The Southeast Asian Ministers of Education Organization
Regional Centre for STEM Education
(SEAMEO STEM-ED)

SEAMEO STEM-ED Five - Year Development Plan (FYDP)

For FY 2020/2021 – FY 2024/2025

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FIVE-YEAR DEVELOPMENT PLAN

FOR FY 2020/2021 – 2024/2025

Southeast Asian Ministers of Education Organization
Regional Centre for STEM Education

20 April 2020

Table of Contents

BACKGROUND 2
SEAMEO STEM-ED DEFINITION OF STEM EDUCATION 3
VISON 3
MISSION 3
FUNCTIONS 3
DEVELOPMENT STRATEGIES 4
DEVELOPMENT THEMES 7
ANNUAL DEVELOPMENT PLAN 11
ORGANIZATION STRUCTURE AND PERSONNEL STRENGTH .. **Error! Bookmark not defined.**
EXPENDITURE BUDGET ..... **Error! Bookmark not defined.**
ANNEX I: PROPOSED DEVELOPMENT PROJECTS ..... **Error! Bookmark not defined.**

BACKGROUND

The Southeast Asian Ministers of Education Organization Regional Centre for STEM Education (SEAMEO STEM-ED) was established to develop and strengthen regional capacities for STEM education, advocate for evidence-based policy, support research to provide evidence for decisions, and provide policy recommendations for STEM education within the SEAMEO member countries. This mission is aligned with the SEAMEO seven priority areas[1] and the UN sustainable development goals related to education. The Centre will fulfill this mission through capacity building activities and partnerships with policymakers, professionals, practitioners, and the private sector.

The Centre will serve as a regional knowledge repository and sponsor of rigorous research on STEM education that builds evidence of good practices, demonstrates workable solutions, and guides effective policy formulation. The Centre will support regional governments' efforts to promote STEM education, enhance the capacities of regional human resources, and enable the workforce to integrate knowledge of science, technology, engineering processes, and mathematics to solve real life problems.

The Centre was formally established after a Memorandum of Agreement was signed between former Minister of Education of Thailand, Dr. Teerakiat Jareonsettasin, and the director of the SEAMEO Secretariat, Dr. Ethel Agnes P. Valenzuela, on 8 May 2019 and the proposed establishment was endorsed by the SEAMEO Council on 23 July 2019.

The Centre opened an office in Bangkok in November 2019. The Thai government provides budgetary support for the Centre's operations and office. In the first year of its establishment, during fiscal years 2019/2020, the Centre will set up the necessary infrastructure for future operations including recruiting essential staff and resource persons, formulating a strategic plan, designing capacity-building projects, building partnerships with strategic partners, raising funds, and making other preparations necessary for the Centre to implement this first 5-year development plan in an effective and efficient manner.

At the Centre's first governing board meeting on 27-28 September 2019, the board approved a framework for a 5-year development plan in accordance with its vision, mission, and duties, which are in line with the United Nations' sustainable development goals and SEAMEO's seven priority areas.

Both the framework and this 5-year development plan are based on input from the SEAMEO member countries and the relevant SEAMEO regional centers obtained through conference calls, individual interviews, group brainstorming during consultative meetings as well as examination of relevant literature reviews. The 5-year plan was further refined using input from a series of stakeholder meetings, which were organized to obtain their feedback on a draft plan and proposed intervention projects.

[1] The SEAMEO seven priority areas include: 1) Achieving universal early childhood care and education, 2) Addressing barriers to inclusion, 3) Resiliency in the face of emergencies, 4) Promoting technical and vocational education and training, 5) Revitalising teacher education, 6) Harmonising higher education and research, and 7) Adopting a 21st Century curriculum.

SEAMEO STEM-ED DEFINITION OF STEM EDUCATION

"STEM education is a teaching and learning approach, which emphasizes the connections among--or the integration of--knowledge and skills in science, technology, engineering, and mathematics to address problems facing our communities as well as larger global issues that require a skilled workforce and knowledgeable citizens."

The 5-year development plan is presented below while the proposed development projects are presented in Annex I.

VISON

A regional research and capacity building Centre of excellence for STEM Education that advocates and supports evidence-based policy and practice.

MISSION

Strengthening regional STEM education capacity through:

a. Advocating evidence-based policy research in STEM education and providing policy recommendations to leaders of STEM education that match national/regional socio-economic development;

b. Developing capacity of educational personnel and policy makers in STEM education;

c. Enriching regional STEM learning units by leveraging existing resources in the region which matches regional context;

d. Supporting the creation of cultures of improvement in schools across the region; and,

e. Building networks and partnerships of policy makers, professionals, practitioners and private sectors in order to strengthen STEM education.

FUNCTIONS

The functions of the Centre can be defined as follows:

a. Sharing expertise and information on effective programs, providing model training programs for teachers and principals, conducting, or co-conducting research and evaluation in collaboration with member countries and STEM-related SEAMEO centers on STEM education programs being implemented by either government or private organizations in the SEAMEO member countries.

b. Disseminating STEM information (database) on what works by collecting, analyzing, and synthesizing data from rigorous research, disseminating useful evidence on the programs

that work to policy makers and practitioners for improving STEM education within SEAMEO member countries.

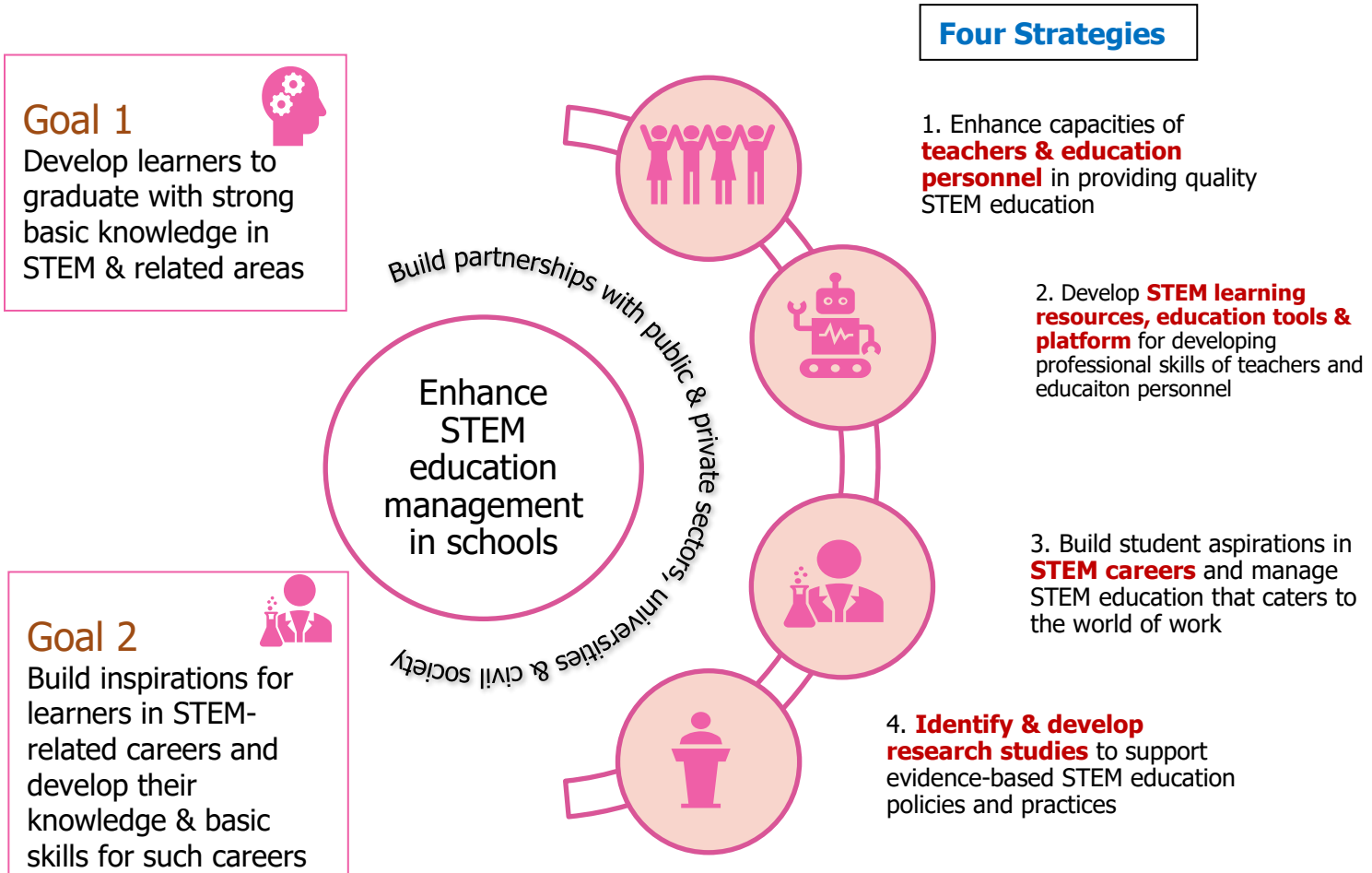
c. Developing and testing model STEM learning materials, and related assessment tools aligned with the existing common core regional learning standards (CCRLS) in science and mathematics by working collaboratively with SEAMEO member countries and STEM related SEAMEO centers and leveraging international and regional expertise.

d. Developing human resources, both educational leaders and practitioners, in the field of STEM education through face-to-face interactions and on-line programs including massive open online course (MOOCs).

e. Providing consultation, technical assistance and advocacy of evidence-based policies and practices for strengthening STEM Education to the regional Ministries of Education.

DEVELOPMENT STRATEGIES

SEAMEO STEM-ED plans to utilize four key strategies to raise the quality of STEM education in Southeast Asia. At the heart of these strategies is the capacity building of schools, which are the critical mechanism for providing education to students who enter into higher education and business enterprises.



Strategy 1: Enhance the capacities of teachers and education personnel in providing quality STEM education

The quality of STEM education is an important factor in enhancing the outcomes for students, for student interest and participation in the lessons, and their STEM-related capacity development.

The primary problems leading to low quality educational outcomes arise from inappropriate levels of teacher knowledge of the content, inadequate teacher pedagogical skills, inadequate teaching materials, low levels of student literacy and numeracy skills, and a mindset that blames students for the poor results. All of these problems will be addressed in the Centre's projects.

Building of teacher confidence in using new teaching techniques or STEM learning modules requires the support of school academic leaders, teacher professional learning communities, and education personnel from the universities.

Objectives

1. Use organizational development strategies to create a culture of improvement in the schools that fosters action to correct deficiencies in learning outcomes.
2. Develop teachers' skills in providing mathematics and STEM education from early childhood, primary through lower secondary levels.
3. Develop teachers' skills to enhance student skills in reading and writing in every subject and at every grade level.
4. Encourage schools to provide supplementary activities for students who have slow development of basic reading and calculations.
5. Develop academic leadership of educators and school administrators to enable them to deliver quality school management.

Approach

Establish STEM professional academies in order to develop skills of educators (teachers, educational advisors, school administrators) in STEM education practices and literacy practices in partnership with leading international universities and universities in Thailand and the region. Use team visits to schools by trained school improvement teams to help school staffs identify improvement priorities and recognize opportunities for improvement.

Strategy 2: Develop STEM learning resources, education tools, and a platform for developing professional skills of teachers and educational personnel

Quality learning resources are another factor that assists teachers in stimulating student interest and building student participation in the lessons, and thus enhance their understanding of scientific and mathematical concepts. Teachers need more than textbooks to help students understand these concepts. Students also benefit from applying their knowledge and technology in projects that address everyday problems that their communities face. Furthermore, using these learning resources in groups opens opportunities for students to develop teamwork skills and learn from their peers.

Tools to assess student knowledge and skills also are important for student development and will enable teachers to adjust their lessons to address the needs of students who lag behind and also provide input for school administrators to plan academic support effectively.

The creation of platforms for academic exchanges, both in person and online, can support and strengthen professional learning communities for teachers and educational personnel.

Objectives

1. Collaborate with partners to mobilize resources to acquire, adapt, develop, and test STEM learning resources that are suitable for the national and regional contexts.
2. Support and develop teachers' skills and confidence to use the STEM learning resources to build student interest and enhance their learning.
3. Organize academic platforms in the form of in-person or online conferences for academic exchanges.

Approach

Mobilize collaborations with partners both local and abroad (from the USA, Korea, Japan, Australia, Germany, etc.) to develop or adapt and test STEM learning resources and assessment tools and if they are proven effective, make them available for widescale adoption by schools in the region. Organize conferences and develop websites on STEM resources and practices that serve as learning sources for teachers and other educational personnel.

Strategy 3: Build student aspirations for STEM careers and develop and manage STEM education that caters to the world of work

The development of a country and a region that is driven by science, technology, and innovation is only possible if there is a sufficient base of youth who are inspired to learn about STEM and develop into adults who seek jobs that use STEM knowledge and skills. Currently the number of students studying science or other STEM related fields is much lower than those who select social science fields and this is because many students lack the interest or the confidence to study STEM related fields, especially when they do not understand them or think that they are too difficult. Furthermore, the formal education system does not pay enough attention to career guidance or to the development of knowledge and skills that are directly related to the world of work.

Objectives

1. Form partnerships with government agencies, private enterprises, universities, and schools to develop and pilot test career academies in secondary schools or vocational schools to prepare students for the world of work, whether they want to go directly into work or enroll in higher education upon graduation.
2. Develop the skills for teachers and school administrators needed to develop and manage career academies.
3. Carry out a rigorous evaluation of the program and use the results to make revisions in the program in order to achieve the highest level of efficiency and effectiveness.
4. Build sustainability by raising additional funds and resources to scale up the program throughout the region.

Approach

Mobilize resources to develop career academies programs by recruiting experts to support their development and building partnerships with interested stakeholders to design programs and make them effective, and create program sustainability by advocating for policy support of the program.

Strategy 4: Identify and/or develop research studies that can contribute to evidence-based STEM education policies and practices

There are multiple approaches to the design and management of STEM education that result in positive student outcomes. Providing reliable information about what works for teachers and school administrators can be useful to them in adapting and planning similar successes in their own schools.

At the same time, collecting and synthesizing quality research studies on the STEM education policies and programs can also help policymakers make informed decisions about which policies and programs are effective and produce high student outcomes, and persuade them to support the adoption and implementation of such policies and programs.

Objectives

1. Set standards for the research to be reviewed in line with international standards with support from international experts.
2. Encourage researchers in the region to conduct research synthesis that meets international standards.
3. Build collaboration with national and regional researchers to undertake research studies on important topics of improvement, such as developing literacy skills for at-risk group of students.
4. Present research findings at recognized public events on a continuous basis in order to advocate effective policy making on issues that are important to enhancing the quality of STEM education in the region.

Approach

Mobilize collaboration with partners, both at the local and international levels (from USA, Australia, etc., and the region), to facilitate exchange of knowledge about research methods and collaborate on synthesizing research studies, and present findings at international conferences or public events.

DEVELOPMENT THEMES

The Centre plans to pursue the four strategies by organizing development projects and activities around three key STEM education development themes as follows:

Key Theme 1: STEM Education Research and Evaluation

Policy advocacy is one of the key roles for the Centre as suggested by the member countries and SEAMEO centers. International policy advocacy is increasingly based on evidence of what works, and a number of countries including the U.K., the U.S., Denmark, the Netherlands, France, Australia, and New Zealand have established centers to review and synthesize research evidence to guide policymakers and practitioners. This movement began in health area, but has spread to education, social work, law enforcement, and other sectors.

The Centre plans to establish a working group of researchers in the region nominated by the SEAMEO member countries to implement this initiative. The program will include an exploration of existing platforms in the region, including the Clearing House platform to select the most effective platform to use in the program. The working group will then determine the standards for studies to be included in systematic reviews. The Centre will

invite researchers from SEAMEO member countries to participate in a series of workshops on rigorous research methods. These workshops will be led by leading international experts. Funding will be raised to support the development of systematic reviews and support new research which meets the set standards.

Research that meets the standards and the systematic reviews will be published on the Centre's Clearing House platform. Finally, the Centre will conduct policy roundtables on the implications of the reviews or studies for strengthening STEM education for policymakers from the SEAMEO member countries. In this way, awareness of evidence-based policy making can be increased in parallel with the capacity building of the regional research community.

Proposed development projects under this key theme include:

Project 1: ***What Works in Southeast Asia*** is a project that aims to create a website for display of research evidence on the effectiveness of various STEM programs and curricula available for use by educators in the region and encourage policymakers and educators to consider this evidence when making decisions about the adoption of STEM programs and curricula.

Accompanying Activity: ***Project Evaluation*** will be an internal ongoing activity that will evaluate and assess the results of Centre projects using the methodologies that meet international standards in order to assess the effectiveness of the Centre's intervention projects.

Key Theme 2: Resources for and the Capacity Building of Educational Personnel

SEAMEO member countries and SEAMEO centers' representatives expressed a shared interest in the development and adoption of common core regional learning standards (CCRLS) in science and math. They also expressed a common desire to promote project-based and problem-based approaches in STEM education. A number of studies indicate that these approaches have positive effects on student learning, especially when students are able to utilize multiple disciplines to construct models and solve real-life problems.

There is considerable enthusiasm among the SEAMEO member countries and SEAMEO regional centers to co-develop learning materials for STEM education. The Centre plans on utilizing the resources and expertise of well-known institutions or scholars from the member countries and the SEAMEO regional centers who can share knowledge, backed up by evidence, about developing new learning material prototypes based on the agreed upon themes. The prototype learning units and materials will guide teachers on how to facilitate STEM project-based learning for students. The units can be piloted in schools within the region, and if proved effective, to be distributed widely.

Capacity building of educational personnel is another critical area in need of development by many SEAMEO member countries. Addressing the need involves personnel at multiple levels from policy leaders, educational administrators, school administrators, teachers, and educational supervisors. All need to enhance their capacities as leaders in STEM education management. The Centre envisions formulating a program that sponsors the development of new learning materials, improves teachers' classroom practices, and increases student motivation. The program will be co-designed and implemented by a working team to be assembled from the SEAMEO member countries and SEAMEO regional centers. The program components will potentially include curriculum materials enhancement, professional development for school leaders and teachers,

strategies for enhancing student motivation, ongoing implementation support, and monitoring and evaluation of program outcomes and impacts.

Proposed development projects under this key theme include:

Project 2: ***STEM Learning Modules*** – The Centre plans to implement three learning module projects: 2.1) STEM Learning Resources on Sustainable Development Goals, 2.2) Southeast Asian Digital STEM, and 2.3) the Korean Corporations for Southeast Asian STEM Education.

The STEM Learning Resources on Sustainable Development Goals project aims to create STEM online learning resources for STEM educators based on the sustainable development goals (SDG). The Centre plans to partner with university faculty in the region and international experts in curriculum development. STEM educators from pilot schools will be trained in the use of inquiry based learning, project-based learning, and the flipped classroom approach. The online learning modules will enable classroom teachers to help their students' develop 21st century skills such as critical thinking, problem-solving, creativity, communication, and collaboration.

The Southeast Asian Digital STEM (SEADSTEM) project aims to develop and disseminate effective learning materials for teachers in Southeast Asia through an online platform (https://www.seadstem.org/). The project will offer a workshop to train teachers in the region to develop new learning units, which will be reviewed for quality and field-tested to determine their effect on teaching practices and students' learning outcomes. It is expected that SEADSTEM will become a popular learning portal for teachers who want to adopt STEM learning units in their schools. The Goethe-Institut and the SEAMEO Regional Centre for Educational Innovation and Technology (SEAMEO INNOTECH) initiated the project in 2018 and developed a number of initial learning units. The Centre is joining forces with the two partners to develop and transform the online platform into a dynamic professional learning community for educators to exchange high-impact practices and resources supported by evidence.

The Korean Corporations for Southeast Asian STEM Education (KOSEA-STEM-ED) project aims to localize selected STEM learning materials and tools developed in South Korea for adoption by schools in Southeast Asia at a highly subsidized or no cost basis. The project plans to seek funding support from Korean conglomerates operating in the region to support the localization, field testing, and assessment of the learning resources and subsidize the procurement of proven materials for ASEAN schools in need of support.

Project 3: ***STEM Career Academies*** is a college and career readiness project that aims to establish career academies as small learning communities within secondary schools. The project will help students connect academic subjects and their applications to the world of work in a specific career pathway. The Centre will develop partnerships among employers, communities, and universities that will provide resources, adult mentors, and opportunities for students to engage in career-related work and internships. In addition to the academic enrichment, career awareness, and occupational skills, the academies will develop 21st century skills in order to prepare young adults for the ever-changing technology-oriented and innovative society.

Project 4: ***STEM Leadership Academy*** – The Centre plans to implement two STEM leadership projects: 4.1) a STEM Professional Academy and 4.2) a School Leadership Academy.

The STEM Professional Academy project will offer a series of professional workshops for STEM educators that are evidence-based and interactive, and whose workshop presenters will model skills in effective teaching strategies in order to assist classroom teachers in developing student critical thinking, problem-solving, communication, and

collaboration. The initial Academy offerings will be virtual because of the restrictions on large gatherings. After the corona virus pandemic ends, the Centre will offer a mix of face-to-face and virtual workshops. Through engagement with national teacher development agencies in Thailand and in the region, the STEM Professional Academy will be institutionalized as part of the professional development for teachers and as part of the pre-service teacher development system.

The School Leadership Academy project aims to improve the preparation of school principals by preparing them to be instructional leaders and enabling them to create cultures of improvement in their schools. This project intends to develop a curriculum for school leaders, field test the new curricula, and persuade universities in the region which prepare principals to adopt it in whole or in part, and assist the adopting universities in doing so. The end result of the project is expected to be the creation of a model training program for principals that effectively develops the necessary knowledge and skills, followed by the reform of principal training in the universities and a significant change in the role of the principal in schools.

Key Theme 3: Advocacy, Partnership and Communication

Policy advocacy and strategic communication are necessary activities for building awareness among education policymakers and practitioners and facilitating the formulation of evidence-based education policies and the adoption of proven teaching practices and tools based on evidence of their effectiveness. The Centre plans to organize awareness-building activities, policy forums or a website to disseminate relevant, practical research information to facilitate the exchange of knowledge among academics, education personnel, and policymakers focused on raising the quality of STEM education.

Proposed development project and activities under this key theme include:

Project 5: ***Policy Advocacy Roundtables*** is an ongoing project that will bring international and regional experts together with regional policymakers to discuss the implications of research findings and experiences in other countries with ASEAN policymakers for the purpose of increasing the efficacy of government actions in the region. The purpose is to encourage policymakers to give more attention to evidence in making policies in the ASEAN countries.

Accompanying Activity: ***Public-Private Partnership Networks*** will be an ongoing activity to build partnerships between public, private, and university partners who can support and collaborate on project implementation with the Centre.

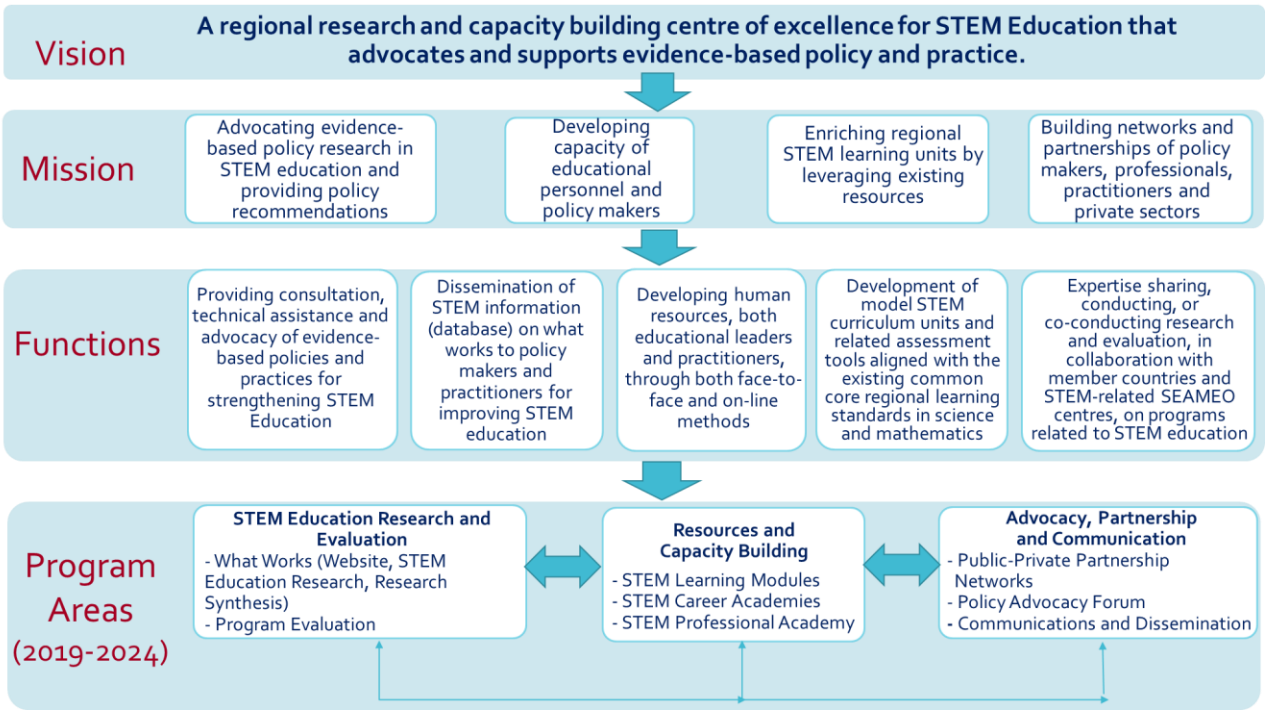
Accompanying Activity: ***Communications and Dissemination*** is an ongoing activity that aims to communicate and disseminate relevant information to a network of academicians, policymakers, and practitioners on STEM education in the region.

The work on communications and dissemination also involves **Project 6: *Southeast Asian Journal of STEM Education***, which is a peer-reviewed Open Source journal whose mission is to encourage the sharing of research and practices in evidence-based STEM education and to develop a body of knowledge that advances STEM education in Southeast Asia.

In addition to the above projects, the Centre was awarded a two-year grant from Chevron Thailand Exploration and Production, Ltd. on 8 April 2020 to implement **Project 7: *Chevron Enjoy Science phase 2***. This public-private-partnership project aims at strengthening Thailand's competitiveness and innovation by improving STEM education in both formal and informal settings, building and sustaining professional capacity within the education system by working more closely with government agencies and private partners,

building a culture of improvement within the schools, and introducing a college and career readiness program called Career Academies, which has been proven to be a successful intervention in many countries, to address the skills gap in the STEM workforce. The project has intervention components and activities that span all three key themes of the Centre and will initiate initial activities for many of the projects listed under the three themes. As such, these projects will utilize partial funds from Chevron Enjoy Science phase 2 to initiate key project activities in the first two years before seeking additional funds to support the continuation and scaling up of the activities after the end of the Chevron project.

The three key development themes are in line with and support the achievement of the Centre's vision and mission and the performance of our functions as illustrated in the diagram below.



ANNUAL DEVELOPMENT PLAN

Year One Development Plan (FY 2020/2021)

1. STEM Education Research and Evaluation Theme

The Centre's plan for project implementation in year one under the STEM Education Research and Evaluation theme is as follows:

1.1. ***"What Works in Southeast Asia"*** project – The Centre plans to kick start this project in year one by following these steps:

1.1.1. Hold consultative meetings to identify and develop researchers for STEM education based on the research development framework that meets international standards.

1.1.2. Set standards for the research to be considered as evidence of effectiveness and research to be included in systematic reviews.

1.1.3. Develop a database of STEM education research in the region, which is credible and conforms to international research standards.

1.1.4. Organize three workshops per year for researchers, both at national and regional levels, to develop research methodology for practices in STEM education led by international experts.

1.1.5. Organize collaboration activities with researchers in Thailand and the region on research proposal writing to request funds from funding agencies.

2. Resources and Capacity Building Theme

The Centre's project implementation plan in year one under the Resources and Capacity Building theme includes four projects as follows:

2.1. ***STEM Learning Modules*** – The Centre plans to work on three projects related to development of STEM learning modules in year one as follows:

2.1.1. The Centre plans to start the development of Sustainable Development Goals (SDG) learning modules by collaborating with Walailuck University in Thailand to develop and pilot test the first two of four proposed STEM learning modules: 1) Climate Smart Agriculture using sensors, AI and IoT, 2) Controlling Dengue Fever in Southeast Asia, 3) Creating Better Air Quality with PM 2.5 sensors, and 4) Using indigenous knowledge to Mitigate Climate Change. The first two learning modules will go through a rigorous study to assess their effectiveness and impacts on teachers' instructional practices and student performance.

2.1.2. Work on the Southeast Asian Digital STEM (SEADSTEM) project with the Goethe-Institut and SEAMEO INNOTECH. The project works on developing digital STEM learning resources by utilizing the expertise of STEM teachers and educators from across the region. Multiple capacity-building workshops led by global STEM experts will be held to develop selected local educators to develop and submit learning units according to international standards and aligned with the SEAMEO Basic Education Standards (SEA-BES).

2.1.3. Work on a collaborative project with a network of STEM learning resource companies from South Korea and EduPark, an education resource company based in Thailand, that aims to pilot test Korean STEM learning resources from these companies and assess their effectiveness on student learning outcomes in order to promote the widespread utilization of effective learning resources in Thailand and across the region. The Centre plans to start the project by working with the Korea Trade-Investment Promotion Agency (KOTRA) to engage Korean conglomerates with the presence in Thailand to make CSR investment in the project to support the localization, field testing, and assessment of the Korean learning resources.

2.2. ***STEM Career Academies*** – The Centre plans to work on establishing career academies at secondary schools, initially in Thailand to pilot test the concept, and eventually to expand across the region. The career academies project is designed to build inspiration, attract more students into STEM careers, and prepare students for the world of work.

2.2.1. In year one, the Centre plans to hold a workshop on Career Academies Model with relevant stakeholders who are interested in adopting the Career Academies model at their schools. The Centre plans to set up a Career Academies Advisory Committee and working groups to oversee project implementation and evaluation and lay the necessary foundation for a pilot test of the concept at secondary schools in Thailand. The Centre will develop Career Academies model including curricular and instruction, career

awareness and internships activities, professional development for teachers, leaders, and parents, student assessment, certification and employment.

2.3. ***STEM Professional Academy*** – This Centre plans to initiate the two professional development academy projects to build the capacities of STEM education personnel in the region as follows:

2.3.1. The Centre plans to work in close partnership with pre-service and in-service teacher development institutions in Thailand and in the region on the development of a STEM professional academy. The project will design a set of courses or curricular modules that will prepare prospective STEM teachers to deliver high-impact instructional practices in their classrooms as well as to be instructional leaders and build a culture of improvement in their schools.

2.3.2. The Centre plans to work on a collaborative project with the Teachers' Council of Thailand and eventually with a number of Thai and regional universities to establish a School Leadership Academy, initially in Thailand, that will provide knowledge and skills for education leaders to enable them to help their staffs provide quality STEM education. The project will design and test a set of courses or curricular modules that will prepare prospective principals to be instructional leaders and build a culture of improvement in their schools.

3. Advocacy, Partnership and Communication Theme

The Centre's plan in year one under the Advocacy, Partnership and Communication theme involves the following project and accompanying activities:

3.1. The Centre plans to host two roundtables on issues related to the distribution and effectiveness of STEM education in the region and encourages each country to have four policymakers and four key university faculty members participate in each roundtable. The aim is to persuade national policymakers to use evidence when designing and implementing national STEM initiatives.

3.2. The Centre plans to establish Public-Private Partnership Networks across the region in order to build collaborative, working partnerships with relevant stakeholders in STEM education to support project implementation and policy advocacy work by the Centre. The relevant activities will involve:

3.2.1. Hold meetings with relevant stakeholders in order to seek collaboration with potential partners that have similar aims and objectives.

3.2.2. Hold separate meetings with relevant partners to discuss collaboration on implement What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, STEM Professional Academy projects together.

3.3. The Centre plans to implement ongoing communications and dissemination activities to build awareness and disseminate information about the projects and activities implemented by the Centre to target audiences using primarily online channels. The communications and dissemination plan in year one includes:

3.3.1. Develop an official website of the Centre at www.seameo-stemed.org.

3.3.2. Work on publishing an online peer-reviewed journal, *Southeast Asian Journal of STEM Education,* which will focus on what works in STEM education in Southeast Asia, quality research reports, and good practices in STEM education from around the world to be accessible from the Centre's website.

3.3.3. Work on publicizing and disseminating information about the four project areas: What Works in Southeast Asia, STEM Learning Modules, STEM

Career Academies, and STEM Professional Academy, using appropriate print and online media.

The Centre plans to start the work on phase 2 of the Chevron Enjoy Science project through many activities. The project plans include creating STEM Professional Academies for teachers and school leaders to help teachers deliver instruction which inspires students to learn and succeed in STEM. The project also intends to build the capacity of Thai educators to develop learning modules, which address relevant problems and situations in the Thai or regional contexts. In addition, the project plans to strengthen and scale professional learning communities (PLCs) and the Thailand School Improvement Program (TSIP) from phase 1 to enhance instructional leadership and create cultures of improvement in schools in order to raise the quality of teaching and student performance.

The Chevron Enjoy Science project aims to pilot a Career Academies Program in high schools as a successful intervention for addressing the skills gap in the STEM workforce. The project plans to increase the capacity of STEM awareness-building in relevant agencies in order to upgrade the quality and management of science museums and learning centers with a more effective outreach to the target communities. Finally, the project also plans to build the capacity of researchers to conduct rigorous studies on the impact of the project and hold policy forums for them to share the findings with policy makers and research granting agencies on the project interventions, which are expected to lead to increased awareness of evidence-based policies and practices and hopefully better-informed policy decisions.

Year Two Development Plan (FY 2021/2022)

1. STEM Education Research and Evaluation Theme

In year two, the Centre plans to build on the work initiated under the STEM Education Research and Evaluation theme in Year One to make noticeable progress as follows:

1.1. ***"What Works in Southeast Asia"*** project – The Centre plans to focus on collecting studies of STEM practices and resources that work through a set of activities below.

1.1.1. Sponsor or assist research studies of STEM education practices and resources that are promising and seem to result in desirable student outcomes in Southeast Asian through collaboration with local and regional researchers who participated in the project in year one.

1.1.2. Begin to populate the What Works in Southeast Asia database as soon as quality research is identified or made available through new studies by the network of researchers in the project.

1.1.3. Continue to hold three workshops per year to develop researchers, both at national and regional levels, on research methodologies that produce reliable evidence and generalizable results about practices in STEM education.

1.1.4. Provide consultation and technical advice to the researchers in the network by international experts to help overcome challenges and ensure the quality of the research work.

1.1.5. Present STEM education research findings and results by researchers in the network to disseminate the information on the STEM practices and resources that work and promote the project to a wider audience of STEM educators and policy makers throughout the region.

2. Resources and Capacity Building Theme

In year two, the Centre plans to continue with project implementation under the Resources and Capacity Building theme for all the projects initiated in year one.

2.1. ***STEM Learning Modules*** – The Centre plans to follow up on the projects related to STEM learning modules as follows:

2.1.1. Follow up on the collaborative project with Walailuck University in Thailand on the development of two more SDG learning modules while assessing the progress and results of the pilot tests of the first two modules in year one in order to make any necessary refinements to make the learning modules effective. If proven effective, the modules will eventually be made accessible to educators across the region.

2.1.2. Follow up on the SEADSTEM project with the Goethe-Institut and SEAMEO INNOTECH to support STEM teachers and educators in the project from participating countries in developing more learning resources. Teachers will try out learning units in their classrooms with a lesson study process with their teacher peers and refine them as necessary to better respond to student learning. A working group of regional researchers will be formed to design and implement a research plan using rigorous methods in order to study the impact of the interventions on students' learning outcomes to provide evidence of the program's effectiveness, and assure educators that they can adopt the units with confidence.

2.1.3. Follow up on the collaborative project with South Korean STEM learning resource companies, EduPark, and KOTRA to engage South Korean conglomerates in the region as donors to fund the assessment and selection of effective learning resources and promote them for widespread utilization in Thailand and expand into other countries in the region. Partnerships with South Korean conglomerates in each country will be sought to support the pilot test of the selected learning resources and the expansion into more schools in the country.

2.2. ***STEM Career Academies*** – After the foundation has been laid for a pilot test of the career academies model in Thailand in year one, in year two the Centre plans to establish actual career academies at secondary schools in partnerships with relevant businesses and universities initially in four areas: health case, computing science, smart agriculture, and teaching.

2.2.1. Teachers and supporting personnel from participating schools will be trained to teach and support the new career academies curricula.

2.2.2. The Centre will work with certifying body partners to develop an evaluation system and to issue professional qualification certificates in line with international standards to students who pass through the program.

2.2.3. The Centre will work with the business sector in the relevant areas to prepare students for internships and eventually employment after graduation.

2.3. ***STEM Professional Academy*** – In year two, the Centre will continue the implementation of the professional academy projects initiated in year one in order to build the capacities of STEM education personnel in the region.

2.3.1. The Centre plans to continue the partnerships with pre-service and in-service teacher development institutions in Thailand and in the region on the development of a STEM professional academy. The project will demonstrate the effectiveness of the new courses by testing their efficacy as professional

development offered by the STEM Professional Academy in collaboration with Teacher Development Agencies initially in Thailand.

2.3.2. The Centre plans to continue the collaboration with the Teachers' Council of Thailand and eventually with a number of Thai and regional universities in the establishment of a School Leadership Academy, initially in Thailand, that will provide skills development for education leaders to enable them to help their staffs provide quality STEM education. The project will demonstrate the effectiveness of the new curriculum at the School Leadership Academy and will work with major universities in Thailand on the transfer of this new leadership curriculum to the principal preparation programs at these universities.

3. Advocacy, Partnership and Communication Theme

In year two, the Centre plans to continue the work on the project and activities under the Advocacy, Partnership and Communication theme that started in year one.

3.1. The Centre plans to hold two roundtables in year two and follow a similar approach and steps as in the first year. The transcripts and videos of the roundtables will be posted on the Centre's website to make them accessible to policymakers and researchers from around the region.

3.2. The Centre will keep expanding the Public-Private Partnership Networks with relevant stakeholders in STEM education across the region and utilize these collaborative partnerships to support project implementation and policy advocacy work by the Centre.

3.2.1. The Centre will continue to hold regular meetings with stakeholders and partners to discuss collaboration on joint STEM education development projects.

3.2.2. The Centre will hold separate meetings with partners to continue the collaboration on What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy project implementation.

3.3. The Centre plans to continue with ongoing communications and dissemination activities, using primarily online channels, to reach out to target audiences in order to build awareness and disseminate information about the projects and activities of the Centre. The communications and dissemination plan in year two includes:

3.3.1. Continue the development and improvement of the Centre's website (www.seameo-stemed.org).

3.3.2. Continue the work on the online journal on the Centre's website addressing what works in STEM education in Southeast Asia, quality STEM education research, and good practices in STEM education from around the world.

3.3.3. Continue the work on publicizing and disseminating information about the four project areas: What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy, through a mix of print and online media.

The Centre plans to continue activities of the Chevron Enjoy Science 2 project in professional development for educators, development of core trainers for both STEM learning and STEM instructional leaders, evaluation of new STEM learning modules at pilot schools and, if effective, digitalized for online access. The Centre will develop impact studies of the elements of the Chevron Enjoy Science model and share the studies with

policy makers and employers to secure additional funds to scale up the elements of the project. The project will end after two years.

Year Three Development Plan (FY 2022/2023)

1. STEM Education Research and Evaluation Theme

In year three, the Centre plans to follow up on the evaluation of the projects and activities done in the first two years in order to determine their progress and assess their achievements and challenges, and make appropriate refinements as needed in order to continue on the course of developing STM education in Southeast Asia.

1.1. ***"What Works in Southeast Asia"*** project – The Centre plans to continue to support quality research on the STEM practices and resources that work and populate the website with the research findings following the activities below.

1.1.1. Continue to support local and regional researchers in the project to conduct research identifying STEM education practices and resources in Southeast Asia that are effective and result in desirable student outcomes.

1.1.2. Continue to populate the What Works in Southeast Asia database with quality research from the network of researchers in the project.

1.1.3. Continue to expand and develop the researcher network, both at national and regional levels, on research methodology for practices in STEM education led by international experts.

1.1.4. Provide continued consultation and technical advice to the researchers in the network by international experts to help overcome challenges and ensure the quality of the research work.

1.1.5. Present STEM education research findings and results by researchers in the network to disseminate the information on the STEM practices and resources that work including those involving the learning modules, career academies, and professional academy in the Centre's projects.

2. Resources and Capacity Building Theme

In year three, the Centre plans to continue implementing all the projects under the Resources and Capacity Building theme.

2.1. ***STEM Learning Modules*** – The Centre plans to follow up on the STEM learning module projects as follows:

2.1.1. Continue to follow up on the project with Walailuck University in Thailand on the SDG learning modules by expanding the project to cover wider geographical areas in Thailand and the region and evaluate the project results.

2.1.2. Continue following up on the SEADSTEM project with the Goethe-Institut and SEAMEO INNOTECH by promoting and supporting teachers from across the region to use the online learning resources from the project and evaluate the project results.

2.1.3. Continue following up on the South Korean learning resource project with South Korean STEM learning resource companies, EduPark, and KOTRA to promote effective localized learning resources for widespread utilization in Thailand and expand into other countries in the region, monitor and support

the use of the resources by adopting schools, and evaluate the project results.

2.1.4. Present research studies on the impact of these projects on student performance at recognized academic conferences.

2.2. ***STEM Career Academies*** – In year three, the project plans to continue to support the establishment of career academies at secondary schools in partnerships with relevant businesses and universities in four areas: health case, computing science, smart agriculture, and teaching.

2.2.1. The project plans to work with the partners in each of the four areas to fine tune the curricula and make them suitable to the local context and demands.

2.2.2. The project plans to provide continued development and support of teachers and supporting personnel from participating schools so they can run the program at their respective schools and develop their students for careers in the four areas.

2.2.3. The project plans to continue to work with certifying body partners on the issuing of professional qualification certificates in line with international standards to students who pass through career academies.

2.2.4. The project plans to continue to work with the business sector in the relevant areas to expand the choices of internships and employment for students who join career academies.

2.2.5. The project plans to provide a system for an assessment and certification of schools that implement career academies in accordance with defined standards.

2.2.6. Rigorous research studies will be carried out to evaluate the results and impacts of the project; the research findings will be presented at recognized academic conferences and submitted to academic journals for publication consideration.

2.3. ***STEM Professional Academy*** – The Centre will continue the implementation of the professional academy projects through year three in order to continue to build the capacities of STEM education personnel in the region.

2.3.1. The Centre plans to continue the partnerships with pre-service and in-service teacher development institutions in Thailand and in the region on the STEM professional academy. The project will work on transferring the courses offered by the new STEM professional academy to the pre-service programs in major universities and in-service teacher development institutions initially in Thailand.

2.3.2. The Centre plans to continue the collaboration with the Teachers' Council of Thailand and Thai and regional universities in the operation of the School Leadership Academy. The project will continue to work on the transfer of the new leadership curriculum to the principal preparation programs at major universities in Thailand.

3. Advocacy, Partnership and Communication Theme

In year three, the Centre plans to continue the work on the project and activities under the Advocacy, Partnership and Communication theme that began in the first two years.

3.1. Similar to the first two years, the Centre plans to hold two roundtables in year three on issues related to the distribution and effectiveness of STEM education in the

region and continues to encourage each country to have four policymakers and four key university faculty members participate in each roundtable in order to advocate increased attention to evidence by national policymakers and the increased efficacy of national STEM initiatives resulting from the use of evidence in their design.

3.2. The Centre will continue to expand and strengthen the Public-Private Partnership Networks with relevant stakeholders in STEM education across the region and utilize these collaborative partnerships to support project implementation and policy advocacy work by the Centre.

3.2.1. The Centre will continue to hold regular meetings with stakeholders and partners to discuss collaboration on joint STEM education development projects.

3.2.2. The Centre will hold separate meetings with partners to continue the collaboration on What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy project implementation.

3.3. The Centre plans to continue the ongoing communications and dissemination activities, using primarily online channels, to reach out to target audiences in order to build awareness and disseminate information about the projects and activities of the Centre. The communications and dissemination plan in year three includes:

3.3.1. Continue the improvement of the Centre's website (www.seameo-stemed.org).

3.3.2. Continue the work on the online journal *(Southeast Asian Journal of STEM Education)* featuring what works in STEM education in Southeast Asia, quality STEM education research, and good practices in STEM education from around the world.

3.3.3. Continue the work on publicizing and disseminating information about the four project areas: What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy, through a mix of print and online media and assess the level of awareness of target audiences on the four project areas.

Year Four Development Plan (FY 2023/2024)

1. STEM Education Research and Evaluation Theme

In year four, the Centre plans to continue following up on the assessment of the projects and activities implemented in the first three years in order to determine their progress and achievements as well as challenges, and continue to fine tune them as needed in order to move towards the goal of developing STEM education in Southeast Asia.

1.1. ***"What Works in Southeast Asia"*** project – The Centre plans to support continued quality research on the STEM practices and resources that work and continue to populate the website with the research findings following the activities below.

1.1.1. Continue to support local and regional researchers in the project to conduct quality research work to identify STEM education practices and resources in Southeast Asia that are effective and result in continuously improved student outcomes.

1.1.2. Continue to populate the What Works in Southeast Asia database with quality research from the expanding researcher network in the project.

1.1.3. Continue to expand and develop the researcher network, both at national and regional levels, on research methodology for practices in STEM education led by international experts.

1.1.4. Provide continued consultation and technical support to the researchers in the network by international experts to help overcome challenges and ensure the quality of the research work.

1.1.5. Present STEM education research findings and results by researchers in the network to disseminate the information on the STEM practices and resources that work.

2. Resources and Capacity Building Theme

In year four, the Centre plans to continue the implementation of many projects under the Resources and Capacity Building theme and capture the successes of these projects and promote them as good practices in STEM education resources for adoption by schools in SEAMEO member countries.

2.1. ***STEM Learning Modules*** – The Centre plans to continue to promote online learning modules as follows:

2.1.1. Continue to develop integrated SDG learning modules with Walailuck University in Thailand as online supplementary learning resources for schools across the region.

2.1.2. Continue to develop more SEADSTEM online learning resources with the Goethe-Institut and SEAMEO INNOTECH and promote the adoption of the learning resources by schools from across the region.

2.1.3. Capture successful outcomes from the South Korean learning resource project with South Korean STEM learning resource companies, EduPark, and KOTRA and promote success stories through teachers' professional learning communities to enhance the effectiveness of the learning resources at adopting schools.

2.2. ***STEM Career Academies*** – In year four, the project plans to seek additional funding from donors to support the expansion of career academies to additional secondary schools throughout Thailand and the expansion into the region.

2.3. ***STEM Professional Academy*** – In year four, the Centre plans to scale up the STEM professional academy projects implemented in the first three years to reach a larger number of STEM education personnel as well as to expand the geographic coverage in the region as follows:

2.3.1. The Centre plans to continue to expand the partnerships with pre-service and in-service teacher development institutions in Thailand and in the region on the STEM professional academy and transfer the courses offered by the academy to the pre-service programs in major universities and in-service teacher development institutions in Thailand and eventually in the region.

2.3.2. The Centre plans to continue the collaboration with the Teachers' Council of Thailand and Thai and regional universities in the operation of the School Leadership Academy. The project plans to continue to work on the transfer of the new leadership curriculum to the principal preparation programs at major universities in Thailand.

3. Advocacy, Partnership, and Communication Theme

In year four, the Centre plans to continue the work on the project and activities under the Advocacy, Partnership and Communication theme that began in the first three years.

3.1. The Centre plans to continue to hold two roundtables in year four on issues related to the distribution and effectiveness of STEM education in the region and encourages participation by policymakers and key university faculty members from each country in order to advocate increased attention to evidence by national policymakers and the increased efficacy of national STEM initiatives resulting from the use of evidence in their design.

3.2. The Centre will continue the expansion and strengthening of the Public-Private Partnership Networks with relevant stakeholders in STEM education across the region and utilize these collaborative partnerships to support project implementation and policy advocacy work by the Centre.

3.2.1. The Centre will continue to hold regular meetings with stakeholders and partners on joint STEM education development projects.

3.2.2. The Centre will continue to hold separate meetings with partners to continue the collaboration on What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy project implementation.

3.3. The Centre plans to continue the ongoing communications and dissemination activities to reach out to target audiences in order to build awareness and disseminate information about the projects and activities of the Centre as follows:

3.3.1. Continue the improvement of the Centre's website (www.seameo-stemed.org).

3.3.2. Continue the work on the online journal featuring what works in STEM education in Southeast Asia and good practices in STEM education from around the world.

3.3.3. Continue the work on publicizing and disseminating information about the four project areas: What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy, through a mix of print and online media and assess the level of awareness of target audiences on the four project areas.

Year Five Development Plan (FY 2024/2025)

1. STEM Education Research and Evaluation Theme

In the final year of this plan, the Centre intends to conduct the assessment of the projects and activities implemented in the first four years in order to determine the results and achievements and the lessons learned, and use these as inputs to formulate the next five-year development plan.

1.1. ***"What Works in Southeast Asia"*** project – The Centre intends to make the What Works in Southeast Asia database a permanent feature of the Centre and continue to support quality research on the STEM practices and resources that work and populate the website with the research findings following the activities below.

1.1.1. Continue to support local and regional researchers in the project to conduct quality research work to identify STEM education practices and resources in

Southeast Asia that are effective and result in continuously improved student outcomes.

1.1.2. Continue to populate the database with quality research from the researcher network in the project.

1.1.3. Continue to develop the researcher network, both at national and regional levels, on research methodology for practices in STEM education led by international experts.

1.1.4. Provide continued consultation and technical support to the researchers in the network by international experts to help overcome challenges and ensure the quality of the research work.

1.1.5. Present STEM education research findings and results by researchers in the network to disseminate the information on the STEM practices and resources that work.

2. Resources and Capacity Building Theme

In year five, the Centre plans to continue the implementation of projects under the Resources and Capacity Building theme that prove to be effective in producing desirable student outcomes and continuously improved performance.

2.1. ***STEM Learning Modules*** – The Centre plans to continue to promote online learning modules as follows:

2.1.1. Continue the development of integrated SDG learning modules with Walailuck University in Thailand as online supplementary learning resources for schools across the region.

2.1.2. Continue the development of more SEADSTEM online learning units with the Goethe-Institut and SEAMEO INNOTECH and promote the adoption of the learning resources by schools from across the region. The SEADSTEM platform will be eventually transformed to a dynamic professional learning community for educators to exchange high-impact practices and resources supported by evidence.

2.1.3. Capture successful outcomes from the South Korean learning resource project and promote success stories through teachers' professional learning communities to enhance the effectiveness of the learning resources at adopting schools.

2.2. ***STEM Career Academies*** – In year five, the Centre plans to continue the support for the establishment of career academies at additional secondary schools throughout Thailand and across the region and work towards the transfer of this new STEM Career Academies model to the implementation agencies to be established within existing agencies or to be newly created in Thailand and in the region.

2.3. ***STEM Professional Academy*** – In year five, the Centre plans to continue the support for scaling up the STEM professional academy projects implemented in the first four years to reach a larger number of STEM education personnel as well as to expand the geographic coverage in the region as follows:

2.3.1. The Centre plans to focus on expanding the partnerships with pre-service and in-service teacher development institutions in Thailand and in the region on the STEM professional academy and transfer the courses offered by the academy to the pre-service programs in major universities and in-service teacher development institutions in Thailand and in the region.

2.3.2. The Centre plans to focus on the collaboration with the Teachers' Council of Thailand and Thai and regional universities in the operation of the School Leadership Academy and the transfer of the new leadership curriculum to the principal preparation programs at major universities in Thailand.

3. Advocacy, Partnership, and Communication Theme

In year five, the Centre plans to continue the work on the project and activities under the Advocacy, Partnership and Communication theme that began in the first four years with an aim towards sustainability.

3.1. The Centre plans to make policy advocacy roundtables a regular event of the Centre in order to provide a platform for the discussion of the implications of research findings and experiences in other countries with ASEAN policymakers for the purpose of encouraging more attention to evidence in making policies in the ASEAN countries.

3.2. As critical tools and resources to support project implementation and policy advocacy work by SEAMEO STEM-ED, the Centre plans to continue the expansion and strengthening of the Public-Private Partnership Networks with relevant stakeholders in STEM education across the region.

3.2.1. The Centre plans to continue to hold regular meetings with stakeholders and partners on joint STEM education development projects.

3.2.2. The Centre plans to continue to hold separate meetings with partners to continue the collaboration on What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy project implementation.

3.3. The Centre plans to continue the ongoing communications and dissemination activities to build awareness among target audiences and disseminate information about the projects and activities of the Centre as follows:

3.3.1. Continue the improvement of the Centre's website (www.seameo-stemed.org).

3.3.2. Continue to publish the online journal featuring what works in STEM education in Southeast Asia, quality research projects, and good practices in STEM education from around the world.

3.3.3. Continue to publicize and disseminate information about the four project areas: What Works in Southeast Asia, STEM Learning Modules, STEM Career Academies, and STEM Professional Academy, through a mix of print and online media and assess the level of awareness of target audiences on the four project areas.

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