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Technical vocational education and training research center as a center of excellence in Universitas Pendidikan Indonesia

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***Abstract*---**This research aims to provide an overview of the Center for Excellence in Higher Education Science and Technology (PUI-PT) in Indonesia, one of which is the Technical Vocational Education and Training Research Center (TVET-RC) belonging to the Universitas Pendidikan Indonesia (UPI). In this research, UPI became the locus and focus of the research center of excellence in the form of TVET-RC, as part of PUI-PT in Indonesia. The results showed that TVET-RC UPI as the leading part of PUI-PT in Indonesia was closely related to the findings in the form of four things: (1) Vocational Teacher Professional Education; (2) Redesign of the vocational expertise spectrum; (3) Mixed learning preparation guide; (4) HR capacity and governance of TVET-RC. The four findings are at the same time the development of TVET-RC at UPI which is able to contribute to the improvement of good and productive human resources.

***Keywords*---**center excellence, vocational education, training research, human resources, development.

Introduction

Technical and Vocational Education and Training (TVET) research has established itself as a distinct and well-defined interdisciplinary field. This component of TVET research is thoroughly conceptualized, with a detailed description of the various methodologies used in the study. The scope of TVET's research objectives is very broad and has high expectations of being achieved (Rahmanullah, 2021). It is hoped that TVET research will shed light on the fundamentals of TVET and its various contexts (e.g., historical, geographic, labor market). TVET research is also expected to shape the provision of skills, for example through pilot projects, or through international monitoring and comparison. TVET study centers should be able to present various efforts and approaches to assess TVET in all its variations, produce recommendations for policy improvement, and TVET planning and practice (Rauner, 2009) and (McKenzie, 2009).

The presence of an institutionally recognized Technical and Vocational Education and Training Research Center (TVET-RC) paves the way for strengthening international networks and collaboration in the TVET field. In this case, TVET-RC, which is integrated with the Faculty of Technology and Vocational Education (FPTK), Universitas Pendidikan Indonesia (UPI), has been actively involved in collaborating with TVET institutions abroad through the UNESCO-UNEVOC network (Rahmanullah, 2021). Currently, UPI is one of the UNEVOC clusters in the Southeast Asia region. The UNEVOC Network is UNESCO's global network of institutions specializing in TVET (Tikly, 2013).

This institution provides an environment for exchange, cooperation, and mutual assistance for its members. There are four types of UNEVOC centers: ministries, national agencies, training providers, and research institutes (including universities). Through international collaboration and peer learning, UNEVOC centers continue to improve the quality of TVET teaching and learning opportunities offered in their respective countries. Currently, there are more than 220 UNEVOC centers located in more than 140 member countries worldwide (including UPI/Indonesia).

In a broader context, the TVET-RC framework refers to post-2015 education targets, one of which is how developing countries should make education policies that focus on skills specifications that are integrated with 21st-century education (Barrett, 2011). 21st-century education not only focuses on cognitive abilities, but also adds life skills education, hones social skills, and self-control, and is able to apply knowledge relevant to vocational-technical work (Sayed & Ahmed, 2015). One of the important agendas and challenges for education and skills for post-2015 developing countries refers to 3 (three) educational frameworks and dimensions, namely post-MDG (Millennium Development Goal) and SDG (Sustainable Development Goal) (Burnett & Felsman, 2012). Based on the explanation above, this research is very important to do to raise the potential of human resources in Indonesia, especially in the UPI academic community by establishing TVET-RC so that it becomes a center of excellence that has competitiveness with various other universities.

Materials and Methods

Research Methods

This study uses a qualitative method with a case study approach. Qualitative was chosen because it was to examine more deeply the development of a center of excellence for TVET-RC. Qualitative has a broader study and focuses on the locus (Maruster & Gijsenberg, 2013). The selection of case studies is based on the potential that exists at UPI as a university in which there is vocational education as well as the development of a center of excellence. This study specifically describes TVET-RC at UPI as part of the center of excellence for higher education science and technology (PUI-PT) in Indonesia. The reason for choosing UPI as the location for the case study is because it is the only higher education institution that is consistent with its identity as an educational and vocational university.

Setting and Research Subject

Research subjects in case studies can be groups, agencies, institutions, individuals, or communities (Roberts & Taylor, 2002). Based on this, the subject of this research is the University of Indonesia Education as the institution where TVET-RC is sheltered. Case studies in detail describe the research subjects more focused, so that they are more focused (Thomas, 2021). The research sample was taken based on the number of faculties at UPI that were included in the TVET-RC flagship program, namely: (1) Faculty of Technology and Vocational Education/FPTK; (2) Faculty of Economics and Business Education/FPEB; (3) Faculty of Social Sciences Education/FPIPS; (4) Faculty of Art and Design Education/FPSD; and (5) Graduate School/SPs. The five populations became the research sample (population sampling) to see the development of TVET-RC as the flagship of PUI-PT at UPI. Each faculty has unique characteristics, so that it is able to give different colors, for example: FPTK as a faculty of engineering, FPEB has economic character, FPIPS is stronger in history, FPSD has a design color, while SPs as a higher level which includes all four.

Data Collection Technique

Data collection techniques in case studies are carried out through interviews, observations, documentation, and Focus Group Discussions or FGD (Thomas, 2021). The data from the FGD results are the results of the exposure of TVET-RC experts and a review of the establishment of TVET in the Faculty of Technology and Vocational Education (FPTK-UPI). The FGD produced the following data: (1) The distribution map of the leading centers of science and technology in higher education in Indonesia; (2) TVET-RC experts at the Indonesian University of Education; (3) Total research results of TVET-RC members in 2018-2021; (4) Cooperation between institutions both at home and abroad; (5) Characteristics of PUI-PT research in Indonesia; and (6) the output of PT PUI in the commercialization process. These data were then analyzed using empirical studies of TVET-RC, MyRIVET, KRIVET, and PUI-PT. The results of the analysis are presented through a descriptive description of TVET-RC as a leading part of PUI-PT in Indonesia.

Data Analysis Technique

Qualitative research with a case study approach does not focus on the quantity of data obtained, but on the quality of the data obtained. The data analysis technique in this study is based on the interpretation or understanding of a phenomenon by an object or participant involved in it (Maruster & Gijsenberg, 2013). There are four data analysis techniques in this study, namely: (1) Category collection, in the form of the characteristics of the five faculties as the forerunner of PT UPI's TVET-RC PUI; (2) Direct interpretation, by looking at phenomena in the five faculties to be developed as centers of excellence; (3) Pattern and equivalence, through the formation of two or more categories; and (4) Naturalistic generalization, by analyzing data based on the opinions of people who are considered TVET experts. The four data analysis techniques are presented descriptively (Thomas, 2021). The results of the data analysis are then presented in the form of a descriptive description in the form of research findings as explained below.

Results and Discussions

Results

The research finding of this study will describe the results of interviews with TVET-RC experts and the Center for Excellence in Higher Education Science and Technology. The results of the interviews become qualitative data, which will be described in detail as follows: (1) Create a map of the distribution of centers of excellence in Indonesia; (2) "A center of excellence (COE) brings together professionals from different disciplines and provides common facilities and resources," reaffirm the terminology for centers of excellence. In academia, it's known as a "competency center" or "capability center"; (3) Provide clear directions according to the PUI-PT roadmap, that COE is aimed at producing research-based products, particularly science and technology; (4) Re-formulating the criteria for PUI-PT institutions including the selection of subjects or research topics, including: academic composition of 35%-65% while commercialization is 65%, having technology or knowledge experts (HUB), as a national reference, and on a world scale (Kadir, 2021).

The list of centers of excellence for higher education (PUI-PT) in Indonesia that have been strengthened in 2016-2020 is 55 units, spread throughout Indonesia. This data is issued by the Institutional Directorate of the Directorate General of Higher Education, the Ministry of Education and Culture of the Republic of Indonesia in 2021. Each university has its own characteristics, so that it becomes the hallmark of its center of excellence. In West Java Province, especially in Bandung City, there are two universities, namely: Bandung Institute of Technology (ITB) with 8 PUI-PT centers of excellence, and Padjadjaran University (UNPAD) with 2 PUI-PT. Meanwhile, UPI does not yet have a PUI-PT, so its position is very strategic with the TVET-RC model as its center of excellence.

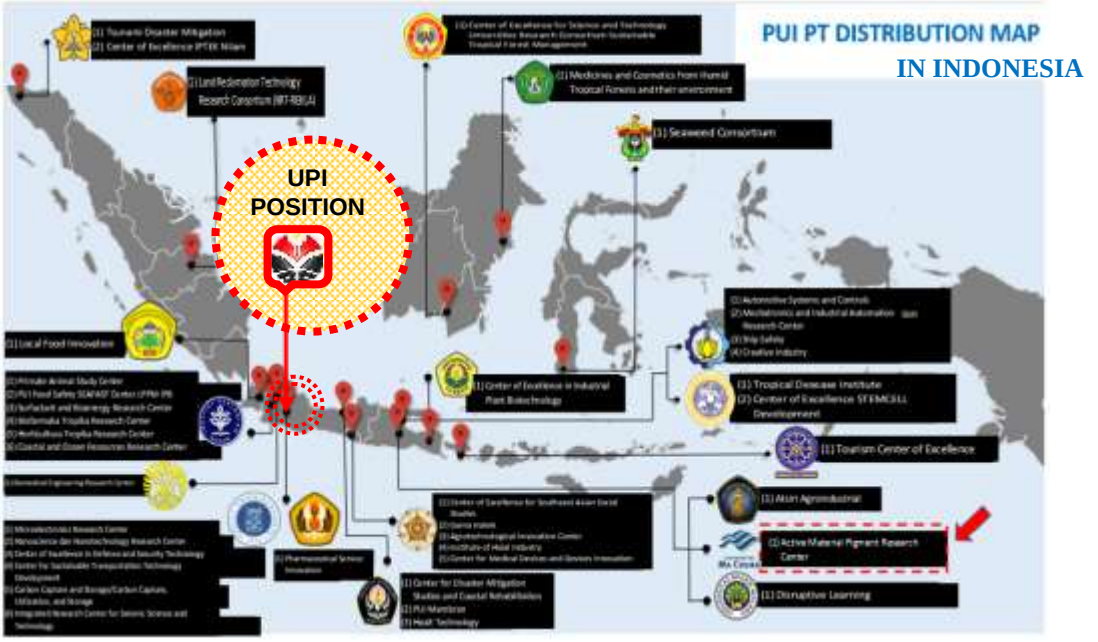

Figure 1. PUI-PT Distribution Map in Indonesia: UPI Position

Based on the distribution map of the center of excellence above (fig. 1), UPI has a very strategic opportunity as a university that is used as a reference for TVET throughout Indonesia. Therefore, it is necessary to develop a roadmap in order to have a clearer development direction. The roadmap is directed at efforts to increase research to produce innovation, especially science and technology. UPI has a very big opportunity in developing a center of excellence in the form of TVET-RC which focuses on preparing and improving superior human resources. In West Java Province, UPI is one of the best state universities besides ITB (technology) and UNPAD (medicine/agriculture). The advantage of UPI is that it has strong educational roots as the only educational university in Indonesia.

The main objective of developing PUI-PT is to increase the capacity and capability of research institutions in higher education to become superior research institutions of international standard in specific fields, such as education, technology, food, vocational, and others. The PUI-PT roadmap at UPI which is closely related to TVET-RC cannot be separated from the UPI research roadmap through the '*Rencana Induk Penelitian*' or Research Master Plan (RIP) which has been stipulated through the Rector's Regulation Number 001 in 2021. The roadmap describes UPI's superior research in achieving its vision and mission as a pioneer and superior university. In principle, the roadmap has four scopes, namely: basic research, research development, research application, and research innovation (fig. 2). The four coverages lead to research based products, namely science and technology as part of TVET-RC. UPI's PUI-PT (center of excellence) roadmap is an implementation as well as supporting government programs in preparing superior human resources.

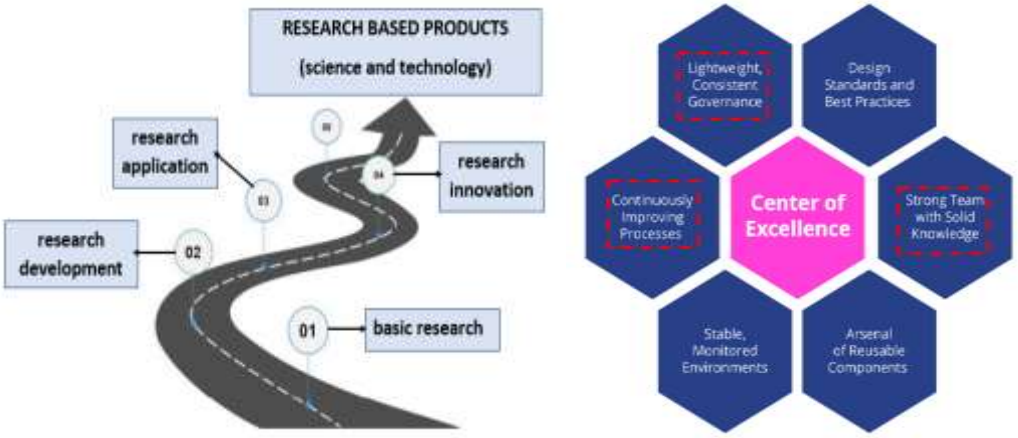

Figure 2. PUI-PT roadmap and center of excellence in UPI

Next finding, COE (center of excellence) thematic classifications sourced from the central government program (*Nawacita* or President Joko Widodo's program), such as: agriculture, renewable energy, health technology, information-communication, transportation, defense-security, advanced materials, disaster mitigation, maritime, policy, and socio-cultural (humanities). Synergy between institutions in higher education, and efficiency or optimization. Graphically, the findings in this study can be seen in the fig. 3 and 4.

To realize a capable science and technology campus (STC) that is at the same time based on the excellence of higher education as a center for the development of science and human resources, efforts are needed to change and improve the quality of academic research institutions into science and technology centers that are multidisciplinary and interdisciplinary. The stages of strategic and metamorphosis of academic institutions into STC can be seen in figure 3 below:

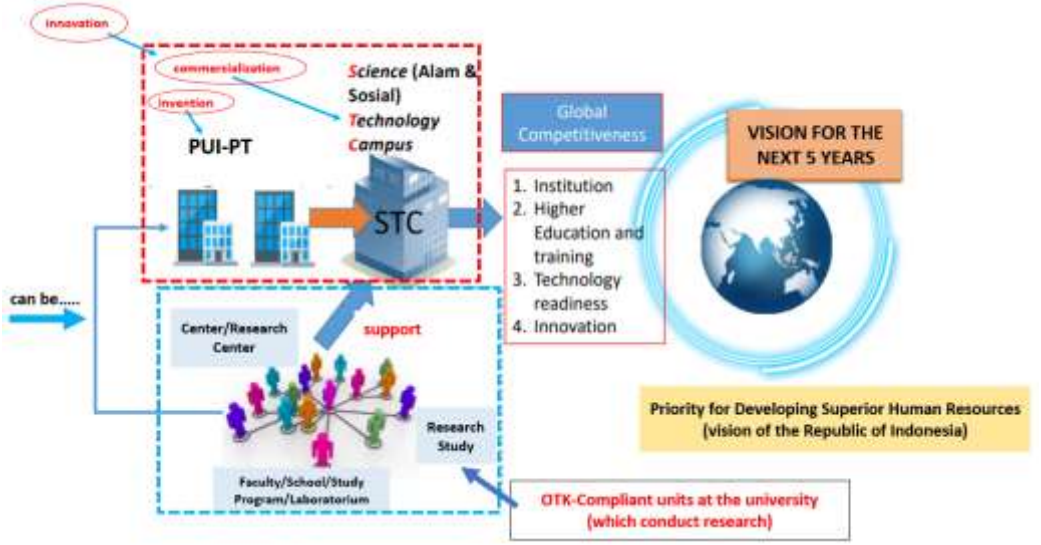

Figure 3. Strategic relationship between PUI-PT and STC

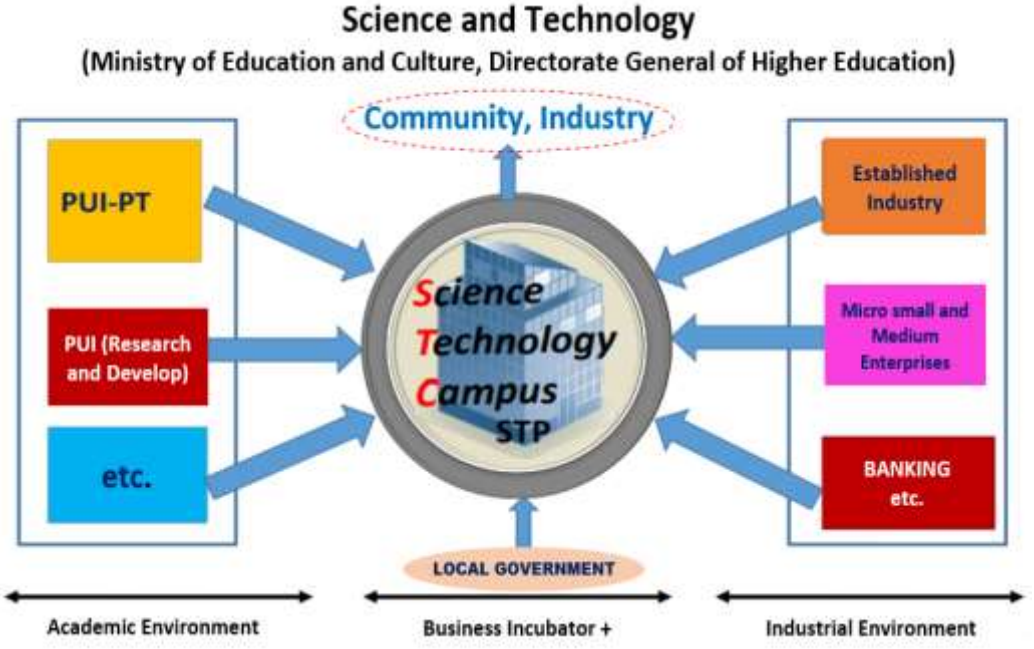

Figure 4. TVET-RC Institutional relationship

Human resources (SDM/HR) in supporting TVET-RC as a center of excellence at UPI is a requirement that must be met. The achievement of the goal of TVET-RC at UPI as a forum for potential development, especially in research and training, both teachers, lecturers, and other skilled workers will not be separated from the learning strategies used. The TVET learning strategy was developed by taking into account the carrying capacity of available resources at UPI. The important impact of TVET-RC UPI learning is the formation of a person's professional identity or expertise, because TVET is a certified skill education standardized in the world of work, competence is valued, career development, and prosperity.

Based on this, to support TVET-RC as one of the leading centers in Indonesia, UPI has prepared its human resources. UPI is the only university in Indonesia that makes education its core business, so that it is firmly attached to all study programs. This has implications for the qualifications of lecturers who have educational backgrounds of S1 (bachelor), S2 (master), S3 (doctor), and professors in the field of education, especially vocational. This educational qualification is the main capital of human resources.

Experts (fig. 5) who support the development of the TVET study center at UPI come from 4 faculties (Rahmanullah, 2021), namely: Faculty of Technology and Vocational Education (FPTK), Faculty of Economics and Business Education (FPEB), Faculty of Social Sciences Education (FPIPS), and Faculty of Art and Design Education (FPSD), and UPI Graduate Schools (SPs). The four faculties and SPs accommodate several study programs that are in line with the research theme in the field of vocational education. Among the missions of the study program is to prepare vocational teachers at the secondary education unit level with competency skills referring to the Expertise Spectrum of Vocational High

Schools, or SMK, or Vocational *Madrasah Aliyah*, or MAK (Tamrin, 2013). Figure 5 shows a list of TVET experts and their areas of expertise (Rahmanullah, 2021).

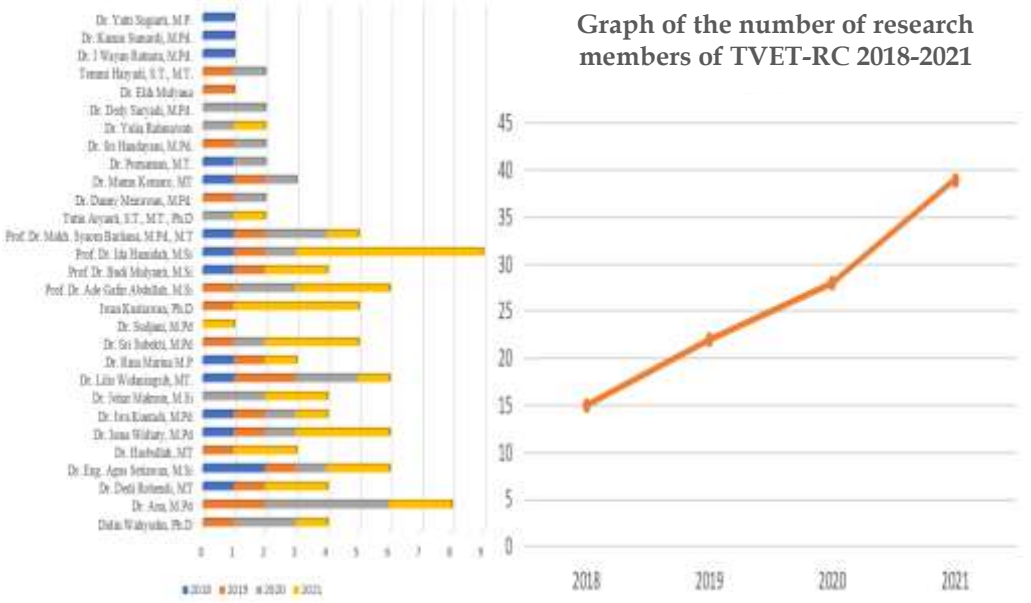

Figure 5. TVET-RC expert in UPI, Indonesia

Study programs relevant to TVET-RC at UPI have obtained international accreditation. This is very important in supporting the development of centers of excellence. There are four study programs at the undergraduate level, namely: (1) Mechanical Engineering Education, accredited by ASIC; (2) Architectural Engineering Education, obtains accreditation from AQAS; (3) Building Engineering Education, accredited by AQAS; and (4) Agroindustry Education already has accreditation from AQAS. As for the master's level, there are several study programs, namely Technology and Vocational Education (PTK), which has obtained accreditation from AQAS, Management study programs accredited by AQAS, and others.

Discussions

This discussion section describes the condition of human resources (SDM/HR) in Indonesia (in general,) which is related to the needs of the industry (both the business world and the industrial world). The main asset in the process of building a nation is quality human resources (Murnomo, 2010). Currently, Indonesia has a demographic bonus of 68.6%, or around 181.3 million people of productive age. This becomes a big development capital if the government manages human resources well so that they have high competence through education transformation (Slamet, 2011). The required competencies must be prepared and supported by the curriculum, facilities and infrastructure, funding, and adaptive management. Productive human resources must have various skills, such as: communication, critical, creative, digital literacy, high curiosity, and the ability to solve problems.

The application of vocational education in Indonesia is not considered optimal. The quality of graduates from vocational high schools (SMK) and polytechnics does not always meet the qualifications of job providers, so there are still many unemployed (Murnomo, 2010). In the unemployment structure, SMK graduates have a higher unemployment rate (11.8%) than SMA graduates (7%) (Statistik, 2017). This happens because the competence of people or the curriculum is problematic. The competencies needed by the company have never been studied during their education. Vocational schools have fewer, opportunities for self-development, or inadequate teacher quality (Winangun, 2017). During internships or field work practices, a number of government agencies and private companies open opportunities for every student to experience the professional world before working for real (Winangun, 2017).

The results of interviews and FGD TVET-RC expertly illustrate that the development of a center of excellence must be based on the potentials possessed by a university, so that it has distinctive characteristics (Rahmanullah, 2021). Universitas Pendidikan Indonesia (UPI), as a higher education institution, has strong potential and roots, one of which is the vocational field. The presence of the vocational education (technical) study program strengthens the reason why UPI produces a lot of vocational personnel, especially teachers for vocational high schools. Inter-institutional collaboration is also carried out in order to strengthen UPI's position as an education center for vocational teacher candidates (Rahmanullah, 2021). Based on this, the center of excellence in the form of TVET-RC at UPI has a very strategic role in the synergy between the provision of productive human resources and industrial needs. The results of studies conducted by UPI researchers must lead to industry needs as well as answers to the lack of professional personnel in the technical and vocational fields (Rahmanullah, 2021).

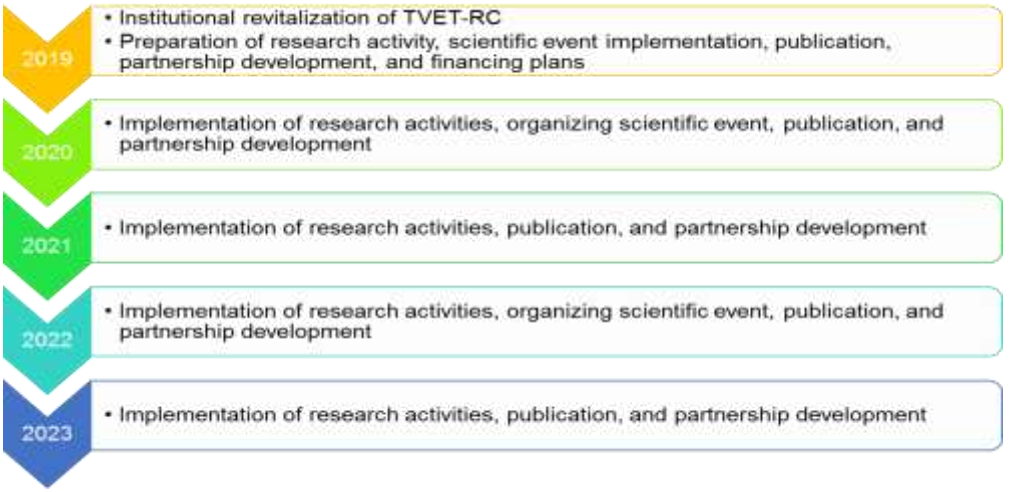

Figure 6. Roadmap and UPI Development for TVET-RC

TVET-RC as one of the study centers in universities, especially UPI, has carried out many activities, especially in 2020 (fig. 6), including: (1) UPI International Conference on TVET; (2) Publishing international conference proceedings indexed

on the Web of Science (Clarivate Analytics); (3) TVET meetings, whether in national, regional or international forums; (4) Providing training services for teachers, lecturers, and researchers in the form of ways to publish articles in indexed international journals, as well as managing international journals; (5) Collaborating with partner institutions, such as: RMUTT Thailand, Labtech Penta International, KRIVET/Korea, UNESCO/UNEVOC, as well as other foreign institutions. TVET-RC UPI in its development has also conducted a number of researches supported by UPI-ADB funding as well as socialization of TVET-RC through the UPI TVET-RC Webinar.

The role of universities in developing human resources, the ability to increase the nation's competitiveness through research and technology is absolutely necessary (Ridwan et al., 2021). The existence of superior units in universities that can embody the *Tri Dharma* (three obligations: education, research, community services) of Higher Education in real activities and actions for the benefit of strengthening the nation's competitiveness, product innovation, and awareness of the need for science and technology in the community from an early age is a bridge in efforts to strengthen the nation's competitiveness in a holistic manner (Rahmanullah, 2021).

The program to strengthen the Center for Excellence in Higher Education Science and Technology (PUI-PT) is expected to produce superior research institutions in terms of mastery of science, technology, and innovation in accordance with the duties and functions of the institution which will later support the agenda for the development of Science and Technology Park or STP, hereinafter referred to as the Science and Technology Campus (STC) further emphasizes that PUI-PT is a research institution in higher education (Kadir, 2021). In addition, in accordance with the Tridharma of higher education, the existence of PUI-PT will attract the growth of superior human resources and transfer of knowledge to future generations in the field of science and technology who have local wisdom and content (Ridwan et al., 2021). When a PUI-PT institution has reached the level of excellence, the PUI-PT institution will still exist, but its technological and scientific output is transferred to the STC (Kadir, 2021).

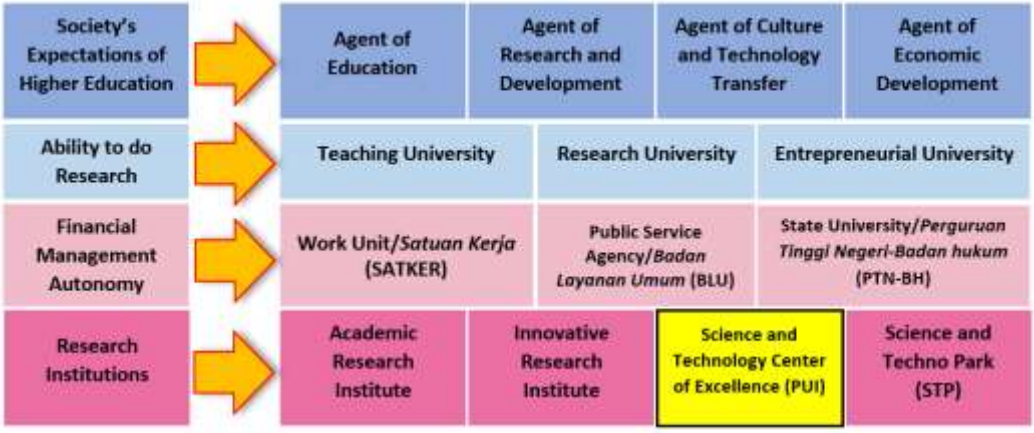

Figure 7. The Position of the Center of Excellence for IPTEK

In a higher and broader order, the direction of the Vocational Education policy as part of developing a center of excellence at UPI needs to start with several things (Rahmanullah, 2021), namely: (1) Preparation of a Roadmap for Vocational High School Development; (2) Increase the number and competence of educators and education personnel (PTK) in Vocational Schools for Educator Certification Programs and Certification of Expertise Teachers for Vocational High Schools.

The creation of a TVET-RC center of excellence at UPI is also based on INPRES NO. 9/2016 on the Revitalization of Vocational High Schools in the Context of Improving the Quality and Competitiveness of Indonesian Human Resources, as well as the Ministry of Research, Technology and Higher Education's policy on facilitating the establishment of vocational education institutions (fig. 7 and 8). This is the basis for cooperation with industry based on Permenperin No. 3/2017 concerning Guidelines for Competency-Based Vocational Training and Development that Link and Match with Industry.

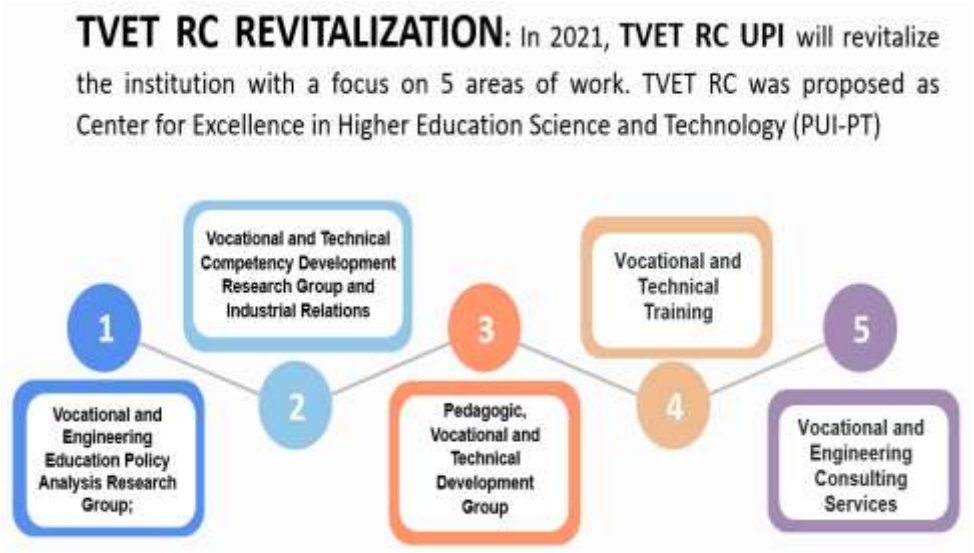

Figure 8. TVET-RC UPI revitalization in 2021

Based on this, the study of the development of the TVET-RC UPI center of excellence is expected to be able to contribute to the advancement of Vocational Education in Indonesia which involves stakeholders or institutions, such as: the Ministry of Manpower (KEMNAKER), the Indonesian Chamber of Commerce and Industry (KADIN), and the Indonesian Employers Association (APINDO), with the following development focus: (1) National Apprenticeship Movement Declaration; (2) SKKNI Development; (3) Trial 3R: Reorientation, revitalization, and rebranding.

Conclusion

This conclusion is the final note of the entire research process, especially the study of the development of the TVET-RC center of excellence at UPI as part of the leading universities in Indonesia. This conclusion answers three research problems, namely:

(1) TVET-RC UPI was formed based on a condition of the importance of a forum for developing the potential of superior human resources in meeting the needs of industry and the challenges of a more competitive future. Based on this, the UPI Chancellor's Decree Number: 7979/UN40/KP/2017 officially established TVET-RC as the study center for UPI. It includes three groups of research areas including: (a) Policy analysis; (b) Competence development and industrial relations, and; (c) Pedagogic development of vocational and technical education;
(2) TVET-RC UPI is supported by reliable human resources, coming from four faculties and one postgraduate, namely: FPTK, FPEB, FPIPS, FPSD, and SPs. The four faculties and SPs accommodate several study programs that are in line with the research theme in the field of vocational education. Among the missions of the study program is to prepare vocational teachers at the secondary education unit level with competency skills referring to the spectrum of expertise of Vocational High Schools (SMK) and Vocational *Madrasah Aliyah* (MAK);
(3) TVET-RC UPI establishes various collaborations to support programs in developing its center of excellence. There are two forms of cooperation, namely: (a) Domestically, such as: Ministry of Public Works and Public Housing of the Republic of Indonesia, Provincial Education Office, Construction Service Provider Institutions, Partner Vocational Schools throughout Indonesia, and others; (b) Overseas, for example: InWEnt/GIZ (Germany), UTHM and UKM (Malaysia), UNESCO/UNEVOC (Thailand/Bangkok), ACER (Australia), KRIVET (Korea), and others.

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