

SOFT INFRASTRUCTURE IN URBAN AND REGIONAL PLANNING RESEARCH: ANALYZING UNDERGRADUATE FINAL PROJECT TRENDS IN COMMEMORATING 101 YEARS OF ENGINEERING EDUCATION IN INDONESIA

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ABSTRACT

This paper describes the trend of the final project at the Undergraduate Urban and Regional Planning Program, Bandung Institute of Technology, as the first planning school in Asia to commemorate 101 years of engineering education in Indonesia. The scope of the study is an analysis of the final project at the graduate program level for the last eleven years from 2010 to 2021. Moreover, reviewing the factors that influence research trends in urban and regional planning. Hence, to show the role of soft infrastructure as the key to the implementation of the latest planning concepts through infrastructure development, and the use of technology to accelerate regional and urban development in a sustainable manner in Indonesia this is based on the finding that most students like the theme of infrastructure and transportation as well as the emergence of new favorite themes about big data, smart cities, as well as social media. This paper also proves that the global theme of soft infrastructure is indeed in the realm of engineering, and the theme of the final project going forward needs to push the theme of governance, which is still less attractive, as well as business processes, all of which represent soft infrastructure in the context of urban and regional planning.

Keywords: Soft infrastructure, smart city, sustainability, urban and regional planning, engineering.

A. INTRODUCTION

Between the years 1870 - the second world war there was an event that appeared western industrialization which resulted in the growth of specialization in Southeast Asia in the form of exports in primary commodities. This makes the growth of cities in Southeast Asia concentrated close to ports which are centers of economic activity. Differences in exported commodities will have different growth impacts, depending on the exported commodity (Huff, 2012). or example, Singapore is a country that was just formed in 1965 and always accepts global economic opportunities, so Singapore always sees the global economy as a horizon of Singapore's economy (Huat, 2011). Two approaches dominate in determining the parameters and perspectives to investigate contemporary cities and urban conditions the impolitic economy of globalization and the postcolonial focus on the subaltern agency (Ong, 2011).

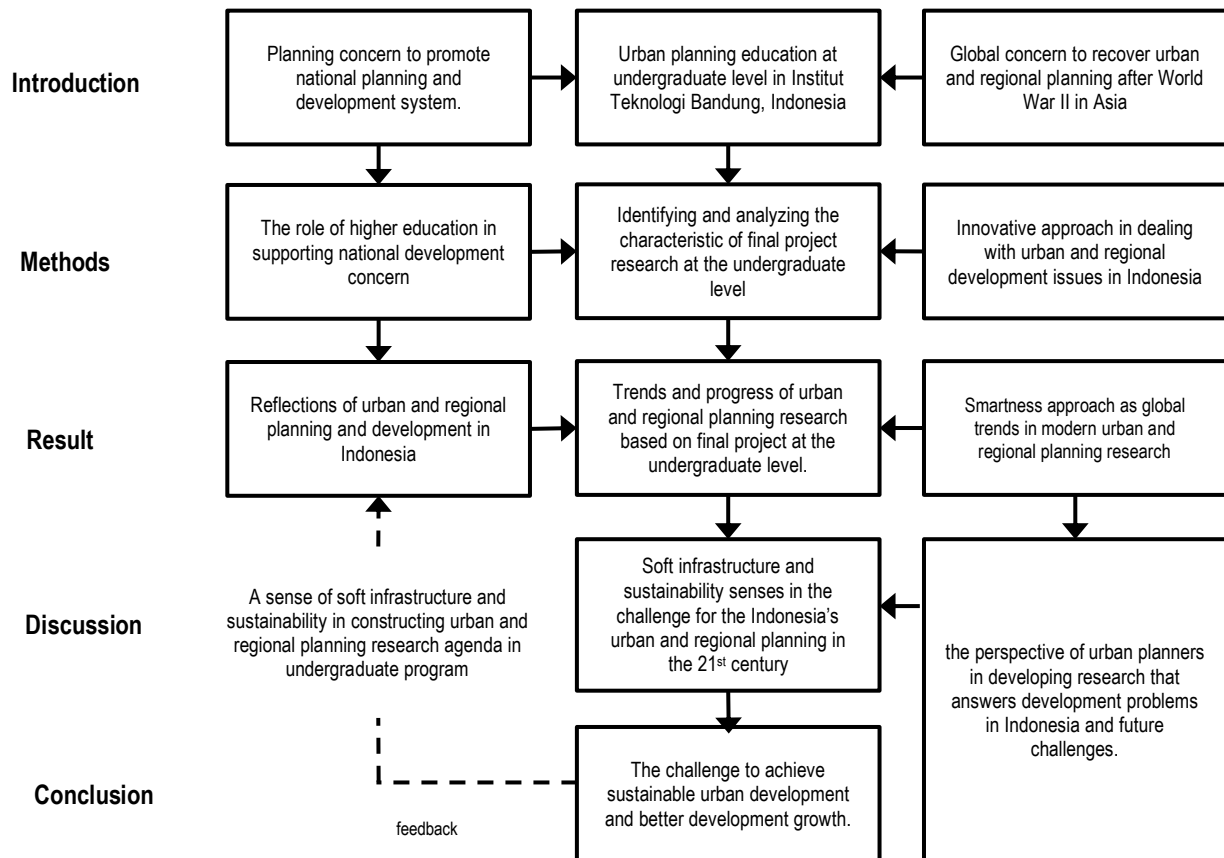
The agglomeration effect of an urban area results in cities that are the gateway to growing into commercial centers. In the city gateway In Southeast Asia, the determining factors that are important related to urbanization include the differing strengths of staples-created urban spread effects, geographically

determined economic realities such as easy access to the sea, railway configurations influenced by geography and economics, and government policy that lay behind infrastructure development. These factors with an emphasis on hard infrastructure appear to be the main determinants of urban growth, the spread of urbanization, and greater rank size urban system order. These factors are major determinants of where urban locations are, how cities will grow, and whether small towns grow fast enough to promote widespread urbanization and regularity of the larger ranking size of the urban system. These determinants have made sustainability a part of the consideration.

The important role of innovation and creative thinking has an important role in the urbanization of 21st-century cultural factors, lifestyle, and material practice (literature, media, art, architecture, and design) is an innovation or creative thinking capable of having a role in planning a city (Lovely & McCann, 2011). In the 21st century, the city has the main form of a human settlement in which there are buildings, waterfront buildings, and horizon towers. The city has an image as a modernist utopia (Miles, 2002).

Cities are characteristic of most civilizations and are considered the full expression of that civilization (Harding, 2003). Cities - big cities in developing countries have become centers of enormous political investment, centers of economic growth, and cultural vitality (Huat, 2011).

Figure 1. The Research Framework



The method identifies and analyzes the research characteristics of undergraduate student ITB urban and regional planning final projects. The results of this study will explain the trends and progress of research

related to urban and regional planning at the undergraduate level. The discussion will explain related to the perspective of planners related to the problems that exist in Indonesia and the challenges going forward.

B. METHODS

Secondary data was obtained from data related to the final project of an undergraduate student at the Bandung Institute of Technology majoring in regional and urban planning over the years, as well as a review of regional and urban planning journals and others. The data used generally are data related to the history of urban and regional planning, the characteristics of urban and regional planning, and the development of urban and regional planning studies.

Analysis was carried out using descriptive analysis methods and grouping analysis to see trends existing in regional and urban planning research for the undergraduate level at the Bandung Institute of Technology, by reviewing research over the past 10 years (2010 – 2021) by undergraduate students and reviewing how trend existing topics, as well as reviewing what factors influence attend regional and urban planning research.

Descriptive analysis was used to interpret regional and urban planning research data for S1 Bandung Institute of Technology students related to the number of graduates, the number of graduates based on skill groups, and the number of graduates based on supervisors. While grouping analysis is used to find out trend topics and research locations for ITB regional and urban planning undergraduate students from 2010 – 2021.

LITERATUR REVIEW

Urban planning in Indonesia in 1930 - 1960 in that range of years is an ideal year to know the impact of political forces and changes in power in urban planning. Urban planning in the era-colonial government forms the symbolic heart of the city (Colombijn, 2006), after the second world war, the heart of the city describes attention to public space, which was previously a problem where public space was ignored and even denied existence (Monclus & Medina, 2018) in timesDutch colonial urban planning is based on zoning where residential and industrial zones are separated and people are separated based on ethnicity (Colombijn, 2006), A strict zoning system separating residential and industrial areas contributes to the non-integration of urban fabric (Monclus & Medina, 2018). After Indonesia's independence at that time, it still maintained colonial planning ideals and at the same time many people took land around canals and railroads for residence, besides that after Indonesia's independence, the ethnic background which in ancient timesDutch colonial enacted but was abolished after Indonesia's independence because it undermined national ideals (Colombijn, 2006). Between 1890 - 1930 in Indonesia, there was rapid economic growth in Jakarta and Surabaya, and even more, rapid growth in several small towns including cities outside Java Island. In 1930 Indonesia had integrated cities because Java Island had the most integrated urban system in Southeast Asia with a population of 2/3 of the total population in Indonesia (Huff, 2012) .It can be observed that there are other factors apart from the physical side related to the integration of cities in Java Island, such as power structures, ethnic diversity, and communication systems between citizens, all of which are aspects of soft infrastructure that are integrated with the development of the physical infrastructure side.

In 1930 - 1960 housing became a major problem in urban development in Indonesia, where housing was an important function in an urban area. In addition to housing problems, other problems faced by urban areas in Indonesia are more oriented toward the physical side, such as a lack of electricity and water supply, flooding,

industrial pollution, land ownership issues, and irregular buildings (Colombijn, 2006). Based on census data from 1890 - 1930 urbanization in Indonesia is contrary to the proportional law, where all cities will tend to grow at the same rate. The island of Java is growing more rapidly, and three factors cause the growth and integration of urban areas on the island of Java. The first is due to the geography of the island, every city on the island of Java can be connected to international shipping flows. There is a transportation and infrastructure system that can support economic activities on the island of Java, and the Dutch government even built a land transportation network to balance food availability throughout the island. The existence of railways that can connect cities on the island of Java, and the expansion of the railway network play an important role in urban growth on the island of Java, especially in the city of Bandung (Huff, 2012). Based on this quote, it can also be interpreted that the aspect of governance at that time was an important factor in the growth and connectivity of cities on the island of Java.

Since the late nineteenth century, there has been a continuous and almost parallel increase in scale and complexity in Manila and Jakarta. Modest trading centers have become the capitals of countries and have turned into sprawling megacities. The latest phase of export-oriented industrialization has brought Manila and Jakarta closer to the world economy while reducing dependence on the region's agricultural hinterland. The provincial capital Jakarta is now integrated into the Jabotabek (Jabotabek) regional plan, including the adjacent regencies of Bogor, Tangerang, and Bekasi. This metropolitan area continues to grow despite large gaps in public infrastructure. Congestion and pollution are problems that occur in metropolitan areas. Budgetary constraints make it impossible to close gaps in utilities, housing, health, education, and transportation for the entire region (Dick & Rimmer, 2003). Based on Dick & Rimmer's research, it can be interpreted that in solving the problem of gaps in the availability of public infrastructure, it is necessary to have a qualified governance system, especially in terms of collaborative area management between the government and other stakeholders, especially developers and investors. This governance system can be interpreted as the importance of the soft infrastructure side that must always accompany the physically oriented governance of infrastructure provision.

From 1946 - 1956, the concept of expressway planning was operational during the late 1930s and applied to certain cities. The concept of expressway planning has assumptions to control traffic services and incorporate freeways into the urban spatial structure and combine them with mass transportation in the city (Mento & Ellis, 2013). There are other planning approaches such as the approach for sustainable cities with a focus on five main points, namely: 1. energy and air quality, 2. water, materials, and waste, 3. land, open spaces, and green spaces, and biodiversity, 4. transportation, and 5. Adequacy of housing and health facilities (Wilson & Beatley, 2018).

After centuries, the quality of cities is still a major concern for humans (Harding, 2003). In cities that are directly adjacent to each other, they have the same historical tendencies, but in current conditions, these cities tend to have different conditions such as economic disparities, and differences in urban development, for example, one is an agrarian city and the other is an industrial city, and so on. -other (Seton & Reba, 2018). In Southeast Asia, industrial city areas change the relationship between the city center and the surrounding area, the industrial city will become a city center with trade as its main activity, while the surrounding area will support the city center (Dick & Rimmer, 2003).

The crisis experienced by modernist urban planning in the 1990s led to the emergence of different planning approaches both in Europe and globally. Globalization and the collapse of the Eastern Bloc in the 1990s gave rise to a new approach to the discipline of planning. Modern urban planning that applies internationally

provides an approach to innovation in the field of architecture and strategic urbanism where urban projects require a structured planning system ranging from general level to zoning, this is important to anticipate the consequences of population explosion in the years of urban growth (Monclus, *New Paradigms and Strategic Urban Projects*, 2011).

Technological developments can be utilized in regional and urban planning, where this technology is multidimensional and complex, but technology is often seen as one dimension without context, with cultural, social, political, economic, and ideological forces that can influence the use of technology in regional and urban planning (O'Hara, 2014). This is what then makes the role of technology in regional and urban planning must be able to straighten its role, that technology is a planning tool to achieve planning goals, where in achieving the planning goals, sustainability is the main consideration. The strengths presented by O'Hara above show that the other side of the presence of technology needs to be contextualized with the forces which are a representation of the soft infrastructure side, including human beings along with the order of cultural life and survival. Diversity nation, ethnicity, and social class show the characteristics of each region and city, because of the nature of globalization and the dream of building a world without borders. The role of education in such a global environment is very important in achieving equality. It is important to identify how cultural and social perceptions are among stakeholder may know students' interest in regional and urban planning (Shady, 2014). In the urban context, complexities involving ethnicity, race, socioeconomic status, language differences (Caves & Wagner, 2018) and immigration create challenges around diversity related to regional and urban planning studies (Bayne, 2014). Globalization greatly affects the economy through free trade, migration, and socio-culture, and it results in more complicated demographics. Regional profiles, economic realities, and political processes shape the process of new norms (Shady, *Globalization, Immigration and Identity Formation Reformation*, 2014).

It is still related to the soft infrastructure side, but in the context of the competence of planners, if it is interpreted the skills that planners should have are related to provisions in analyzing problems and solving these problems innovatively and intelligently (Caves & Wagner, 2018). Some of these skills are the ability to see the big picture and the interrelatedness of different elements that comprise the physical, political, fiscal, cultural, and environmental conditions of communities and places; Creative problem-solving; A sense of livable and sustainability; the Ability to articulate and communicate; Empathy among people; Being passionate to promote quality of life; and fast learners. Lebih jauh dari itu, Caves&Wagner menjelaskan tentang specialty competencies terutama sustainability dengan mempertimbangkan land use and environmental, comprehensive planning methods, and community activism.

Planning practices cover an extraordinary spectrum of activities and approaches to problem-solving and decision-making. It is used to create goals, policies, and procedures to address social or economic challenges. At its core planning is shared values in individual and community well-being, justice, economic stability, and environmental sustainability. Planning will continue to evolve according to existing conditions and innovations (Caves & Wagner, 2018).

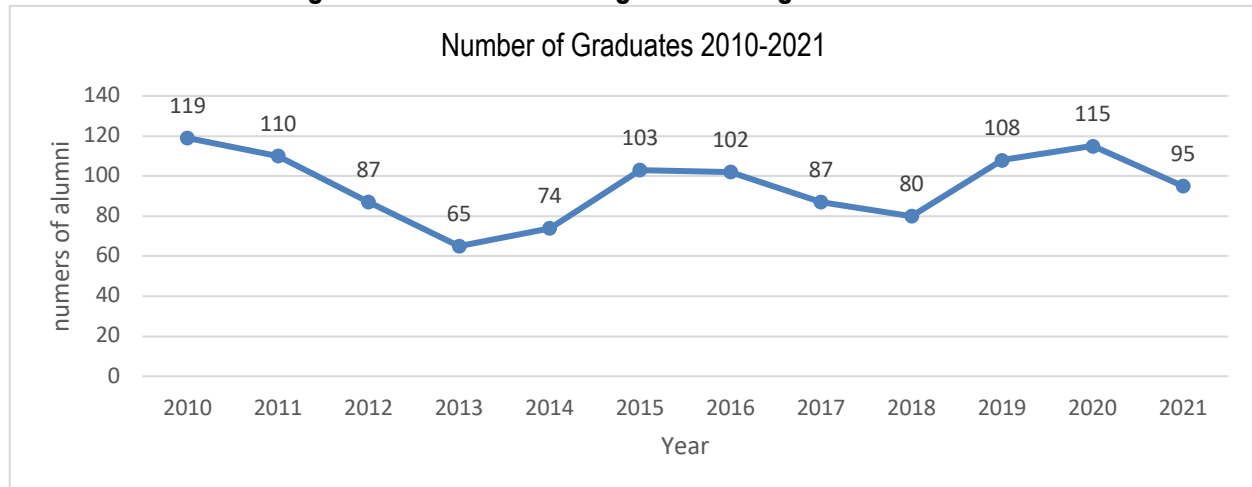
Most of the keywords from soft infrastructure are concerned with environmental preservation, especially in terms of governance and social life, what becomes more interesting is that the discussion of soft infrastructure is widely studied in the realm of engineering, as a complement to engineering knowledge that prioritizes management and development as a whole. and discussion of the role of technology for development.

Meanwhile, based on lens.org, the search for scholarly works from the soft infrastructure theme, has more to do with the keywords engineering, business, and political sciences. This shows that soft infrastructure is complementary knowledge to engineering science which is more technical in nature, where this understanding would be wiser to complement the context from a business perspective because it relates to investment and the role of the private sector in development, and there are political sciences in determining the direction of development including decision making to choose which engineering product to implement.

C. RESULTS AND DISCUSSION

Based on data from urban area planning graduates from the Bandung Institute of Technology, there were 1,145 students with the most graduates in 2010 with a total of 119 students or 10.39%, while 2013 was the year with the fewest graduates with a total of 65 students or 5.68%. With details of the number of graduates in 2010 – 2020 can be seen in Figure 2.

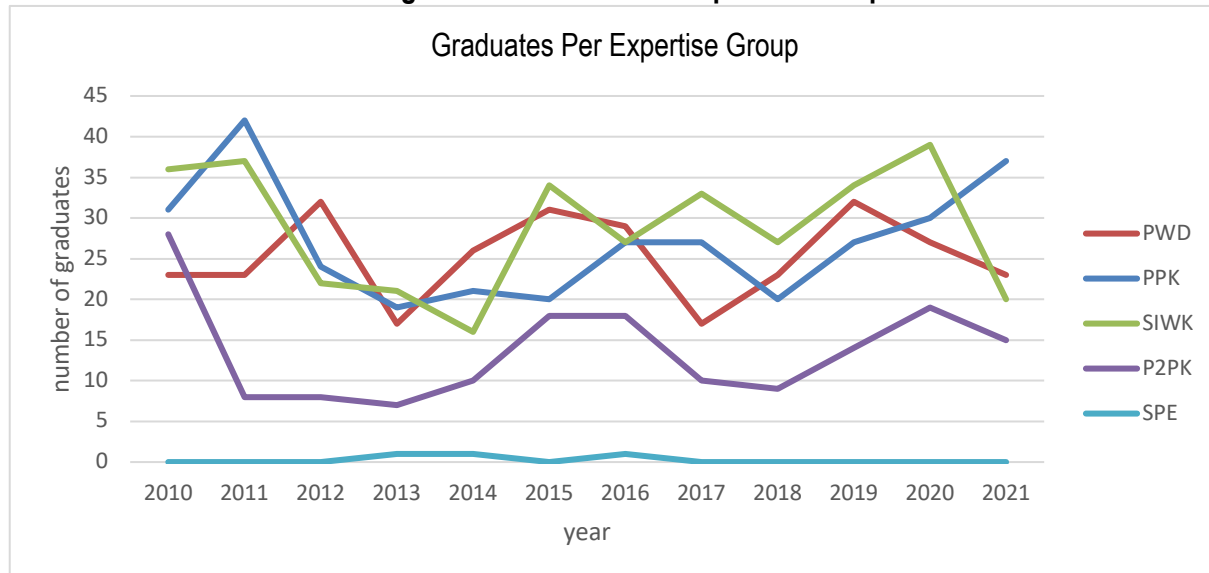
Figure 2. Number of Undergraduate Program Graduates



Source: Urban and Regional Planning, ITB, 2022

There are several groups of expertise for graduates of urban planning at the Bandung Institute of Technology, including regional and rural development (PWD), urban planning and design (PPK), regional and urban infrastructure systems (SIWK), development management and policy development (P2PK), and systems economic modeling (region-village; city; infrastructure-transport; governance; government-urban governance; economic modeling) (SPE). With the expertise group, regional and city infrastructure systems are the expertise group with the most graduates with a total of 346 graduates or 30.21%, while the economic modeling system (region-village; city; infrastructure-transportation; governance; government-urban governance; economic modeling) is the expert group with the least number of graduates with a total of 3 people or 0.26%. Data from ITB regional and urban planning graduates in 2010 the most desirable skill group was SIWK, in 2011 the most in-demand skill group was PPK, in 2012 the most in-demand skill group was PWD, in 2013 the most in-demand skill group was SIWK, in 2014 the most popular skill group is PWD, in 2015 the most popular skill group is SIWK, in 2016 the most popular skill group is PWD, in 2017 the most popular skill group is SWIK, in 2018 the most popular skill group is SIWK, in 2019 the most in-demand skill group is SIWK, in 2020 the most in-demand skill group is SIWK, in 2021 the most in-demand skill group is PPK With details of ITB regional and urban planning graduates each year are as follows:

Figure 3. Graduates Per Expertise Group



Source: *Urban and Regional Planning, ITB, 2022*

Trend Student research has a tendency to raise the city of Bandung as a case study with a total of 344 research or 30%. Several provinces that have never been used as case studies include Bengkulu Province, North Sulawesi Province, West Sulawesi Province, Southeast Sulawesi Province, Gorontalo Province, Maluku Province, North Maluku Province, and West Papua Province. Research topics or themes that are most frequently discussed are the processes of identifying and developing a case that refers to each group of experts. The most frequently discussed group of final project topics from 2010 – 2021 is discussing infrastructure and transportation, while the least discussed final project topic from 2010 – 2021 is planning information systems. In 2016 there is a tendency where the topic of the final project is about big data, smart cities, and social media are starting to be frequently used as the topic of the final project when compared to 2010 - 2015 the topics of big data, smart city, and social media are not used much as the topic of the final project.

DISCUSSIONS

Planning science in all regions of the world draws from a variety of disciplines, including civil engineering, architecture, landscape architecture, surveying, public health, and law. From this various knowledge, a variety of knowledge and experiences are utilized to design interventions. The historical origins and early evolution of planning education have had a global impact on planning. It is important to recognize that throughout the twentieth-century global exchange and international professional relations were important factors in advancing planning education. After World War II, in both the US and UK, urban planning and

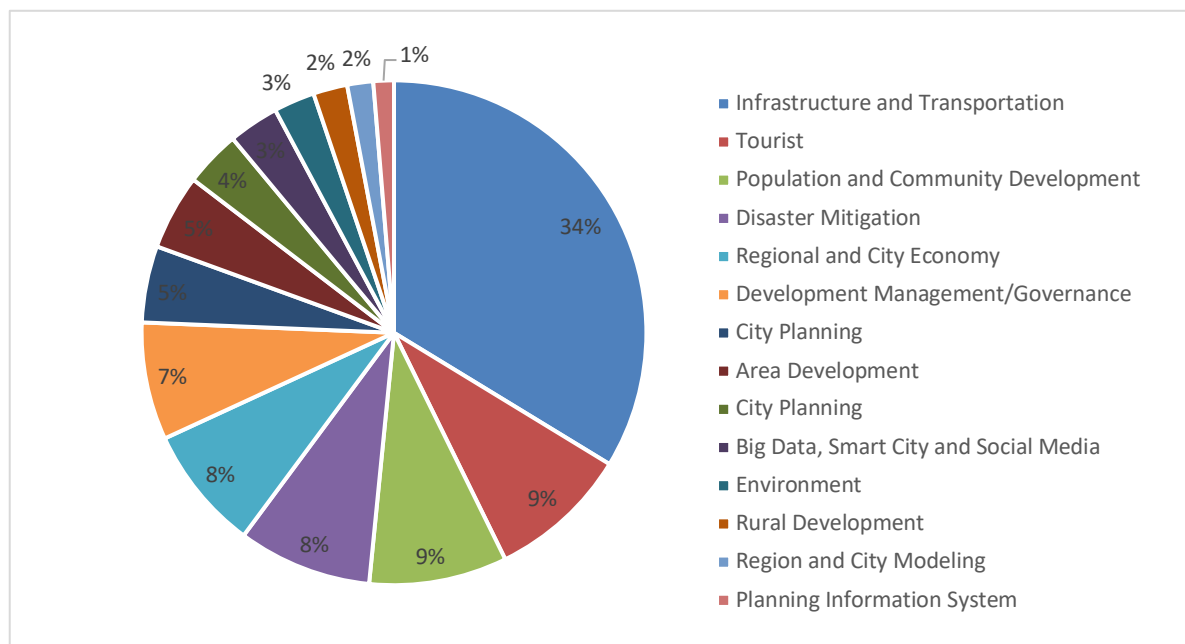
planning education stepped out of the shadow of the design discipline into a very different mode of the training program. pioneering planning education, in the US and UK, which supported the transatlantic planning dialogue as a precursor to the spread of global planning education in the post-World War II era. Although historical traditions in educational planning continue to influence current conditions, the emergence of national and international associations of planning educators (Silver, 2018). MIT As the oldest urban planning department located in the United States, this program was founded in 1933 providing insight into planner education. Urban and urban planning at MIT originally had a focus on physical planning and design but dramatically evolved into a multidisciplinary focus on the social and political challenges facing urban areas in the United States and around the world, after a significant reorientation in the late 1960s. From books and projects of the Joint Center for Urban Studies to innovative studies of urban form, the program expanded to take on a wide range of economic development and environmental policy initiatives (Vale, 2018).

Planning education will be very different from the current educational model, one of which is due to technological factors. For example, Minerva applies the learning method whereby students come to a specified city to see the city in their daily lives so that they can gain experience from that city. This method will be repeated with case studies in different cities (Evans-Cowley, 2018). Technological developments are expected to be able to assist in regional and urban planning, especially in integrating the information needed in regional and urban planning so that plans drawn up or made can take advantage of the latest information.

Globalization has implications for almost all aspects of social life. The unceasing utilization of the so-called 'free trade' is actually a set of double standards that protect certain markets in rich countries and deny poor and developing countries the opportunity to benefit from the segment of the economy that is most profitable to them. This economic disparity has resulted in inequality, segregating into different classes. Recent migration trends around the world appear to be driven in part by economic and social disparities. Immigration patterns have changed the demographics of migration destination countries, this has resulted in several new problems, namely, how to deal with cultural and ethnic differences generated by immigration (Shady, Globalization, Immigration and Indentify Formation Reformation, 2014).

The development of the times has made problems in cities, especially in Indonesia, different, such as problems related to housing, industry, open space/public space, zoning, disparities in economic growth, infrastructure, etc. These problems arise due to the needs of the community or political needs, not only the community has a role in forming a city, but politics also has a role in forming a city. Innovation has an important role in the development of a city, the emergence of a new idea makes the development of an urban area unique and different so that it can have a positive effect on the city.

Figure 4. Graph of the Final Project Topic Groups 2010 – 2021



Source: *Urban and Regional Planning, ITB, 2022*

Based on the topic of the student's final project, the last topic of infrastructure and transportation is the topic most often taken from 1,145 students who graduate, around 34% or 389 students take the topic of infrastructure and transportation, even topics related to infrastructure and transportation from 2010 - 2021 are always the most popular topics. much discussed compared to other topics. In the Indonesian context, where 2010 – 2021 a lot of infrastructure development has taken place, the problems and impacts of infrastructure and transportation are the most frequently discussed topics because they have an impact on the continuity of people's lives, the economic development of a city, and so on. In detail about infrastructure and transportation theme, it turns out that it places more emphasis on discussions about mobility, public services, sustainability, location theory, financing, infrastructure performance. This gives the fact that this theme is more directed towards soft infrastructure compared to hard infrastructure in the engineering context.

Meanwhile, when compared to the discussion on soft infrastructure in international journals which are more dominant in discussing engineering, business, and political science, this is in line with the theme of the final project of the undergraduate student of Urban and Regional Planning at the Bandung Institute of Technology. Another thing that can be conveyed is that the political science theme is alluded to in the group of themes on planning management/governance which is not significant in number (less than 10 percent). On the other hand, through the emergence of the latest themes on big data, smart city, and social media, we will finally be able to discuss the business side. Sustainability, which is the main jargon of urban and regional planning in Indonesia, is specifically discussed on the environment, and can also be discussed on other themes. In terms of the emergence of the theme of big data, smart city and social media, it will be more significant for the future to be studied in the context of sustainability as the other side of the need to accelerate economic development in the digital era.

D. CONCLUSION

The results of regional and urban planning students' final projects at the Bandung Institute of Technology have varied in terms of research or research conducted, with the domination of topics concerning infrastructure and transportation. In the period 2010 – 2021, the topic of infrastructure and transportation has always been the most frequently discussed research topic with a total of 385 studies out of 1142, while the topic of information systems and planning is the research topic that is rarely discussed. In the period 2010 – 2021, the topic of information systems and planning has a total of 15 research out of 1142.

In 2010 - 2014 the topic of population and community development became the most frequently discussed topic after infrastructure and transportation, but after 2014 the topic of population and community development began to decline followed by topics on disaster mitigation, regional and city economics, tourism, and management. /development governance. In 2015 - 2021 the topic of disaster mitigation and tourism is the final project topic that is the most discussed after infrastructure and transportation.

In the period 2010 – 2021 for all students with a total of 1,145 student graduates with the most graduates in 2010 with a total of 119 students graduating, while 2013 was the year with the fewest student graduations with a total of 65 students graduating. If grouped by skill group, there are variations each year in 2010, 2013, 2015, 2017, 2018, 2019, and 2020 the regional and city infrastructure systems (SIWK) expertise group is the expert group with the most graduates, in 2011 and 2021 the expertise group urban planning and design (PPK) became the expertise group with the most graduates, and in 2012 and 2014 the regional and rural development expertise group became the expertise group with the most graduates, while the development management and policy development (P2PK) expertise group and economic modeling systems (region-village; city;infrastructure-transportation; governance;government-urban governance; economic modeling) (SPE) has never been the skill group with the most graduates in the period 2010 – 2021.

In the period 2010 – 2021 for the undergraduate final project ITB urban and regional planning students, the most study areas were in Bandung City, West Java Province with a total of 344 research from 1,145 research and Bandung Regency with a total of 65 research from 1,145 research. On a local scale, apart from West Java Province which has a total of 652 research out of 1,145 research, DKI Jakarta Province is the second province with the most study areas with a total of 127 research out of 1,145 research, and Central Java Province with a total of 61 research out of 1,145 research. Several provinces have never been studying areas until 2021, namely Bengkulu, North Sulawesi, West Sulawesi, Southeast Sulawesi, Gorontalo, Maluku, North Maluku, and West Papua.

In the study area of Bandung City and Bandung Regency, the main topic of discussion is infrastructure and transportation with a total of 156 research from 409 research, followed by the topic of urban design with a total of 41 research from 409 research, and development management/governance, regional and city economy, tourism with a total of 26 studies out of 409 each. As for the Cirebon Metropolitan area (Cirebon City, Cirebon Regency, Majalengka Regency, Subang Regency, Sumedang Regency, Indramayu Regency, Kuningan), the majority of topics are about infrastructure and transportation, disaster mitigation, and population and community development).

Again, this paper shows that the discussion on infrastructure and transportation is a favorite topic for final undergraduate student projects, because this discussion looks more real in practice. In a case of soft infrastructure, in more detail, the sub-themes on infrastructure and transportation place more emphasis on the soft infrastructure side, such as themes on mobility, public services, sustainability, location theory, financing, infrastructure performance. Meanwhile, for other theme groups, there are also those related to soft

infrastructure, namely planning management/governance, as well as discussion on population and community development, both of which research is still below 10 percent.

In the context of the favorite theme of soft infrastructure at the international journal level, it is stated that there are at least three major popular themes, namely engineering, business, and political science. This is also consistent with the final project that has been carried out so far, where the representation of the engineering was the big theme of infrastructure and transportation, and political science alluded to in the discussion on planning management/governance, even on disaster mitigation, as well as in the discussion on population and community development. The challenge going forward, if soft infrastructure is used as the key to achieve a sustainable urban and regional planning condition in Indonesia, is to further strengthen research on this soft infrastructure, including for new trending themes on big data, smart city, and social media, to accompany development of technical engineering and technology for urban and regional planning in Indonesia in the digital era.

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