A New Perspective in Science and Technology Park Model (STPM) for Eco-Social Development Using Penta-Helix Concept: Case Study in Sumedang Regency

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Abstract. Sumedang is one of the Regency in West Java Province. This regency has a potential for being the SMART CITY which has the well-known campus such as Padjadjaran Univeristy. This research aims to analyse the model of Science and Technology Park (STP) in a new perspective that is appropriate with the eco-social condition in Sumedang. STP is a science park that is managed by the professional specialties to grow up the community welfare through the innovation culture, business competitiveness, and institution based on knowledge. Generally, this research was conducted by using 3 phases that are analysing the eco-social condition, comparing the STPM in the different area, and designing the concept of STPM. The Penta-Helix concept uses the 5 major components that are Government, Research Institute, Company, Information Technology (IT) and Society. Through this concept, Sumedang could be a SMART CITY and the eco-social progress thruster in West Java Province.

Keywords: Penta-Helix Concept, Science and Technology Park (STP), Smart City, Sumedang Regency

1. Introduction
In Indonesia, the development of Science and Technology Park (STP) has been established since 2002 that was governed in UU 18/2002 about systems of national research, development, and the implementation of science and technology. This rule gives a chance and encourages the government and private sector to develop the infrastructure of science and technology for facilitating the growing synergy between institutional science and technology elements in the society. The development of STP also was rated as a
strategic step to encourage the hilirization of research and technology in various research institutes to be harnessed by industry and society. The Vision of National Development in The Mid-Term (RPJMN) 2014-2019 has decreed that would build 100 units of STP in all over Indonesia.

Generally, STP is a science park that is managed by the professional specialties with the goals to grow up the community welfare through the innovation culture, business competitiveness, and institution based on knowledge. Each of STP has its own characteristic and goal. Some of the STP in the world that is [1]:

- **Stanford Industrial Park in Silicon Valley**
  Silicon Valley is one of the areas in San Jose, Northern California, USA. In this area was built some of the Silicon Chip Company and the other company in high tech field. The development of Silicon Valley area that was followed by the growing high-tech business was started by the centre development technology in USA to the most technology development in the world. Silicon Valley is the most impactful centre of research and technology development in the world. There are some company that was domiciled in Silicon Valley such as Apple, Cisco, Google, Hewlett Packard, Intel, Microsoft, Oracle, Sun Microsystems, and Yahoo.

- **Science and Technology Park in Bangalore Area, India**
  The development program in India is a certain step. Indian’s people want to develop their country by using knowledge based on society concept. The capital city, Andhar Pradesh, was being a high-tech city. The information technology was used to 3 major goals that are to promote the economic growth, improve the quality of society’s life, and to drive a good government. President of commissioner Infosys, Narayana Murthy, said that in doing development, every country can’t dream to control in every aspect. The broad base development concept makes the country does not have the real competitive advantage.

  The government, through the Education Institute, tried to build an STP to improve the human resources in the region. Science and Technology Park in the city/regency build as [2]:
  1. The centre of technology implementation to improve the commerce in the region
  2. The place for training, internship, centre of technology dissemination, and centre of business advocation to the society

  Some of Science and Technology Park that has been found showed that the consideration of STPM was depended on the potential or the necessity of the region. This research aims to identify and analyze the appropriate STPM by considering the necessity of society in Sumedang based on eco-social aspect. The STPM designed by using the Penta-Helix concept that is Government, Research Institute, Company, Information Technology (IT), and Society. The development of eco-social aspect consists of agriculture, fishery affairs, animal husbandry, plantation, forestry, marketing, traditional craft, and industry. Moreover, this research could give a new insight for the government in the STP development realization.

2. Research Method
The research about planning the development of Science and Technology park in Sumedang Regency has done by some of the earlier researchers such as [1] and [3]. The collecting data was done by using the Literature Review Method which was collecting the earlier research and comparing it to the Sumedang condition to find the STPM using the Penta-Helix concept. This study was continually done to find an appropriate STPM in Sumedang Regency condition. Generally, this research was conducted by using 3 phases that are analyzing the eco-social condition of some aspect was analyzed such as agriculture, fishery affairs, animal husbandry, plantation, forestry, marketing, traditional craft, and industry; comparing the STPM in different areas consist of the Stanford Industrial Park in Silicon Valley and STP in Bangalore Area, India; Designing the STPM by Making a breakthrough about the appropriate
STPM based on the Sumedang condition using the Penta-Helix concept between Government, Research Institute, Company, IT, and Society

![Diagram showing pathways]

**Figure 1.** The pathways of Science and Technology Park Model (STPM) research

3. ECO-SOCIAL CONDITION IN SUMEDANG REGENCY

Sumedang regency has a high potential in natural resources in the strategic area. As an Education Area, Sumedang has some of the well-known campuses, especially in Jatinangor, such as Padjadjaran University (Unpad) that could help to grow up the eco-social aspect in this area. The directed development could change this area to be a SMART CITY. Nevertheless, high potential natural resources did not follow by good human resources. It has an impact on the decline in productivity that can be seen from the decline of natural resources exploitation. Some of the eco-social condition that is [4]:

1. **Agriculture:** the paddy production in 2014 was 472,220 tonne (T) from the 90,297 Hectare (Ha) harvest territory. It was decreased about 3.69% from 492,024 T in 2013
2. **Fishery Affairs:** the fish production mostly declined such as tilapia that declined from 164,608 in 2013 to 125,835 in 2014
3. **Animal Husbandry:** the amount of livestock declined such as goats from 39,998 in 2013 to 31,916 in 2014
4. **Plantation:** the amount of plantation production mostly increased. However, there’s still a decline in production in some plant such as pepper production from 165.27 in 2013 to 164.69 in 2014
5. **Forestry:** the production of forestry was mostly decline such as bamboo production from 3,440 in 2013 to 400 in 2014

Not only in natural resources, Sumedang also rich in traditional craft such as Kacapi Indung, Airgun, statues, bamboo sculptures, and the other traditional music instruments. Some of the handicrafts have been distributed for the public, even exported such as woodwork craft and traditional musical instrument. However, the development of this traditional craft has not been equal yet. It proved by some handicrafts that were hard to sell because of the lack of access and distributor. The small amount of industry also made the low productivity of the laborer. Most of the industry was the home industry that was classified into a small industry with 5,880 units in 2014. The high amount of seeker job that was 10,016 people and laborer only 117,330 people still needs much attention to improve the social aspect in this area. Regionally in West Java Province, there was a fluctuation of economic growth with the lowest was 4.29% in 2009 (Table. 1)
By developing the Science and Technology Park, the productivity of natural resources management in Sumedang Regency could rise along with the enhanced number of big industry, increased investment, implementation research of research institute, and laborer training by experts in their field. The interaction between government, research institute, company, and society could be a new breakthrough in directed development in eco-social aspect.

4. Science and Technology Park Model (STPM)
The STPM is an important thing in directed the development of STP. The development strategy was implemented through two development priorities that are strengthening the National Innovation System (SINas) that serves as a vehicle for the development of science and technology towards the vision of science and technology development in the long term; and Improving Research by Developing and Applying the Science and Technology (Science and Technology P3) are carried out in accordance with the directions outlined in RPJPN 2005-2024 [3]. The closed cooperation between the organizers in one sector is the main factor of declining performance competency in the work. The self-development concept in the world of work will make them harder to improve themselves. By doing an open cooperation, an attempt can be better both in principal and technical. Thus, the synergy between the Penta-Helix components was needed in the management of STP. The main sectors in Penta-Helix concept were Government, Research Institute, Company, Information Technology (IT), and Society (Fig. 1). Each of the components has their own duty but still connected for building up together.

| ASPECT                          | YEAR |      |      |      |      |
|---------------------------------|------|------|------|------|------|
|                                 | Baseline | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
| Current Economic Growth (LPE)   | (%)  | 6.48 | 6.21 | 4.29 | 6.09 | 6.48 | 6.21 |
| Inflation (%)                   |      | 5.10 | 11.11| 3.09 | 6.46 | 3.10 | 3.86 |

Table 1. The current economic growth and inflation of West Java Province in 2007-2012 [5]
Figure 2. The 5 major components for open collaboration in STPM

The management of the STP area has to be run out by the various sectors that have a structural organization and together financial contributions which was declared in Memorandum of Understanding (MoU). Specifically, Information Technology aspect works as tools of information and publication in the whole of STP management. The other networking between the Penta-Helix concept that is:

1. Government-Company
   The Government, as the highest authority, was privileged in making the policies of development and management by considering the corporate interest of making an investment, developing the STP, and a place for occupation implementation

2. Government-Research Institute
   The Government could coordinate and encourage the several research institutes in terms of innovation, laborer training, and research improvement that can be implemented by the society

3. Government-Society
   The Government could encourage the society to participate themselves in business activities, start-up improvement, laborer training course to improve their productivity in work, and help them to improve and conserve the traditional arts and crafts

4. Company-Research Institute
   The Company could collaborate with the research institute in terms of research improvement, laborer recruitment, and laborer training course by the expertise in the research institute

5. Company-Society
   The Company could recruit the laborer from the society, doing an internship, and investing in the start-up product to improve the quality of product and can be sold by the company

6. Research Institute-Society
   The Research Institute could give the courses and laborer training by the expertise in their own field and implement it to improve their productivity in their work

In Science and Technology Park management, the government is the major component that will evaluate the continuity and the other component that is involved in it. Some important things that the Penta-Helix components have to be concerned about in STP management, that are:

1. Generally, the construction of STP needs about 10 years to establish their management. In the management, the government should create a clear of the coordinate path that can improve the continuity of STP.
2. An agreement should create between the association, developer, planning contractor, and the other component in STP which is connecting each other such as prospective company customer, development of facilitation and installation, coordination, and promotion
3. Consultation procedure and coordination agency should be appointed to encourage the trusting feelings
4. The political arbitrage should be made to solve the problems between the component in STP
5. The decision maker should not join the association. STP management should have the clear structural leadership between the component representatives
6. The STP coordinator should be appointed which has the capability to accommodate the importance of public and private sector equitably

Figure 3. The suggested paths for the development of Science and Technology Park (STP) in Sumedang [6]

According to District Regulation (Perda) 2/2012 and 22/2010, Sumedang Regency directed as the Centre of Local Activity (PKL) that is an area which has function to serve the activity in sub district scale, equipped by the tools and infrastructure as a Centre of education in Jatinangor, agribusiness and industry nonpolluting consist of 5 sub-district that are Jatinangor, Tanjungsari, Cimanggung, Sukasari, and Pamulihan. Some of infrastructure plan developments in Sumedang that are [7]

1. Development of Road infrastructure (improving the capacity and strategic road condition)
2. Development of Connection infrastructure (reactivating the railroad tracks in Rancaekek Jatinangor-Tanjungsari and developing the traffic conditions and road transport)
3. Development of water energy resources infrastructure (developing the infrastructure of flood control and improving the irrigation network condition)

4. Development of energy infrastructure (developing the energy from the final exile (TPA) of rubbish, developing the bioenergy, developing the plumbing of regional and city gas, utilizing the coal for the industry, developing the village independent of energy)

5. Development of settlement infrastructure (developing the city settlement that is consist of the vertical building development in Jatinangor, education area development in Jatinangor, preparation area for building development, managing the rubbish and operational of TPA Legok Nangka Regional, clean water improvement, waste management improvement, slum arrangement, the setting up of the urban drainage network, construction of unified sports area, construction of Hospital Type C)

6. Development of Rancaekek industry area that was lies in Sumedang Regency and Bandung Regency

The infrastructure development program above can enhance the capability of STP construction in Sumedang. Besides the environment factor, the facility development and the preparation phase of STP construction should be noticed. Some of the facilitation and service that were needed in a Science and Technology Park that are Accounting, Business Consulting (including coaches and mentors), Food and Beverage, ICT infrastructure, Industrial Design, Intellectual property, Investment community including banks, Legal, Market research, Networking Sessions – a diverse set targeted at different outcomes, Patent attorneys, Public and Media Relations, Science and Technology consulting, Security, Shared lab and other facilities, and Transportation [8]. The facilitations construction and services were conditional and continual based on the importance of STP administrator. Some recommendations of STP construction preparation stage that are [9]:

1. The areas with well-developed logistic system and availability of an international airport that provided by human resources that have a higher education and vocational secondary education degrees, and the existence of developed business structures available for the techno-park would be an asset.

2. The company that will be cooperated in STP should match with the business profile of the techno-park; rigid requirements for the ratio of resident companies engaged in developments and other entities (resident companies must make at least 50-70% of the total number of structures), local and regional administrations should have relevant business units to ensure the activities of resident companies (interaction with customs, territorial and tax issues, etc.) and to promote attraction of new residents to the techno park;

3. Research Institute should have research and development centers; laboratories and resource centers with the appropriate software and hardware; Universities and structures of additional education and advanced training, including corporate universities or intermediary educational firm providing personnel training; and a business incubator.

4. The infrastructure of STP should have a good social environment, including the provision of employees with an affordable and comfortable living space, personal social services, centers for sports and leisure; shopping capacities.
Based on the Planning Area Map, Jatinangor was a recommendation area for Science and Technology Park construction. The existence of some Research Institutes, Government Agency, Research Agency, and the primary road of cross-town could support the construction. There are some of the Research Agency near the Sumedang Area that are Geospatial Information Agency (BIG), Environment Geology Agency, National Aeronautics and Space Administration (LAPAN), Indonesian Institute of Sciences (LIPI), Ministry of Energy and Mineral Resources, Industrial Engineering, Industrial Research and Development Agency, Ministry of Culture and Tourism, and Study and Technology Application Agency (BPPT). The STP construction could be done in the Public and Social Services Zone which was located in the centre of Jatinangor and Regency Bound. The strategic area with the directed construction could enhance the function of STP in Sumedang Regency for West Java Province.

5. Waste Management as One Of The Breakthrough Project of STPM in Sumedang

Waste management is one of the major problems that need to get some serious attention. It was not appropriate for the sustainable and environmental insights processing techniques. Thus, the sustainable and innovative techniques were needed to give the benefit for society and environment such as to improve the human behavior in waste management. As in Sumedang, there are still a lot of problems both in the government and society behave that could exacerbate this problem. There are 4 major factors that growing up the waste that are consumption level, income level, population level, and life patterns. Public awareness and innovation in waste management were needed between the government and society.

Sumedang Regency has 102,356 of the total population, 18.17 km² areas of administration, 1,565 tonne/day of total garbage in TPA, and 210 tonnes/day of unmanaged garbage [10]. From the analysis result, it can be concluded that the average of human waste in Sumedang was 0.017 tonnes/day for each human. The garbage was mostly consisting of 62.27% food garbage. This problem certainly needs a serious attention for both the government and society. By collaborating between the Penta-Helix in an STP, the waste management problem would be solved by doing some technology innovation in recycling bins; developing the facilities and infrastructure of waste management; and socializing to the society about how to manage their rubbish.
Padjadjaran University (Unpad), as a research institute in Sumedang, could be the prime mover in waste management innovation. Unpad, during managing the garbage, was trying to be a self-sufficient campus in waste management by doing some technology innovation to recycle the garbage. The organic bin and liquid waste recycled by using the anaerobic method to produce the liquid fertilizer and biogas. The biogas could be used for the lab fuel and energy resources in lighting the road in Unpad. For the plastic and bottle garbage, it recycled by putting it into the “crusher machine” to produce the plastic ore. Unpad also did a research about how to decline the garbage residue by using the machine called incinerator. This machine could burn the garbage about 150 tonnes/day. This machine was enough to recycle the public garbage around the campus area. By implementing STP in Sumedang, the society could involve their self in the development of waste management and collaborate with Unpad. This activity would also increase the work field for the society in implementing the technology and applying it in their daily life to solve the waste management problem in Sumedang.

6. Conclusion

By the high potential in natural resources and the strategic area, Sumedang Regency could be the SMART CITY with the capable eco-social conditions. The Penta-Helix concept in Science and Technology Park management could be made as a basic planning in making the policies and regulations. As the supreme authority holder, the government should embrace and push the whole main component in STP by collaborating each other to create the areas of high innovation for public welfare. By developing the STP, Sumedang could supporting the economy and social conditions, especially for West Java Province.

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