Roadmap Development Research and Community Service of Four-Year Mechanical Engineering Program

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Abstract. With the growth in manufacturing value added (MVA), Indonesia occupies the highest position in ASEAN. Indonesia's MVA reached 4.84 percent, while in ASEAN it was around 4.5 percent, then at the global level it was ranked 9th in the world. From the manufacturing sector, Indonesia is in the top five in the world by percentage of its contribution to GDP. Even the Indonesian economy has entered the one trillion-dollar group, or a third of the ASEAN economy. The government's policy for long-term national industrial development is in accordance with Presidential Regulation Number 2 of 2015 concerning the 2015–2035 National Industrial Development Master Plan (RIPIN). The targets of this regulation focus on industrial development, stages of developing industrial resources and infrastructure, achieving industrial development, developing facilities and infrastructure, priority industries and small and medium-sized industries, industrial estates, industrial empowerment, as well as fiscal and non-fiscal facilities. Departing from the above background, it is hoped that every university, especially study programs, must develop a research road map and PKM according to their respective areas of excellence that can synergize all existing research and PKM in accordance with the vision and mission of the State University of Surabaya. This research method uses descriptive survey research, where the analysis studies the respondents through interviews and secondary data collection. The analytical method used in this research is secondary data analysis. Secondary data sources can come from LPPM Unesa, statistical data documents or reports on research results that have been carried out by Unesa Vocational lecturers. Document data taken include: National Research RIP Documents, Unesa Strategic Plan, Unesa Research RIP, and other relevant documents. The result of this research is a research road map and PKM. For the road map from the research mapping, 5 major topics were produced, namely: materials (polymers, composites, plastics, metals, nano materials), manufacturing (machining, CNC, welding, coating, painting), design (steering, chassis, stability, noise, vibration), control (plc, electrical, pneumatic, hydraulic, mechatronic), and ergonomics (design, anatomy, packaging, QFD, quality control). For the road map the results of the PKM mapping resulted in 2 major topics, namely: TTG (agricultural equipment, production equipment, transportation equipment, and household equipment), and training (skills, finance, management, packaging, web).

1   Introduction

With the growth of manufacturing value added (MVA), Indonesia occupies the highest position among ASEAN countries. Indonesia's MVA was able to reach 4.84%, while in ASEAN it was around 4.5%. At the global level, Indonesia is currently ranked 9th in the world. From the manufacturing sector, Indonesia is in the world's top five in terms of percentage contribution to GDP, ahead of Japan, India and the United States. Even the Indonesian economy has entered the one trillion-dollar group, or a third of the ASEAN economy.

Issuance of Presidential Regulation Number 2 of 2018 concerning the 2015–2019 National Industrial Policy. The government's policy for long-term national industrial development is in accordance with Presidential Regulation Number 2 of 2015 concerning the 2015–2035 National Industrial Development Master Plan (RIPIN). Several goals have been set until 2019, including increasing the growth rate of the non-oil and gas processing industry by 5.5–6.2 percent. The role of the manufacturing industry in the economy can contribute 18.2–19.4 percent. In addition, efforts to increase exports of domestic industrial products.

The demand for labor in the industrial sector will increase by more than 8% until 2035. This increase is spread across all manufacturing sub-sectors, such as the food and beverage industry, metals, textiles and clothing, and automotive. Industrial HR development aims to create a skilled workforce that meets the needs of today's business world.

This is one of the considerations for the preparation of the Research and Community Service Roadmap carried out by the Vocational Program of the Mechanical Engineering D4 study program, State University of Surabaya, especially in an effort to participate in achieving national development goals by developing quality human resources through vocational education.

There are 17 world global topics that are widely applied by all countries and are applied in choosing research topics and PKM in 2016–2030, namely: Eradicating poverty; ending hunger; Good health and well-being; quality and quality education; gender equality; access to clean water and sanitation; clean and affordable energy; decent work and economic growth; infrastructure, industry, and innovation; reduce disparities/inequalities; sustainable cities and communities; responsible consumption and production; action on climate change, life under water; life on land; peace, justice and strong institutions; and partnerships to achieve goals.

There are 9 Research Focuses from the government in the 2020–2024 PRN which have been directed to support global issues in the world, namely: Food, energy, health, transportation, engineering, defense and security, maritime, social humanities-education-and arts and culture, multi-disciplinary and across sectors.

In 2011, the Directorate General of Higher Education (DIKTI) of the Ministry of Education and Culture urges that every tertiary institution establish and implement a

"Higher Education Research Quality Assurance System (SPMPPT)" to obtain higher quality research and measurable outcomes that are more beneficial for improving life. Society at large. Responding to the DIKTI policy, the State University of Surabaya has attempted to develop a clear, targeted, and measurable research roadmap, which is outlined in the Research Master Plan (RIP) for a period of five years. The RIP is a formal document that contains the vision, strategy for achieving the institution's leading research themes, including research topics that all researchers at the State University of Surabaya must refer to.

2   Research Methods

Time and Place

1. Time
    This research is a descriptive survey research, where the analysis study of respondents through interviews and also secondary data collection, until the reporting is carried out from April 2021 to December 2021.
2. Place
    The place of data collection is done online and through interviews with parties related to Research and PKM.

Research Methods
The method used is as follows:

a. Direct data collection through online data and direct interviews with related parties for Research and PKM
b. Direct tracing through the final research report and PKM books that have been carried out by the lecturers.

Data Analysis Technique
The analytical method used in this research is secondary data analysis. Secondary data sources can come from LPPM Unesa, statistical data documents or reports on research results that have been carried out by Unesa Vocational lecturers. Document data taken include: National Research RIP Documents, Unesa Strategic Plan, Unesa Research RIP, and other relevant documents. The next researcher will rearrange or combine information into new ways to answer research questions, which are then used to develop a research roadmap and PKM for the Applied Mechanical Engineering Undergraduate Study Program.

3   Result and Discussion

3.1   Coordination Meetings

Initial coordination meeting with the entire research team and PKM, this is done to equalize perceptions of what data must be collected so that all data collected will be in

Fig. 1. Coordination meetings

Fig. 2. Looking for data to head office

the same condition and there is no mistake in choosing the data. In addition, this meeting is required to determine and distribute tasks to all existing team members (Fig. 1).

3.2 Field Study

Knowing the literature commonly used for making research roadmaps and PKM in the D4 Mechanical Engineering study program. This field study was carried out at the central library, LPPM, collecting data and also visiting SME places that are commonly used as research or making PKM for the D4 TM study program (Figs. 2, 3, 4, and 5).

3.3 Colleting Research and PKM Data for D4 TM Lecturers

Looking for research and PKM data for D4 TM lecturers, starting from tracking through the Unesa LPPM web, looking at research decrees obtained by lecturers. This is done so that all homebase lecturers can detect their research flow correctly and correctly (Fig. 6).

3.4 Sorting Research and PKM Data for D4 TM Lecturers

The research members sort and differentiate all data about the research of D4 TM lecturers. See in detail the titles that have been produced by the research of D4 TM lecturers (Fig. 7).

Fig. 3. Looking for data to SMEs

Fig. 4. Looking for data to SMK

Fig. 5. Looking for data to SMK

3.5 Mapping Research and PKM Data for D4 TM Lecturers

All members of the research team began to map and distinguish what are the characteristics of each PKM D4 TM lecturer. All D4 TM lecturers have a stipulation that the lecturer PKM program is more directed to the tool assistance program for SMEs that are around the campus or around the residence of the D4 TM lecturer.

Fig. 6. Collect research and PKM data

Fig. 7. Sorting research and PKM data

3.6 Creating a D4 TM Research Roadmap

After all the literature, research data, expertise data and research directions for D4 TM lecturers, an outline will be made of a Research Roadmap for D4 TM lecturers. From the making of this roadmap, it is hoped that later it will produce a superiority for the D4 TM study program (Fig. 8).

3.7 Creating a PKM D4 TM Roadmap

After all the literature, PKM data, expertise data and PKM directions for D4 TM lecturers, an outline will be made of a PKM Roadmap for D4 TM lecturers. From the making of this roadmap, it is hoped that later it will produce a superiority for the D4 TM study program (Fig. 9).

3.8 Discussion

Based on the data that has been collected in the research on the preparation of the roadmap for the D4 Mechanical Engineering study program, it can be grouped into
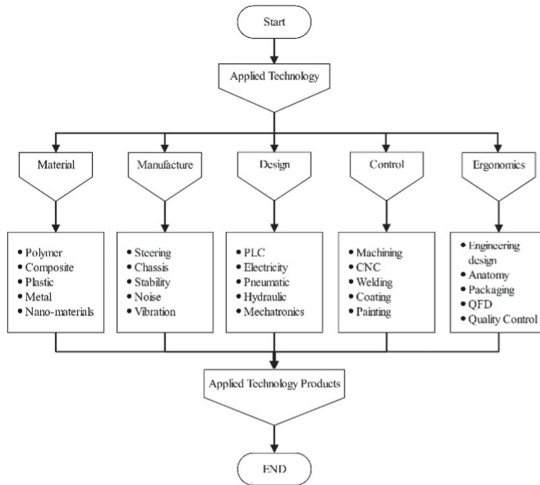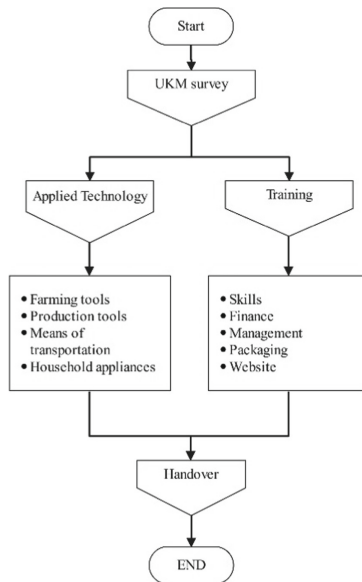
Fig. 8. Research Roadmap D4 TM

Fig. 9. Roadmap PKM D4 TM

several categories which can be developed in the future within the scope of sustainable umbrella research. Some of the groupings can be seen in Tables 1, 2, 3, 4, and 5.

Analysis of research on the research roadmap of the D4 Mechanical Engineering study program leads to the topic of materials, namely polymers (10%), composites (26%), plastics (7%), metals (50%), and nano materials (7%).

Table 1. Material

No	Topics	Number of Research Titles	Percentage (%)
1	Polymer	3	10
2	Composite	8	26
3	Plastic	2	7
4	Metal	15	50
5	Nano Materials	2	7
Total		30	100

Table 2. Manufacture

No	Topics	Number of Research Titles	Percentage (%)
1	Machining	8	23
2	CNC	4	11
3	Welding	6	17
4	Coating	9	26
5	Painting	8	23
Total		35	100

Table 3. Design

No	Topics	Number of Research Titles	Percentage (%)
1	Steering Wheel	3	12
2	Chassis	2	8
3	Stability	4	16
4	Noise	7	28
5	Vibration	9	36
Total		25	100

Analysis of the research on the research roadmap for the D4 Mechanical Engineering study program leads to manufacturing topics, namely machining (23%), CNC (11%), welding (17%), coating (26%), and painting (23%).

Table 4. Control

No	Topics	Number of Research Titles	Percentage (%)
1	PLC	3	15
2	Electricity	6	30
3	Pneumatic	3	15
4	Hydraulic	4	20
5	Mechatronics	4	20
Total		20	100

Table 5. Ergonomic

No	Topics	Number of Research Titles	Percentage (%)
1	Planning	8	32
2	Anatomy	2	8
3	Packaging	4	16
4	QFD	7	28
5	Quality control	4	16
Total		25	100

The research analysis on the research roadmap for the D4 Mechanical Engineering study program leads to design topics, namely steering (12%), chassis (8%), stability (16%), noise (28%), and vibration (36%).

Analysis of the research on the research roadmap for the D4 Mechanical Engineering study program leads to control topics, namely PLC (15%), electricity (30%), pneumatics (15%), hydraulics (20%), and mechatronics (20%).

Research analysis on the research roadmap for the D4 Mechanical Engineering study program leads to ergonomics topics, namely design (32%), anatomy (8%), packaging (16%), QFD (28%), and quality control (16%).

Based on the data that has been collected in the research on the preparation of the roadmap for the D4 Mechanical Engineering study program, it can be grouped into several categories which can be developed in the future within the scope of sustainable umbrella research. Some of the groupings can be seen in Tables 6 and 7.

PKM analysis on the PKM roadmap for the Mechanical Engineering D4 study program, many of them lead to the topic of Appropriate Technology, namely agricultural equipment (27%), production equipment (27%), transportation equipment (13%), and household appliances (33%).

The PKM analysis on the PKM roadmap for the Mechanical Engineering D4 study program leads a lot to the topic of training, namely skills (22.5%), finance (15%), management (22.5%), packaging (15%), and web (25%).

Table 6. Appropriate technology

No	Topics	Number of Research Titles	Percentage (%)
1	Farming Tools	8	27
2	Production Tools	8	27
3	Means Transportation	4	13
4	Household Appliance	10	33
Total		30	100

Table 7. Training

No	Topics	Number of Research Titles	Percentage (%)
1	Skills	9	22,5
2	Finance	6	15
3	Management	9	22,5
4	Packaging	6	15
5	Web	10	25
Total		40	100

4   Conclusion

a. The process of making the research roadmap is carried out in a way, first we collect research data, namely through the LPPM web, Research Decree, Research Final Report, and ask for data directly from the research chair. From the data then grouped and mapped according to the research cluster. From the mapping then we calculate the percentage to what extent. From the results of the mapping, 5 major topics were produced, namely: materials, manufacturing, design, control, and ergonomics.
b. The process of making the PKM roadmap is carried out in a way, first we collect PKM data, namely through the LPPM web, PKM SK, PKM Final Report, requesting data directly from the PKM chairman, and tracing from PKM partners. From the data then grouped and mapped according to the PKM clumps. From the mapping then we calculate the percentage to what extent. From the results of the mapping, 2 major topics were produced, namely: TTG and training.

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