Mechanisms of Driving Science-Based and Technology Demonstration Classrooms Under the Supervision of Rajamangala University of Technology Lanna, Chiang Rai, Thailand

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Abstract
This qualitative research aimed to analyze the mechanisms of driving the science-based technology demonstration classrooms under the supervision of Rajamangala University of Technology Lanna, Chiang Rai. The research sample consisted of 30 individuals, including university administrators, curriculum administrators, instructors, teaching assistants, and support staff. Interviews and focus group discussions were utilized as research tools, and descriptive statistics were employed for data analysis. The findings revealed that the mechanisms of driving science-based technology demonstration classrooms under the university's supervision have a significant impact on creating educational opportunities and enhancing competitiveness. Moreover, these mechanisms also contribute to producing skilled workers who can contribute to both government and industrial sectors. The collaborative efforts and participation of stakeholders in identifying and solving organizational issues have led to the development of education strategies that align with the requirements of both public and private sectors. For elevating the university to higher standards, it is vital for every staff member to take responsibility for producing competent graduates who can actively contribute to society. For this, leaders must be dares to innovate and take action is imperative, while faculty members must embody the spirit of professional educators, going beyond their roles as mere instructors. Additionally, the community's support, modern and comprehensive curriculum standards, and students' practical knowledge and skills transfer are also essential. Furthermore, the active involvement of enterprises in curriculum development and supporting the industrial labor market is vital for fostering a well-rounded educational environment.

Keywords: Driving Mechanisms, Science-Based Technology Demonstration Classrooms

Introduction

This research project of science-based technology demonstration classrooms is a joint initiative between Rajamangala University of Technology Lanna - RMUTL and San Kamphaeng Technical College and the Prototype Development Project is jointly conducted by Rajamangala University of Technology Lanna (RMUTL) and the National Science, Technology, and Innovation Policy Office (STI). These initiatives have been implemented between the academic years 2018 to 2020 with Diploma level in Mechatronics, and they aim to integrate seamless educational management processes. These processes encompass Vocational Certificate (Voc.) three-year program and Higher Vocational Certificate (Higher Voc.) two-year programs, followed by the Bachelor's degree program, with a focus on the core vocational curriculum aligned with the Vocational Education Commission (VEC) guidelines.

In the context of this study, science-based technology demonstration classrooms within the Pre-Engineering program were examined. These classes involve a unique arrangement where graduate students serve as mentors, taking on roles that encompass life care, academic support, and project consultation for Vocational Certificate (Voc.) students. Moreover, these graduate mentors actively contribute to the transfer of industrial knowledge by conducting instruction and collaborating on industry-related research.

Furthermore, the university and college faculty members participate in teaching and knowledge sharing, ensuring that students acquire fundamental skills that align with industry standards. The curriculum emphasizes a fusion of academic and vocational learning, incorporating lessons derived from industrial practices to prepare students for further studies in technology-related professional programs.

Upon successful completion of the Vocational Certificate (Voc.) level, students have two career development pathways: 1) Those demonstrating expertise in practical work are further developed as productive professionals and may pursue the Higher Vocational Certificate (Higher Voc.) program, and 2) Those displaying innovation, creativity, and product development capabilities are nurtured as innovative personnel, fostering a continuous of exploration and progress.

The development of a country's capacity for global competition necessitates the cultivation of skilled individuals who can effectively drive various mechanisms towards predetermined objectives. University-level education plays a pivotal role in knowledge advancement, facilitating the integration of cutting-edge technologies into academic content, and producing specialized professionals who possess the ability to align their skills with theoretical knowledge, thereby meeting the demands of the labor market. This synchronization of education with the economic and social landscape, both at local and national levels, enables seamless expansion of businesses, communities, and industries.

Although, the educational institutions had not been fully aligned their outputs with the societal and industrial needs, resulting in an insufficient supply of personnel tailored to meet the demands of communities and industries. For the expansion of technical, technological, and innovative competencies, teaching and learning practices must integrate working skills with contemporary science and technology. However, the developing instructors, curricula, and teaching methodologies to meet requirements of industries and communities have been limited.

As part of Thailand's strategy for economic advancement and to prevent from being a middle-income country, the nation has undertaken efforts to restructure its economy, emphasizing the fields of science and technology. This approach aims to drive economic growth and develop skilled labor to propel the country towards becoming a center for human resource development and scientific and technological progress. These endeavors are crucial for supporting the expanding labor market and driving development across all sectors in Chiang Rai Province, as well as in the Upper Northern Region, including the Mekong sub-region and the five traditional industries and five new industries (5 S-curves and 5 new S-curves).

In this context, planning and developing human resources and skilled labor are of utmost importance and necessity. This involves equipping individuals with relevant knowledge and specialized expertise, aligning with the demands of both the industrial sector and the labor market of the country. A well-designed development plan is vital to efficiently and effectively drive economic growth, create jobs, generate income, and foster transformative societal changes in all dimensions of the nation with the government's policies. This requires collaboration between relevant state agencies involved in educational management, as well as cooperation from all sectors, including the public, private, tertiary, vocational, and secondary education sectors.

Adopting an integrated education model that encompasses both theoretical learning and practical work within business entities is essential. In this regard, Rajamangala University of Technology Lanna, Chiang Rai, under the guidance and supervision of the College of Technology and Interdisciplinary, Rajamangala University of Technology Lanna, Doi Saket has actively been involved in such efforts since 2007 to the present.

The development of skilled technical and vocational education graduates to meet the demands of the industrial sector has been a paramount objective in driving Thailand's economic progress and elevating its global competitiveness. To achieve this goal, educational institutions have emphasized the integration of theoretical knowledge and practical skills relevant to the contemporary workplace, fostering graduates who possess the necessary expertise to contribute effectively to the industrial and vocational sectors. Furthermore, the aim has been to produce graduates equipped to meet the needs of both vocational and higher education institutions with the principles of the "Cooperative Education 4.0" concept proposed by Wijit Srisa-an (2017). In recognition of this initiative, Wichit Srisa-an was honored as a visionary and pioneer of Cooperative Education in Thailand, leading towards Cooperative Education 4.0 in the 21st century, an integral part of Education 4.0 that seeks to enhance the quality of human resource development, knowledge creation, and innovation with the standards set by the Office of the Higher Education Commission (OHEC).

This paper focuses on the significance of planning and developing human resources and skilled labor, designed to equip graduates to enter the labor market. The study reveals three crucial key attributes by employers: (1) the promptly ability to apply knowledge and skills in the workplace, (2) tolerant, and (3) advanced English proficiency. From these findings, the concept of Cooperative Education has evolved into a "University-Workplace Engagement," where Cooperative Education is now integrated into specialized and vocational undergraduate curricula, for four-year study, with full-time, four-month work placements at partnering enterprises. This approach creates a unique Teaching Engagement model that bridges the gap between university and workplace, promoting collaborative thinking and mutual benefits. As a result, this innovative University-Workplace Engagement has become a catalyst for positive social impact.

Moreover, RMUTL remains committed to meeting the labor market demands and industrial sectors by adhering to the government's policies on human resource development for national progress. The institution focuses on developing self-skills and knowledge for a successful career, creating "Hands-On Professionals." These professionals are well-prepared to meet the requirements of the labor market and industrial enterprises. This proactive approach is aligned with the country's vision to foster human capital, leading to national development. (RMUTL, 2022).

In 2019, Rajamangala University of Technology Lanna, Chiang Rai, was granted an educational equity fund to administer educational management, providing educational opportunities and equal access for students who are disadvantaged in their educational pursuits. The university organized educational programs for both vocational certificate and higher vocational certificate levels. It was found that students and their parents became aware of education, the opportunities that offered, and the future progress of their children. Consequently, a substantial number of students were enrolled in this institution, surpassing the university's admission plan.

The university perceived this as an opportunity to educate this group of students who could study in higher-level educational programs at Rajamangala University of Technology Lanna, Chiang Rai. However, it was recognized that some students did not fully meet the required qualifications and criteria set by the industries.

From the reasons mentioned above, Rajamangala University of Technology Lanna, Chiang Rai, realizes the significance and opportunities in education, as well as the importance of building collaborative networks with all stakeholders, including the government, private sector, and educational institutions at all levels: tertiary, vocational, and secondary. Embracing the concept of experiential learning in real workplace settings, the university aims to develop students' fundamental vocational skills through "Gifted Hands-on" learning approaches. This initiative aims to foster teaching methodologies and essential skills necessary for the 21st century and encourages students to learn effectively.

To achieve this, teachers must act as facilitators, coaches, and mentors, moving away from their comfort zones and embracing a learning-oriented environment. This necessitates continuous teacher development and a shift towards a learner-centered approach via educational research which promote self-development and continuous upskilling and reskilling of the teaching staff (graduate or postgraduate students). The goal is to equip them with up-to-date technological knowledge and adapt to the changing trends, thereby creating a conducive learning environment that prepares students for the demands of the industry.

Research Objectives

To investigate the mechanisms of driving technology demonstration classrooms under the supervision of Rajamangala University of Technology Lanna, Chiang Rai.

Research Benefits

1. The study's findings will provide insights for curriculum development to produce graduates aligned with the requirements of both the public and private sectors.
2. The study's outcomes will guide strategies to increase the number of students pursuing higher education levels at the university.

3. The study's results will enable the university to compete in the educational landscape and formulate future strategies encompassing proactive, preventive, corrective, and adaptive approaches.
4. The study's findings will provide directions for curriculum enhancement to meet the needs of students, parents, and collaborating organizations, including industrial partners.
5. The study's outcomes will facilitate planning communication strategies to enhance the accessibility of university information, thus creating opportunities for engagement with the university's data.

Research Methodology

This research employs a qualitative research design to investigate the educational management situation at the undergraduate level of Rajamangala University of Technology Lanna, Chiang Rai, and the mechanisms driving the implementation of science-based technology demonstration classrooms under the university's supervision.

***Population**:*
The research involves a sample of 30 individuals, including university administrators, program administrators, instructors, teaching assistants, and support staff.

***Data Collection Instruments**:*
The study adopts a qualitative research approach with the following data collection instruments:

1. Semi-structured interviews: Interviews will be conducted with groups of university administrators, program administrators, and instructors. The interview questions will focus on the educational management situation at the undergraduate level of the university and the mechanisms driving the implementation of science-based technology demonstration classrooms under the university's supervision.
2. Focus group discussions: Focus group discussions will be held with university administrators, program administrators, instructors, teaching assistants, and support staff to explore the educational management situation at the undergraduate level of the university and the mechanisms driving the implementation of science-based technology demonstration classrooms under the university's supervision.

Data Analysis:
The data in this research was analyzed using a interpretative approach, and conclusions were drawn deductively as a result of the research. After conducting interviews and focus group discussions, the findings were subjected to a SWOT analysis to identify strategic directions for curriculum development that align with the needs of students and the labor market. The TOWS Matrix was employed to further analyze the current university environment and situation identified from the SWOT analysis, enabling the generation of new strategies. This process involved matching internal and external factors of Rajamangala University of Technology Lanna, Chiang Rai, which have been developed based on the results of the SWOT analysis.

Research Results

Educational Management Issues at the Undergraduate Level of Rajamangala University of Technology Lanna, Chiang Rai, and Mechanisms Driving the Project of Science and Technology-Based Practice Rooms under the University's Supervision.

Based on the results from interviews and focus group discussions, the SWOT analysis yielded the following findings:

(1) Internal Factors Within the Organization

Strengths:

1. The university has a unique identity and a management that emphasizes driving the project of science-based technology demonstration classrooms.
2. There is a diverse range of specialized professional courses suitable for students.
3. The faculty staff possesses knowledge, skills, and expertise in their respective fields and has a service-oriented mindset.
4. The university is an adaptable organization in terms of management and administration.
5. There is a quality-oriented teaching and learning system that aims to produce graduates who are skilled practitioners, emphasizing experiential training and professional skills.
6. The university offers language programs for students' learning.
7. A customer-oriented approach is adopted within the organization.
8. The university has strong collaborations with various networks, both from the public and industrial sectors.
9. Academic mentors provide guidance and support for students' academic and life skills development.
10. The university is equipped with comprehensive and up-to-date professional laboratories.

Weaknesses:

1. The university is located in a remote area.
2. Limited resources, such as budget and information systems.
3. The place on managing specialized professional learning facilities is relatively limited.
4. There is limited research and international networking at the university.
5. Some staff members lack a shared sense of responsibility and efficiency in their work.

(2) External Factors Outside the Organization

Opportunities:

1. The global wave of digital transformation has created a demand for graduates who possess relevant skills and professional readiness for the workforce.
2. The university's location within an economic special zone and the Greater Mekong Sub-region offers collaborations opportunities to provide specialized vocational training.
3. The growing industrial network within Chiang Rai's economic special zone presents the university opportunities for recognition and enhance cooperation.
4. Chiang Rai's infrastructure development is ready to support the city's growth, including road, water, and air transportation.

Threats:

1. The declining school-age population reduces the pool of qualified applicants.
2. Increased competition in student admissions.

3. The availability of online education diminishes the necessity for university-based learning.
4. Economic crises and pandemics impact the decision-making process for students and parents.
5. The labor market demands more knowledgeable and specialized graduates, such as those with professional skills and language proficiency.

The SWOT analysis is a valuable tool used by organizations to assess their current position by analyzing internal factors (Strengths and Weaknesses) as well as external factors (Opportunities and Threats). Once the SWOT analysis is complete, the TOWS Matrix (also known as the SWOT Matrix) can be employed to develop new strategies that align with the organization's situation. The TOWS Matrix combines the elements from the SWOT analysis to formulate appropriate strategies.

Aggressive Strategies:

1. Develop specialized professional programs to produce skilled labor force and workforce for both public and industrial sectors.
2. Establish collaborations with industrial establishments in Chiang Rai's economic special zone to provide specialized vocational workforce for the labor market.

Corrective Strategies:

Enhance the standards of specialized laboratories to conduct tests and train labor skills, supporting the growth of industrial networks in Chiang Rai's economic special zone.

Preventive Strategies:

Develop online distance learning courses to reduce learning time, enhance knowledge through online media, and provide practical experience through hands-on training.

Responsive Strategies:

Implement a rebranding of the organization to create a memorable identity, aligning it with the modernization and improvement of courses to meet the workforce demands for both short-term and long-term vocational programs.

Research Conclusion

1. The research findings from interviews and group discussions, coupled with the SWOT analysis and subsequent analysis using the TOWS Matrix, have led to the development of new strategies and data for decision-making regarding the establishment of a technology-based science demonstration classroom under the supervision of Rajamangala University of Technology Lanna, Chiang Rai.
2. Project Mechanism of Driving Science-based Technology Demonstration Classrooms under the Supervision of Rajamangala University of Technology Lanna, Chiang Rai, for the Pre-Engineering Vocational Certificate Program.

Findings Summary:

2.1. The research team conducted meetings to plan the analysis results from the SWOT analysis process and developed new strategies using the TOWS Matrix. The project to establish the mechanism of driving science-based technology demonstration classrooms under the supervision of Rajamangala University of Technology Lanna,

Chiang Rai, was approved. The research project was initiated to create mechanisms for the establishment of the Science-based and Technology in 2022. Research funding in the amount of 371,800 Baht was requested and supported by the Fundamental Fund (FF) for the fiscal year 2023.

2.2. Preparations were made to request permission for the implementation of the Pre-Engineering Vocational Certificate Program from the Institute of Technology and Innovation, Rajamangala University of Technology Lanna. This information was used in the management of education and the teaching process in 2023, with the curriculum administrators, faculty members, and instructors. Additionally, a plan for student enrollment in 2023 was prepared, targeting 20 new students.

2.3. After the data and resource preparations were completed, the research project proposal was presented at the meeting of Rajamangala University of Technology Lanna's management committee, with a presentation to the research committee for funding from the Fundamental Fund (FF) for the fiscal year 2023. The proposal was approved, and funding sources for driving the establishment of the Science and Technology Vocational School's Training Laboratory were secured.

2.4. The research team, curriculum administrators, academic affairs department, and public relations department held a meeting to plan the promotion of student enrollment. The enrollment period was set from December 2022 to April 2023, with information disseminated through various channels, both traditional and online media. The four rounds of enrollment attracted significant interest of students and parents, with a confirmation rate of 75% for online media channels, such as Facebook, Line, Videos, Websites, and Webpages, which served as the most effective means for prospective students to access information.

The student admission plan for the academic year 2023 comprises two main stages: student recruitment and preparatory activities before enrollment. The responsibility for overseeing all activities lies with the Student Affairs Office, with collaboration from the research team. The entire process, from planning to execution, evaluation, and summarization of the activities, will take place from June 17th to June 25th, 2023.

In terms of the teaching and learning process, the research team, with all faculty members, will participate in curriculum planning with course coordinators. Each faculty member will be responsible for teaching courses during both the first and second semesters of the academic year 2023.

Lastly, in order to enhance the curriculum and life skills, the research team and all faculty members, including course coordinators, will emphasize an integrated approach to teaching and learning that actively involves students. This approach is designed to meet the requirements and students' aptitudes.

Research Discussion

The driving mechanisms for the science-based technology demonstration classrooms, under the supervision of Rajamangala University of Technology Lanna, have proven to create educational opportunities and enhance competitiveness in the realm of education. Moreover, the program effectively produces skilled labor, thereby meeting the demands of both the public and private sectors. The collective awareness and recognition of organizational challenges have active participation from all stakeholders. Consequently, the program has developed education strategies that align with the needs of both the public and private

sectors. This endeavor serves as a critical focal point for all personnel in elevating the university's standards, fostering acceptance, and nurturing its distinct identity. The core mission centers around the production of well-prepared graduates.

To achieve success, resolute and innovative leadership is essential. Faculty members must possess a professional teaching spirit, moving beyond mere duty to become devoted educators. Community support is indispensable, and curricula and instructional processes must be modern, comprehensive, and up-to-date. Students must truly comprehend, apply, and disseminate knowledge, while employers must actively participate in curriculum development and adapt their workforce to support the industrial market, aligning with the findings of the research conducted by Watcharin Siripanich, Director of EEC TOP (2018). The study outlines the "EEC Model," which serves to build a supplementary workforce capable of accommodating investments in the development of targeted 20 industrial clusters, comprising both existing and new S-Curve groups.

The two educational approach comprises vocational and university levels. The former involves the Statchic Certificate Level (Vocational Certificate; Voc.Cert.), followed by the Advanced Vocational Certificate Level (Advanced Vocational Certificate; Adv.Voc.Cert.), while the latter involves the 2+2 formula. In this context, "2" refers to the transition from Voc.Cert. to Adv.Voc.Cert., and the second "2" denotes the progression from Adv.Voc.Cert. to a Bachelor's degree. Additionally, for the university sector, short-term technological courses in collaboration with vocational education have been offered to approximately 400,000 unemployed graduates to facilitate their entry into the industrial sector within the EEC area. These short-term modules, which require three to six months of study, serve as a supplement to regular studies and short-term training. The aim is to augment technical expertise among the workforce within the industrial setting, as the industry approaches the era of Industry 4.0. Consequently, it is essential to prepare a workforce well-equipped to embrace the Industry 4.0 system, emphasizing automation knowledge.

The development of workforce preparation in support of the Eastern Economic Corridor (EEC) adheres to the Work-integrated Learning (WiL) model, initially pioneered and implemented years ago at the Sattahip Technical College to address the incongruity between industrial demands for technologically competent labor and educational outputs that emphasize general knowledge and common skills. This model will be further extended to other educational institutions nationwide next year. Aligning with the findings of Nuttinan Lalorkaew (2018) who proposed the implementation of the School in the Workplace (STI-WiL) project aimed to address this incongruity. It was designed to bridge the gap between the "industrial sector," which requires workforce expertise in technology, manufacturing, and production processes, and the "educational sector," which produces a workforce emphasizing general knowledge and skills. This was achieved through the development of an educational management approach that connects industry with effective educational institutions using a "School in the Workplace" or "Work-integrated Learning" format, spanning the two-year duration of the curriculum. The motto of the STI-WiL project emphasizes "Learn what you Work & Work what you Learn," exemplifying a two-way learning process which was relevant to Niwat Moonpa (2020), Former Director of College of Technology and Interdisciplinary who presented fours projects: 1. Educational management to produce technicians in the form of a school in Michelin Siam factory. 2. The development of teachers for the school system in the factory. 3. The model of professional education and technology collaboration with industrial sector. 4. WIL feeder. All of the projects will operate by demand driven with public, industries, and academic cooperation.

Additionally, the successful implementation of the STI-WiL project has prompted Rajamangala University of Technology Lanna to assume the role of an agency that coordinates and manages education in conjunction with industry and comprehensive vocational and high school institutions in the STEM for TVET format through the establishment of the first TVET HUB LANNA in the country. This collaboration includes the National Science, Technology, and Innovation Policy Office (STIPO), Chevron Thailand Exploration and Production Limited, and the Asian Institute of Technology since December 2015. All the courses are integrated from lower educational levels to the tertiary level.

Furthermore, personnel development has been enhanced to foster innovative learning in various forms, such as Constructionism, CDIO (Conceive, Design, Implement, Operate), and STEM for TVET teacher professional development for college instructors and educators from vocational and networked high schools. Additionally, educators have been empowered with research and integration capabilities in teaching, research, and administration, thus transforming the university into an innovative vocational education organization for the benefit of Thailand's future.

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