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍**  
Ministry of Industry, Science, Technology & Innovation  
លេខ: ១៣៤ MISTI / ២០២១

**សេចក្តីសម្រេច  
ស្តីពី**

**ការបង្កើតគណៈកម្មការអន្តរក្រសួង  
ដើម្បីរៀបចំ និងកសាងរបៀបវារៈស្រាវជ្រាវជាតិ**

**ទេសរដ្ឋមន្ត្រី រដ្ឋមន្ត្រីក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍**

- បានឃើញរដ្ឋធម្មនុញ្ញនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រឹត្យលេខ នស/រកត/០៩១៨/៩២៥ ចុះថ្ងៃទី០៦ ខែកញ្ញា ឆ្នាំ២០១៨ ស្តីពីការតែងតាំងរាជរដ្ឋាភិបាលនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រឹត្យលេខ នស/រកត/០៣២០/៤២១ ចុះថ្ងៃទី៣០ ខែមីនា ឆ្នាំ២០២០ ស្តីពីការតែងតាំងនិងកែសម្រួលសមាសភាពរាជរដ្ឋាភិបាលនៃព្រះរាជាណាចក្រកម្ពុជា
- បានឃើញព្រះរាជក្រមលេខ នស/រកម/០៦១៨/០១២ ចុះថ្ងៃទី២៨ ខែមិថុនា ឆ្នាំ២០១៨ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីការរៀបចំនិងការប្រព្រឹត្តទៅនៃគណៈរដ្ឋមន្ត្រី
- បានឃើញព្រះរាជក្រមលេខ នស/រកម/០៣២០/០០៩ ចុះថ្ងៃទី២៦ ខែមីនា ឆ្នាំ២០២០ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីការបង្កើតក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍
- បានឃើញអនុក្រឹត្យលេខ៤៨ អនក្រ.បក ចុះថ្ងៃទី៦ ខែមេសា ឆ្នាំ២០២០ ស្តីពីការរៀបចំនិងការប្រព្រឹត្តទៅរបស់ក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍
- យោងលិខិតចាត់តាំងសមាសភាពឱ្យចូលរួមក្នុងគណៈកម្មការអន្តរក្រសួង ដើម្បីរៀបចំ និងកសាងរបៀបវារៈស្រាវជ្រាវជាតិ របស់បណ្តាក្រសួង ស្ថាប័នពាក់ព័ន្ធ
- យោងតាមសំណូមពរការងារចាំបាច់

**សម្រេច**

**ប្រការ១.\_**

ត្រូវបានបង្កើតគណៈកម្មការអន្តរក្រសួង ដើម្បីរៀបចំ និងកសាងរបៀបវារៈស្រាវជ្រាវជាតិ ( សរសេរជាអក្សរកាត់ថា **គ.វ.ស.ជ.** ) ដែលមានសមាសភាព៖

- |                              |  |                    |
|------------------------------|--|--------------------|
| ១. ឯកឧត្តម ហង់ ជួនធីត        | រដ្ឋលេខាធិការនៃក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍  | ប្រធាន             |
| ២. ឯកឧត្តមបណ្ឌិត ហ៊ុល សៀងហង់ | អគ្គនាយកនៃអគ្គនាយកដ្ឋានវិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍នៃក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍ | អនុប្រធានប្រចាំការ |

ក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍  
៤៥ មហាវិថីព្រះនរោត្តម សង្កាត់ផ្សារថ្មី៣  
ខណ្ឌដូនពេញ ភ្នំពេញ ១២២០៥ (ព្រះរាជាណាចក្រកម្ពុជា)

ឧទ្ទកាល័យឯកឧត្តមកិត្តិសង្ឃាបណ្ឌិត ទេសរដ្ឋមន្ត្រី  
ទូរស័ព្ទលេខ: (៨៥៥) ២៣ ២១១ ៧៧៥  
អ៊ីម៉ែល: misti.smcb@met@gmail.com

៣. លោកបណ្ឌិត និត ប៊ុនឡែ	អគ្គនាយករងនៃអគ្គនាយកដ្ឋានឧត្តមសិក្សា នៃក្រសួងអប់រំ យុវជន និងកីឡា	អនុប្រធាន
៤. ឯកឧត្តម ថង សាម៉ុន	ទីប្រឹក្សាក្រសួង និងជាអគ្គនាយករងនៃអគ្គនាយកដ្ឋាន អប់រំបណ្តុះបណ្តាលបច្ចេកទេស និងវិជ្ជាជីវៈ	អនុប្រធាន
៥. ឯកឧត្តម ង៉ែត វិបុល	នៃក្រសួងការងារ និងបណ្តុះបណ្តាលវិជ្ជាជីវៈ	អនុប្រធាន
៦. ឯកឧត្តម ជា វុទ្ធី	ទីប្រឹក្សាក្រសួង និងជាអគ្គនាយករងនៃអគ្គនាយកដ្ឋាន ឧស្សាហកម្មនៃក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	អនុប្រធាន
៧. ឯកឧត្តម ការ សុវុទ្ធី	អគ្គលេខាធិការរងគណៈកម្មាធិការវិនិយោគកម្ពុជា នៃក្រុមប្រឹក្សាអភិវឌ្ឍន៍កម្ពុជា	សមាជិក
៨. លោក ជា កុកហុង	អគ្គលេខាធិការរងនៃអគ្គលេខាធិការដ្ឋានក្រុមប្រឹក្សាជាតិ អភិវឌ្ឍន៍ដោយចីរភាពនៃក្រសួងបរិស្ថាន	សមាជិក
៩. លោក ឡោ សត្យា	អគ្គនាយករងនៃអគ្គនាយកដ្ឋានគោលនយោបាយ នៃក្រសួងសេដ្ឋកិច្ច និងហិរញ្ញវត្ថុ	សមាជិក
១០. លោក នូវ ថាវ៉ា	អគ្គនាយករងនៃអគ្គនាយកដ្ឋានសហគ្រាសធុនតូច និងមធ្យម និងសិប្បកម្មនៃក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	សមាជិក
១១. លោក គឹម ធនសំណាង	អគ្គនាយករងនៃវិទ្យាស្ថានស្តង់ដារកម្ពុជានៃក្រសួង ឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	សមាជិក
១២. លោក ខៀវ វិជ្ជានន្ទ	អគ្គនាយករងនៃអគ្គនាយកដ្ឋានទឹកស្អាតនៃក្រសួង ឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	សមាជិក
១៣. លោកស្រីបណ្ឌិត សេង មុំ	អគ្គនាយករងនៃវិទ្យាស្ថានជាតិវិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍នៃក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	សមាជិក
១៤. លោកសាស្ត្រាចារ្យ ម៉ម សុវត្ថា	សាកលវិទ្យាធិការរងនៃសាកលវិទ្យាល័យភូមិន្ទកសិកម្ម សាកលវិទ្យាធិការរងនៃសាកលវិទ្យាល័យ វិទ្យាសាស្ត្រសុខាភិបាល	សមាជិក
១៥. លោកបណ្ឌិត ជ័យ ចាន់អឿន	ព្រឹទ្ធបុរសរងមហាវិទ្យាល័យវិទ្យាសាស្ត្រ នៃសាកលវិទ្យាល័យភូមិន្ទភ្នំពេញ	សមាជិក
១៦. លោកបណ្ឌិត លីវ យី	ប្រធាននាយកដ្ឋានស្រាវជ្រាវនិងអភិវឌ្ឍន៍បច្ចេកវិទ្យា នៃក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	សមាជិក
១៧. លោកបណ្ឌិត ស្រីន បញ្ញាវិទ្ធី	ប្រធាននាយកដ្ឋានគោលនយោបាយវិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍ នៃក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	សមាជិកអចិន្ត្រៃយ៍
១៨. លោក ខន សុខេង	ប្រធានការិយាល័យនៃនាយកដ្ឋានគោលនយោបាយ វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍នៃក្រសួង ឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍	សមាជិក



**ប្រការ២..**

**គ.វ.ស.ជ.** មានតួនាទី និងភារកិច្ចដូចខាងក្រោម៖

- ផ្តល់យោបល់លើការកំណត់ទិសដៅយុទ្ធសាស្ត្រលើការស្រាវជ្រាវ និងអភិវឌ្ឍន៍សម្រាប់ទិសដៅរយៈពេលខ្លី មធ្យម និងវែង
- ផ្តល់យោបល់លើការកំណត់អាទិភាពនៃប្រធានបទសម្រាប់ធ្វើការស្រាវជ្រាវ និងអភិវឌ្ឍន៍ស្របតាមវិស័យ អាទិភាព និងធានាឱ្យបាននូវសន្តិសុខ និងផលប្រយោជន៍ជាតិ
- ប្រឹក្សា ពិគ្រោះយោបល់ ពិនិត្យ និងកែតម្រូវលើដំណើរការនៃការកសាងរបៀបវារៈស្រាវជ្រាវជាតិ
- ទទួលបន្ទុកសម្របសម្រួល ប្រមូល និងចងក្រងឯកសារនិងទិន្នន័យពាក់ព័ន្ធលើការងារការស្រាវជ្រាវ និង អភិវឌ្ឍន៍តាមបណ្តាក្រសួង ស្ថាប័ន សាកលវិទ្យាល័យ មជ្ឈមណ្ឌលស្រាវជ្រាវ និងវិស័យឯកជន
- ធ្វើការសម្របសម្រួលលើកិច្ចសហប្រតិបត្តិការរវាងក្រសួង ស្ថាប័នពាក់ព័ន្ធ សាកលវិទ្យាល័យ និងមជ្ឈមណ្ឌល ស្រាវជ្រាវ និងវិស័យឯកជន
- ធ្វើការផ្សព្វផ្សាយ បោះពុម្ព និងលើកតម្កើងការស្រាវជ្រាវ និងអភិវឌ្ឍន៍
- ធ្វើការសិក្សា និងវិភាគស្របតាមតម្រូវការជាក់ស្តែងរបស់សង្គម និងពិភពលោក
- ធ្វើរបាយការណ៍ជូនថ្នាក់ដឹកនាំក្រសួង ពិនិត្យ និងសម្រេច
- បំពេញភារកិច្ចផ្សេងទៀតតាមការណែនាំរបស់ប្រធាន គ.វ.ស.ជ. និងរបស់ថ្នាក់ដឹកនាំក្រសួង។

**ប្រការ៣..**

អនុប្រធាន និងសមាជិកនៃ **គ.វ.ស.ជ.** ត្រូវចូលរួមប្រជុំតាមការអញ្ជើញរបស់ប្រធាន។

ក្នុងករណីប្រធាន **គ.វ.ស.ជ.** អវត្តមាន ឬមានធុរៈ ប្រធានអាចប្រគល់សិទ្ធិជូនអនុប្រធាន ឬសមាជិក ដើម្បី ដឹកនាំកិច្ចប្រជុំជំនួស។

ប្រធាន **គ.វ.ស.ជ.** មានសិទ្ធិអញ្ជើញក្រសួង ស្ថាប័នពាក់ព័ន្ធ និងវិស័យឯកជន ចូលរួមប្រជុំតាមការចាំបាច់។

**ប្រការ៤..**

នាយកឧទ្ធរណ៍ អគ្គនាយក អគ្គាធិការ ប្រធានមជ្ឈមណ្ឌល គ្រប់អង្គភាពពាក់ព័ន្ធ និងសាមីខ្លួន ត្រូវទទួល បន្ទុកអនុវត្តសេចក្តីសម្រេចនេះ ចាប់ពីថ្ងៃចុះហត្ថលេខាតទៅ។

ថ្ងៃ ៣២ ១៣ ២០២១ ខែ វិច្ឆិកា ឆ្នាំ ២០២១ ត្រីស័ក ព.ស.២៥៦៥  
ធ្វើនៅរាជធានីភ្នំពេញ ថ្ងៃទី ០៧ ខែ កក្កដា ឆ្នាំ២០២១

**ទេសរដ្ឋមន្ត្រី**

**រដ្ឋមន្ត្រីក្រសួងស្ថាប័ន និងសហគមន៍ វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍**



**កិត្តិសេដ្ឋាបណ្ឌិត ចម ប្រសិទ្ធ**

**អន្តរាគមន៍៖**

- ឧទ្ធរណ៍ សម្តេចអគ្គមហាសេនាបតីតេជោនាយករដ្ឋមន្ត្រី
- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួង ស្ថាប័នពាក់ព័ន្ធ
- ក្រុមប្រឹក្សាជាតិវិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍
- ដូចប្រការ៤
- ឯកសារ-កាលប្បវត្តិ

លេខៈ ២២២ ប្រ.ជ. គ.វ.ស.ជ. ២០២១

៣

ក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍  
៤៥ មហាវិថីព្រះនរោត្តម សង្កាត់ផ្សារថ្មី៣  
ខណ្ឌដូនពេញ ភ្នំពេញ ១២២០៥ (ព្រះរាជាណាចក្រកម្ពុជា)

ឧទ្ធរណ៍យកឧត្តមកិត្តិសេដ្ឋាបណ្ឌិត ទេសរដ្ឋមន្ត្រី  
ទូរស័ព្ទលេខ៖ (៨៥៥) ២៣ ២១១ ៧៧៥  
អ៊ីមែល៖ misti.sr@binet@gmail.com

## Appendix B List of Organisation Consulted

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### **Ministry of Industry, Science, Technology & Innovation (MISTI)**

- General Department of Science, Technology & Innovation
- National Institute of Science, Technology & Innovation
- General Department of Industry
- General Department of SMEs and Handicraft
- General Department of General Affairs
- Institute of Standards of Cambodia

### **Advisory Board Members of National Council of Science, Technology & Innovation**

### **Former National Science and Technology Council**

### **Ministry of Economy and Finance (MEF)**

- General Department of Economic Policy and Public Finance

### **Supreme National Economic Council (SNEC)**

### **Ministry of Foreign Affairs and International Cooperation (MFAIC)**

- General Department of International Cooperation
- National Institute of Diplomacy and International Relations

### **Ministry of Education, Youth and Sports (MOEYS)**

- General Department of Higher Education
- General Department of Policy and Planning

### **Ministry of Post and Telecommunications (MPTC)**

- General Department of ICT

### **Ministry of Commerce (MOC)**

- General Department of International Trade
- General Department of Trade Promotion

### **Ministry of Labor and Vocational Training (MLVT)**

- General Department of TVET

### **Ministry of Agriculture, Forestry and Fisheries (MAFF)**

- General Department of Agriculture

### **Ministry of Health (MOH)**

- General Department of Health

### **Ministry of Planning (MOP)**

- General Department of Planning
- National Institute of Statistics

### **Ministry of Public Work and Transportation (MPWT)**

- General Department of Logistics
- General Department of Planning

### **Ministry of Interior (MOI)**

- General Commissariat of National Police

### **Ministry of National Defense (MOD)**

- Royal Cambodian Armed Forces

### **Ministry of Civil Service (MCS)**

### **Council for the Development of Cambodia (CDC)**

### **Techo Startup Center (TSC)**

### **SME Bank of Cambodia**

### **Federation of Associations for Small and Medium Enterprises of Cambodia (FASMEC)**

### **Cambodia Chamber of Commerce (CCC)**

### **Institute of Technology of Cambodia (ITC)**

### **Royal University of Phnom Penh (RUPP)**

### **Royal University of Agriculture (RUA)**

### **National Institute of Post and Telecommunication and ICT (NIPTICT)**

### **National Polytechnic Institute of Cambodia (NPIC)**

### **Cambodia Development Resource Institute (CDRI)**

### **Kirirom Institute of Technology (KIT)**

### **Asian Vision Institute (AVI)**

### **Impact Hub Phnom Penh**

### **Small World Venture**

### **Amru Rice Co., Ltd.**

### **GGear Group Co., Ltd.**

### **ISI Group**

### **Mong Reththy Group Co., Ltd.**

### **The Royal Group Company**

### **Bongloy Payment PLC**

### **Japan International Cooperation Agency (JICA)**

### **Asian Development Bank (ADB)**

### **World Bank**



## Appendix C    **Typology of public research institutions**

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Generally, three major categories of public research institutions can be identified:

- **Scientific research institutes** produce new applied or fundamental knowledge and usually have 100% of their income coming from institutional funding received from the government. Some of them are 'big science' institutes based on large-scale research infrastructure typically beyond the financial reach of universities. Others do 'little science', which could also be done in the university sector. Examples of scientific research institutes include the Max Planck institutes in Germany and CERN in Switzerland. Historically, some scientific research institutes have their origins in Research Councils or Academies of Science, which simultaneously funded and performed research.
- **Government laboratories**, sometimes referred to as 'sector institutes', produce new applied knowledge to support the missions of their line ministries and generally also measure and monitor the achievement of those missions. These laboratories usually have high levels of institutional funding, but may receive income from externally financed research projects and the sale of services as well. These laboratories often perform routine monitoring activities for the government, such as monitoring fish stock, collecting public health statistics, producing standards, and generating weather forecasts. Such activities are supported by their own research capabilities and used for regulatory or emergency response purposes.
- **Publicly funded research and technology organizations (RTOs)**, sometimes referred to as 'applied industrial research institutes', focus on generating applied knowledge and doing research and development with and for the industry. RTOs work on user or problem-orientated research for the benefit of the domestic industry. They usually receive most of their funds competitively; however, public subsidy is still crucial as it allows them to develop capabilities beyond what the industry can tackle by itself. RTOs can support advanced industrial innovation and development following a three-stage model<sup>35</sup>:
  - Using public subsidy to do exploratory research and develop areas of capability or technology platforms that private-sector actors tend not to afford.
  - Refining and exploiting that knowledge in relatively un-standardized ways, often collaborating with industry.
  - Engaging in more routine exploitation of the knowledge, including via consulting and services.

Well-known examples of RTOs include the Fraunhofer Society in Germany, the Netherlands Organisation for Applied Scientific Research (TNO), the Technical Research Centre of Finland (VTT) and the Industrial Technology Research Institute (ITRI) in Taiwan.

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<sup>35</sup> Arnold, E. (2010). *Latvia. Peer Review Outcome Report*. Technopolis Group.

