Government- Pulled Triple Helix for Supporting National Aircraft Industry in the Global Value Chain with Tipology Hierarchy

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Abstract
This study reconstructs the government- pulled triple helix for supporting national aircraft industry in the Global Value Chain (gvc) with tipology hierarchy. By employing Soft Systems Methodology (SSM), this research revealed that Triple Helix Model for development aircraft industry directed to design Macro Policy, revitalize test laboratories, strengthen aircraft financing policy, building supporting Industries and empower aerospace human resources. The government-pulled triple helix model has overlapping the role played by Academia (A), Busines (B), and Government (G) in the development of the aircraft industry. In fact, according to Etkowitz, H. (2008) that overlapping of role only occurs in university pushed triple helix model. In addition, the configuration of actor G in the triple helix needed for development national aircraft industry is not generic but based on specific context. In aircraft development, especially for strengthening the aerospace industry cluster, the role of association is also important. In the GVC of Aircraft Industry with typology of hierarchy, PT DI is required to be able to build networks with industry partners, domestic and foreign research institutions and aircraft component industry associations. The Government will obtain lesson learnt on how the strategy for supporting the national aircrafts development such as program of N 219, N 245 or R 80 which developed at present.

Keywords: *triple helix, global value chain, aircraft industry, soft systems methodology*

A. INTRODUCTION

In the national context, there are three national aircraft development programs, two of which are government initiations and one is private initiation. The two government initiation programs are the N 219 and N 245. While one private initiation program is the R 80.

The N 219 and N 245 programs have been stated in Presidential Decree No.2 / 2015 on the National Medium-Term Development Plan (RPJMN) 2015-2019. Meanwhile, the development of the R 80 aircraft initiated by PT RAI has been stated in Presidential Regulation No. 58/2017 concerning National Strategic Projects. Eventhough the supporting for aircraft industry is stated clearly in some regulation, but the some sectoral policy such as innovation, financing, testing labs facilities, and human resource supporting which needed still low.

In innovation sector, if we look at the macro research group as a priority base for allocating the five-year research budget as regulated in Presidential Regulation No. 38/2018 on the National Research Master Plan (RIRN) 2017-2045, it is known whether in the applied research or advanced research for manufacturing group which are the container for aerospace research are only prioritized in the period 2025-2029 and 2030-2034.

Moreover, in article 5 related to the research field, aerospace field has not been stated expressly such as the other eight research fields, namely: food, energy, health, transportation, engineering products, defense and security, maritime and social humanities. In addition, some testing labs facilities for N 219 or R 80 such as: Drop Test, Flight Simulator Engineering (EFS), Composite Test, Runway test, and Telemetry System are not currently available or need to be revitilized (Muzakir, M.A.I. dkk, 2015).

At financial sector, government regulations governing the mortgage of aircraft as a guarantee of repayment of a debt as mentioned in Article 13 paragraph (3) Law No. 15, 1992 on Aviation has not been realized (Danishswara, G. & Darmawan,A.K., 2014). In fact, an almost impossible if the external fund purchase of aircraft is only sourced from one financial institution alone let alone only from the institution of domestic financing (Muzakir, M.A.I dkk, 2015). Moreover, the one of key success of air craft Y 12F produced by Harbin Aircraft Industry, China and ATR 72: 600 that respectively on the same class with N 219 and R 80 are the government supporting on financial sector.

While in industrial sector, in 2013, PT DI allocated research fund is only about 1% of the total turnover (3 trillion IDR) which is about 30 Billion IDR (PT DI Report, 2013). Though, the budget is needed into design development for R-80 is approximately US $ 300 million. Moreover, the total test facility PT DI that can be used for upgrading N 250 only a maximum 30%.

Meanwhile, production capacity of PT DI is currently still very weak at only 12 aircraft per year, whereas the expected production capacity is 36 aircraft per year. On the one hand, the international market share of R-80 aircraft is about 150 aircraft per year. Even, in the period 2010-2029, the market needs turboprop aircraft with a passenger capacity of 61-120 is predicted to increase (Presentation of PT. RAI, 2014); (Workshop conducted by Ministry of Marine, 2018).

Need of engineers for producing R-80 is about 1.000 people, or approximately 2 million man hours. Meanwhile, in the next 3 years, many engineers of PT DI will retire. Likewise, aerospace engineers are scattered in ITB, Agency for Assessment and Application of Technology (BPPT) as well as National Institute of Aeronautics and Space (LAPAN) which have been a partner of PT DI in the development of aircraft has become more limited (Muzakir, M.A.I.dkk, 2015).

The problem of still weak support for the aircraft industry which cover the sectoral policy such as industrial and human resources as mentioned above shows that the intensity of collaboration amongst main actors of triple helix which consist of ABG in developing national aircraft industry is still weak. Whereas, collaboration between stakeholders mainly amongs triple helix actors is even the key to success in the aircraft industry (Muzakir, M.A.I dkk 2015; Suijun (Lucy) Yi, 2013).

In fact, the pattern of collaboration in the development of the aircraft industry is no longer closed innovation but open innovation in the global value chain. Among the examples: firstly, Airbus or EADS (European Aeronautics Defense and Space Company). The Airbus industry is an alliance of European aircraft industry companies. Secondly, Boeing. As the world's largest industry, Boeing consolidated with Mc Donnel Doughlas, and Boeing has so far made many alliances with foreign companies such as Japan in the production of 777 and 787.

Thirdly, the making of ATR 42 and 72 is through the Alenia Italia alliance and Aerospatiale (France). Cross-country alliances are a strategic recipe for mastering certain aircraft market segments such as those carried out by Boeing and Airbus. Airbus involve Bombardier for C series products, whereas Boeing invite Embraer for joining in making some product. This alliance further strengthened the Boeing and Airbus hegemony in the 100-150 aircraft market. As before, four long-distance jet markets were contested by four companies: Bombardier, Embraer, Sukhoi-Alenia, and Mitsubishi.

The importance of cross-country collaboration in the aircraft industry shows that the aircraft industry is part of the global value chain, which means that the need to be part of the global value chain is success key for the aircraft industry. As one example is the structure of the aircraft body. Of the total structure of an aircraft body, the property right of a lead firm is a maximum of only 25%, the remaining 75% is a share of thousands of companies from various countries (FGD conducted by MoRTHD on July, 30, 2018).

Some studies have shown that the success of the aircraft industry is largely determined by the extent of collaboration between triple helix actors consisting of ABG (Etkowitz, H., 2008).

Triple Helix Concept

According to Etkowitz, there are three types of triple helix models namely Model I is Government- pulled Triple Helix or also called statist models, Model II is laissez faire model, and Model III is a University -Pushed Triple Helix.

In the model I, the government played a dominant role in directing universities and industries. The state (government) is very dominant in determining research programs, themes and priorities aimed at fullfiling to the interests of national defense. In model I, in addition to the main task of providing teaching, the university also plays a role in training and conducting special basic and applied research directed by the government. The role of industry supported by universities is in the development of certain technologies according to the direction of the government.

Model II laissez-faire model is a model that reduces the role of the state. In this model, the format shifts from the top-down process to the bottom-up process. The interaction mechanism occurs based on the market demand, the role of the government is not direct but as an enabling factor, especially in providing a conducive environment / regulation. Government is needed when there is a market failure.

The model III is a model that encourages the creation of spinn-off industry of universities, strategic alliances of companies with government laboratories and university research groups. Therefore, this form of relationship is not through government control, but is naturally encouraged by university.

In this model, universities, firms, and governments each “take the role of the other” in triple helix interactions even as they maintain their primary roles and distinct identities. The university takes the role of industry by stimulating the development of new firms from research, introducing “the capitalization of knowledge” as an academic goal. Firms develop training to ever higher levels and share knowledge through joint ventures, acting a bit like universities. Governments act as public venture capitalists while continuing their regulatory activities.

Among these three models, University-Pushed Triple Helix is perceived as ideal innovation model, because of the desire for innovation emerges voulantary of the three actors namely University (A), Business (B) and Government (G). On the contrary, model I is a model that is considered a failure because of the low bottom-up initiative as well as the level of innovation tends to be very low.

Meanwhile, model II simply relies on market mechanisms which are certainly very vulnerable to causing economic instability (Etkowitz, 2008; Etzkowitz, H & Leydesdorff, L. 2000).

However, in the context of the development of the aircraft industry, the relatively powerful model is model I, where the Government plays more control in directing industry and university. This is also indicated by Etzkowitz, H. et.al, 2007 when explaining the plus minus of the Government-pulled triple helix model.

The effectiveness of implementing the triple helix model ever been, both in developing and developed countries. For developed countries such as the United States especially in the first and second world wars. At that time, the American Government put Industry and University as a service for the needs of the State, especially to strengthen national defense.

The example of developing countries that implement the model I, especially in the development of the aircraft industry are Latin American countries such as Brazil and Argentina. Brazil's experience shows that since the 1970s and the beginning of the 1980s with its *sabato* vision, the Government of Brazil succeeded in developing the National Aircraft Industry, Embraer.

As for Argentina, in the 1960s, they applied the model I. The Argentine government applies a statistic model because they believe that only the government has the ability and resources to mobilize other innovation actors (industry and universities) in order to develop sience-based industries (Etkowitz, H., 2008. p.14). By adopting static model, the Argentine Government succeeded in developing the Aircraft Industry (FAMA) which was the first aircraft industry in Latin America (Vertesy & Szirmai, 2010).

In line with Etkowitz H. (2008), the report of Kemenristekdikti (2015) also shows several examples of how strong the involvement of governments from various countries in supporting the aircraft industry. First, dispute between Boeing (USA) and Airbus (Europe) in 2004. The United States and European Union brought their trade dispute to WTO, where the USA stated that Airbus had received US $ 15 billion in subsidies and otherwise the EU stated that Boeing had received US $ 18 billion subsidies. In 1992, the EU and USA agreed to limit subsidies to 33% of the total cost of developing new aircraft.

Second, HAM (China), supported by the government in the form of subsidies and capital assistance. The Chinese government protects the market by requiring foreign investors into a joint venture to enter the Chinese market, in addition all domestic aircraft needs must be fulfilled and / or involve the Chinese industry.

Third, Bombardier (Canada), Bombardir gets guaranteed bonds from the government in the form of R&D funding around US $12 billion each year. Fifth, Embraer (Brazil), as in the Muzakir, M.A.I (2015), that the Brazilian government provides *Pro Ex* which is interest reduction of around 3.5% on loans for overseas buyers. Even though in 1999, the policy was considered illegal and finally stopped.

The dominance of government role in the context of the model I in the development of the aircraft industry as described by Etkowitz, H. (2008) is very relevant to the concept of Global Value Chain with typology hierarchical (Gereffi, G et.al 2005). Based on result study of Muzakir, M.A.I. dkk (2015) that the Indonesia Aircraft Industry is in the category of GVC with typology hierarchy. The main characteristics of it are very top down and the intensity of government support needed is very high and long-term.

The findings of Etkowitz, H. (2008) related to the effectiveness of model I in encouraging the development of the aircraft industry as in Latin American countries, especially Argentina and Brazil, also in line with the findings of some other studies. First, research of (Jones, H.G., 1999) on the WACO Aircraft Industry in 1919-1963. In that study, it was concluded that the role of the government in encouraging increased R&D activities and becoming the first market for the aircraft industry was a key factor in the success of the WACO.

Second, research of Steenhuis & Bruijn (2004) related to the factors of failure and success of the aircraft industry in four countries namely Romaero-Romania, IPTN-Indonesia, AVIC-China, and Embraer-Brazil. According to them, that the failure factor of Romaero-Romania was due to a lack of government support, especially funding in the development of medium or large aircraft.

Meanwhile Indonesia, according to Steenhuis & Bruijn (2004), even though Indonesia is more advanced than Romania both in aircraft design and production capabilities, but in addition to low production efficiency, the termination of government funding support, especially for the N 250 program, is one of the main factors in the failure of IPTN. As with China and Brazil, according to Steenhuis and Bruijn, national government support for two countries is very high, from financing for developing aircraft till providing market.

Brazil can be said to be relatively successful between these countries, according to Steenhuis and Bruijn (2004), the process of developing the Brazilian aircraft industry began in 1950-1980, where industrial development consisted of three phases: first, training programs to encourage the development of the aircraft industry. second, the formation of local manufacturing capabilities, and third, preparation for the construction of the aircraft industry.

Brazil is a developing country that has succeeded in developing aircraft with more than 50 passengers in global economy such as ERJ-145; ERJ-170/190. Steenhuis and Bruijn stressed that the Brazilian government's long-term commitment was one of the key factors. Unlike what happened with Romania or Indonesia, although in the 1980s Embraer was faced with an economic crisis, the Brazilian government remained committed to continue support the company.

Third, the comparative study of industrial cluster between China and the United States was conducted by Chu, Zhang&Jin (2010). In conclusion, Chu, Zhang and Jin recommended that in the development of the aircraft industry, the government must shift from closed innovation to open innovation. In addition, the government must establish the aircraft industrial clusters.

Fourth, Vertesy & Szirmai (2010) on Interrupted Innovation: Innovation System Dynamics in Latecomer Aerospace Industries. The study analyzed four aircraft industries namely Embraer-Brazil, COMAC-China, IPTN-Indonesia and FAMA-Argentina. It confirms Steenhuis and Bruijn (2004) that Argentina's failure besides the failure of privatization and the strength of military control was the lack of sectoral policy coherence of industry, science and technology and defense.

The failure of Indonesia, almost similar to Argentina, the both no continuity of government support whether financially and politically, even IPTN have the ability to transfer technology, but the ability of manufacturing is still low. Meanwhile, Avic-China and Embraer-Brazil, according to Vertesy and Szirmai that the government of both have had a number of coherent and long-term policies to encourage the development of the national aircraft whether in economical, political and industrial development policies and supporting for global market penetration.

Fifth, Stewart, Lawyers, & Group (2007) on China 's Industrial Subsidies Study: High Technology, in its conclusion, Stewart explained that the success of the Chinese Aircraft Industry was due to the strong support of its government policies. The policy support was stated explicitly in both the Guidelines for the National Economic and Social Development period (2006-2010) and in The Guidelines for the National Medium and Long-Term Science and Technology Development Plan (2006-2020). And one of China's important economic policies that encourage aircraft manufacturing is subsidies cross-industry for the High Tech Industry.

Sixth, research of Pritchard, D. (2010) on a number of aircraft industries, namely Boeing United States, Airbus Europe, Bombardier Canada, United Aircraft Corporation (UAC) Russia, COMAC China, Embraer Brazil, Aircraft Industry Mexico and the Italian Aircraft Industry. In addition, Pritchard explained that the success of the Brazilian Embraer was due to the coherence of its innovation, economic and development policies. Meanwhile, Italian aircraft industry has high government support, especially in R&D and manufacturing budget

Seventh, the research of Suijun (Lucy) Yi (2013) for her dissertation recommended that in creating new ideas and technological innovations and also maintaining Boeing's superiority in the global economy, Boeing must strengthen cooperation with US Government.

Governmet Pulled Triple Helix in GVC

Review of previous literature reveals that study which is closer to this research scope, especially in analyzing how the government support in the triple helix collaboration for the developing aircraft industry in the global value chain is only two, namely Mcguire, S. (2014) on Global value chains and state support in the aircraft industry and research for a dissertation from Muzakir, M.A.I.dkk (2015) on policy process as hierarchy in encouraging technology upgrading in global value chain-national aircraft industry: IPTN Failure Analysis of N 250 Aircraft Program.

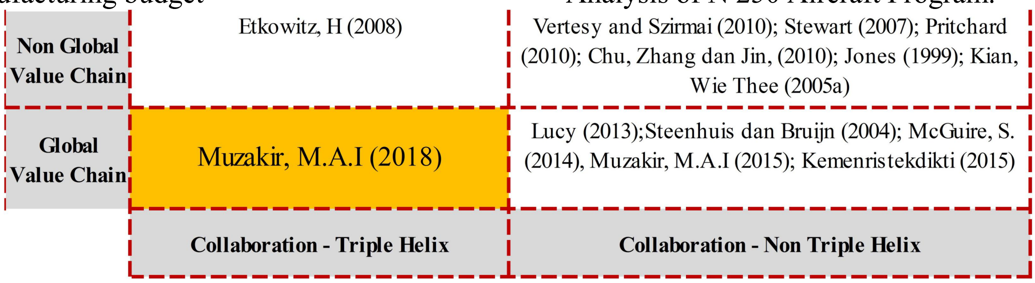


Figure 1: Map of the previous research on Government-Pulled triple helix for supporting the development of the national aircraft industry

McGuire, S. (2014) stated that the Chinese government's intervention was very comprehensive in supporting the development of the aircraft industry, it covered some aspects such as aircraft development, testing facilities, component industries, development of C 919 long range jet aircraft and providing the domestic market. In addition, McGuire, S. said that the Chinese government also invested in COMAC through state-owned enterprises. Even the Government also appoints the bank of state to offer variety of domestic aircraft financing schemes. Besides the support of the central government, the regional government also provides subsidies loans for the development of aerospace facilities. According to the author, McGuire does not describe how the role of research institution or university in the triple helix framework in the development of aircraft.

McGuire also did not explicitly explain how the Global Value Chain structure of COMAC in the development of C 919 so that patterns of coordination of relations between COMAC and the Supplier Industry could be identified including the level of intensity of the government's role.

Meanwhile, Gereffi, G et.al (2005) divide the structure of the Global Value Chain into five types, namely: Hierarchy, Captive, Relational, Modular dan Market. They identify three variables that play a large role in determining the structure of the Global Value Chain. They are consist of the complexity of information the production of a good or service requires (design and process); the ability to codify or systematize the transfer of knowledge along the chain; and the capabilities of existing suppliers to produce efficiently and reliably.

According to Gereffi, GVC with typology of hierarchy need more support from government involvement compared the fourth others. But Gereffi et al have not explained how the intensity and form of government support in the development of the aircraft industry. The gap tried to be answered by Muzakir, M.A.I. dkk (2015) through his study as mentioned above.

Muzakir, M.A.I. dkk (2015) founded that intensity government support needed in developing national aircraft industry is very high and in the form of policy harmonization between national and sectoral level which is strengthened by high political commitment for long term.

Furthermore, Muzakir explained that the GVC typology of aircraft which is effective for aircraft technology upgrade is not completely hierarchical since actually lead firm codifiability and supplier competence in complying with the lead firm requirements are very high. But, Muzakir did not yet explained how the government role in the triple helix model for developing aircraft industry in the GVC with typology of hierarchy. Whereas as explained earlier that the development of the aircraft industry

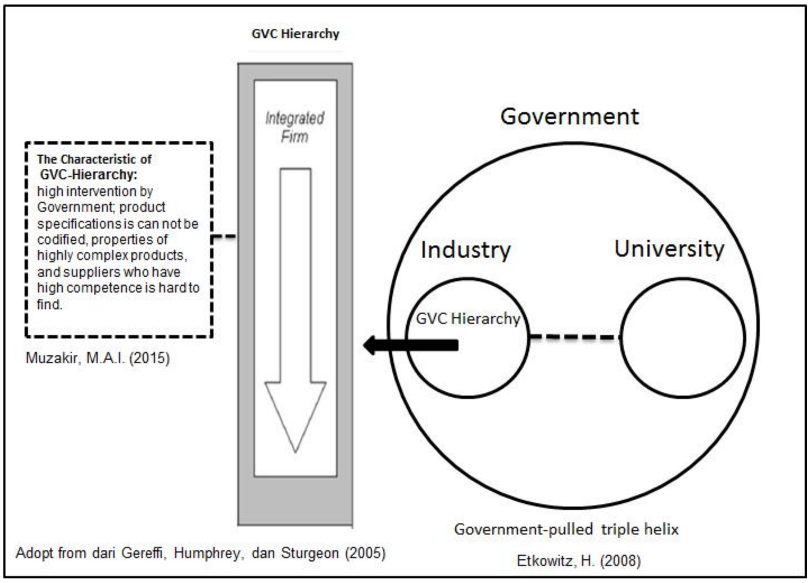


Figure 2: Conceptual framework for Government-Pulled triple helix for supporting the development of the national aircraft industry in the global value chain with typology of hierarchy.

in the global market requires effective collaboration amongst ABG (Etkowitz, H., 2008). Therefore, this study is directed to fill the space gap left by Etkowitz, H. (2008), Gereffi, Humphrey & Sturgeon (2005) and Muzakir, M.A.I.dkk (2015) namely reconstructing the model I of triple helix in encouraging the development of the aircraft industry with GVC with typology of hierarchy (Figure 1). Finally, the main focus of this research is to design a government-pulled triple helix for supporting the development of the national aircraft industry in the global value chain with typology of hierarchy (Figure 2).

B. METHODE

This research has some characteristics both referring to factual problematic and conceptual problematic issues. The first characteristic is related to complexity and messy problem situation in collaboration based on model I triple helix in supporting aircraft upgrade through technology development capability of GVC with typology of hierarchy.

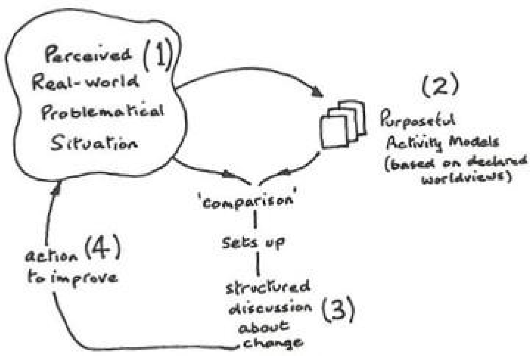


Figure 3: The iconic representation of SSM's learning cycle (Checkland, P., Poulter, 2006).

Second, this study focuses on Human Activities System (HAS) which is many of conflicting worldviews between actors (Checkland, 1999; Hardjosoekarto, 2013). It is seemed in the implementation of collaboration among triple helix actors in supporting aircraft technology development.

Based on those characteristics, Soft Systems Methodology (SSM) will be used to design the triple helix model in supporting aircraft industries with a hierarchical typology.

SSM is consisting of four steps as learning cycle, namely: (1) finding out about the initial situation which is seen as problematical, (2) model building, it includes two steps namely: formulating root definitions (RD) meeting the CATWOE requirements and defining conceptual model. A root definition expresses the core transformation that would be “a system to do P by Q in order to achieve R”. (3) Discussing or Comparative analysis of the conceptual model through debating with the theory or the best practice of countries in supporting aircraft industry through triple helix model, (4) Define/take the action to improve the situation (Checkland, P., Poulter, 2006; Westcombe, 2017) for doing this research, the four steps above is added with data collecting technique for each (Table 1).

Table 1: Data collecting technique

Step	Data collecting technique
1	Review of documents, interviews with stakeholders, review of related focused group discussion (FGD) for digging factual problems of application of model I triple helix in the perspective of policy process as hierarchy Bromley (1989)
2	-Review of documents, interviews to identify the transformation that is required at model I triple helix (Etkowitz, H., 2008). -Informal discussion, interview, and assessing documents to draw up a conceptual model in the context of the transformation that is required at at model I triple helix (Etkowitz, H., 2008).
3-4	Informal Discussion, Interview, Assessing of FGD related the comparison between the conceptual model with the theory / concept, or with the best practice of other countries in supporting aircraft industry through triple helix model

Finding Out

On this step identified the situation both the social and political aspects. In addition defining research questions, namely: How does the design of model I triple helix to encourage the air craft industry with typology of hierarchy

Model Building

In this stages produced Root Definition, namely:

The system is owned and operated by researchers in order to use the framework of model I triple helix to support the air craft industry with typology of hierarchy (P) through research-based action research interest SSM (Q) to guarante the framework of model I triple helix in supporting the independence of national aircraft industry (R).

CATWOE especially transformation is monitored by three independent criterias: 1. Efficacy - to judge if T is actually working and producing its intended consequences; 2. Efficiency – T is being achieved with the minimum of resources; and 3. Effectiveness whether the transformation is strategically aligned to the higher purpose.

Root definition as mentioned above will be used to design conceptual model shown in figure 4. It controlled by *CATWOE* (see table.2).

Table 2: CATWOE (Controller for RD)

Code	Description
C: Customer ***the victims or beneficiaries of "T"***	Researchers team, PT DI, PT Region Aviation Industry (RAI), Analum, Government (MoRTHE, MoESA, MoI, MoSOE, BAPPENAS, MoF, MoI, BPPT, LAPAN) and Academia (Institute Technology of Bandung)
A: Actor: ***who would do T***	Researchers team
T: Transformatin ***the convertion of input to output***	To reconstruct model I triple helix to encourage the air craft industry with typology of hierarchy
W: Weltanschauung ***the worldview which makes this 'T" meeaningfull***	The government support for upgrading technology of aircraft through technology development capabiity are key success factor aircraft industry
O: Owner ***who could stop T***	Researchers team
E: Environmental Constraints	Budget and time are limited

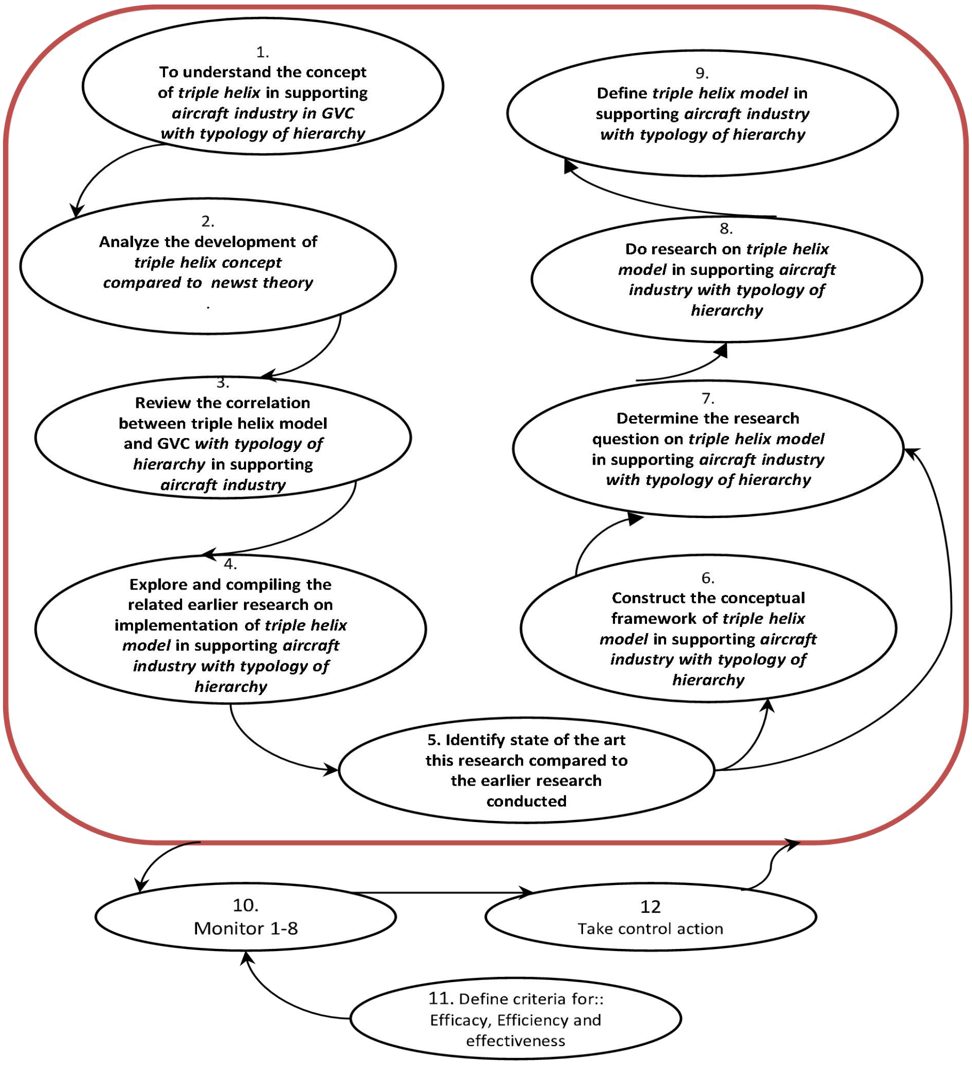


Figure 4: Conceptual Model of Reconstructing Government-Pulled triple helix in Promoting technology upgrade of Global Value Chain with a Hierarchical Typology of Indonesia Aircraft Industry

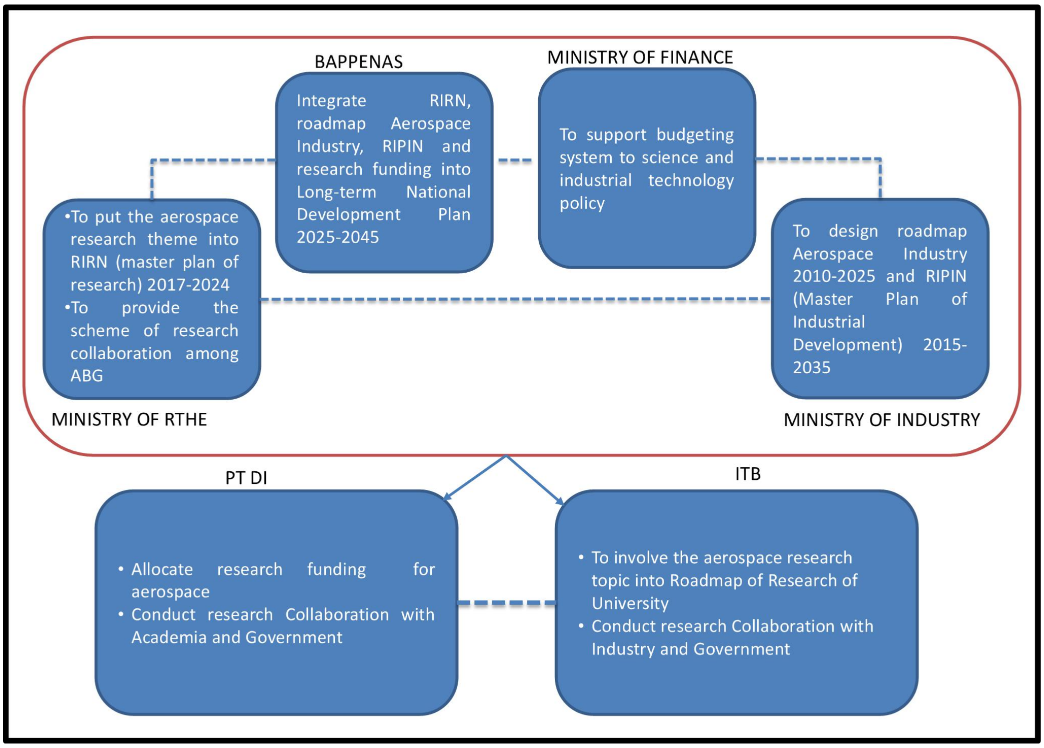
DEBATING AND FINDING

Based on the conceptual model which designed, further conducted the debating process whether through FGD, interviews or by comparing with the results of previous studies, especially in the national context. In the last, conceptual model obtains three main inputs as follows:

Through focused group discussion (FGD) conducted by MoRTHD at Hotel Santika BSD, on Friday, july 30, 2018 and interview with the Expert of Experimental Aerodynamic- BPPT, Anton Adibroto, dated october 29-30, 2018 concluded that the problem of government pulled triple helix for the development of the national aircraft industry can be classified into five aspects, namely: policy sustainability, infrastructure, supporting industries, financing, and human resources of aerospace.

This findings confirm some previous studies, especially the study of Steenhuis and Bruijn (2004), Vertesy & Szirmai (2010) and finally Muzakir, M.A.I (2015) that development of aircraft industry should be supported through policy harmonization amongst macro, meso and micro / operational level. The concept is in line with the concept of Bromley's policy of Bromley's policy process as

Figure 5 Government Pulled Triple Helix Model in Designing Macro Policy



hierarchy (1985). In the model of its public policy process, Bromley divided the hierarchy level of the public policy process into three different levels, namely: policy level, organizational level, and operational level. Therefore, the government pulled triple helix model is directed to strengthen these four aspects, namely: macro policy, strengthening infrastructure, financing, supporting industries and aerospace human resources.

Government Pulled Triple Helix Model for Designing Macro Policy

Government pulled triple helix model for attaining the support of macro policy as effective for aircraft national development described on model as follow.The composition of actors in the government pulled triple helix model for designing macro policy are consisting of the six spheres, four of them are representative of government and two others are representative of industry and university (Figure 5).

The government actors are consisting of Ministry of National Development Planning (BAPPENAS), Ministry of Finance (MoF), Ministry of Industry (MoI), and Ministry of Research, Technology and Higher Education (MoRTHE). The role of MoRTHE is to put the aerospace research theme into RIRN (master plan of research) 2017-2024 and to provide the scheme of research collaboration among ABG. MoI design roadmap Aerospace Industry 2010-2025 and RIPIN (Master Plan of Industrial Development) 2015-2035. BAPPENAS do integrate amongst RIRN, roadmap Aerospace Industry, and RIPIN. In addition, putting aerospace direction into Long-term National Development Plan 2025-2045.

Finally, MoF support budgeting system to science and industrial technology policy. The role of PT DI as representative of Industry is allocate research funding for aerospace and conduct research collaboration with Academia and Government. In addition, the role of Institute of Technology Bandung is to involve the aerospace research topic into roadmap of research of university and

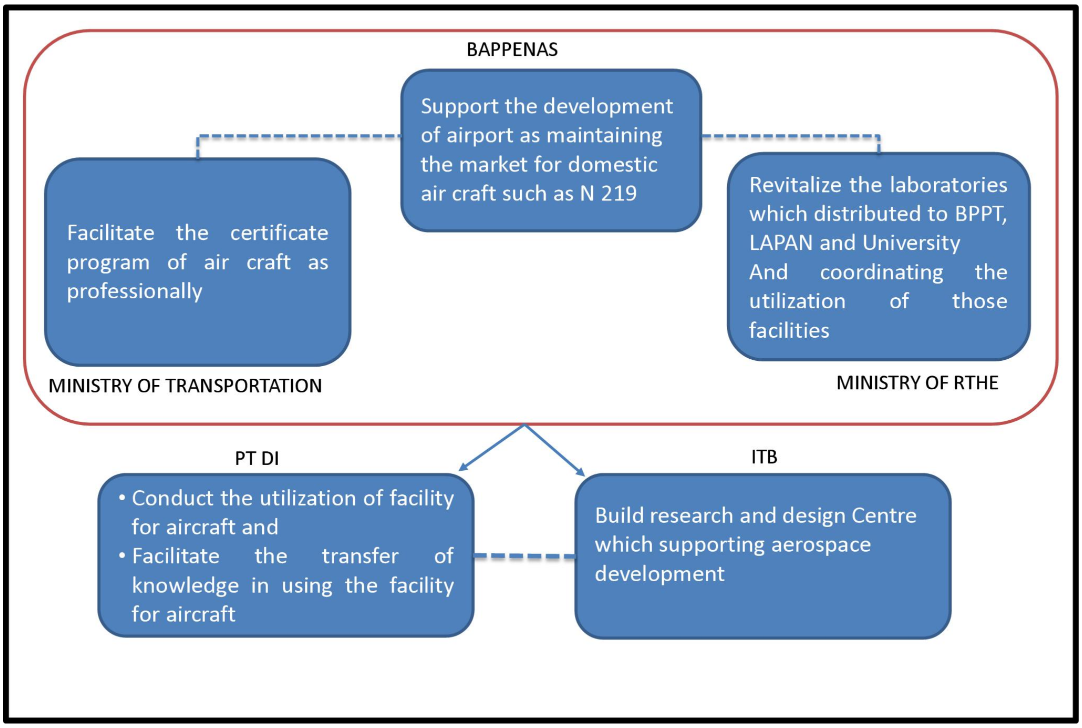


Figure 6 Government Pulled Triple Helix Model for Revitilizing Test laboratories

conduct research collaboration with Industry and Government Design of government pulled triple helix for revitilizing test laboratories for aircraft national development as described in figure 6. are consisting of five spheres, three are representative of government and two others are representative of industry and university (Figure 5).

The three government actors are Ministry of National Development Planning (BAPPENAS), Ministry of Transportation (MoT) and MoRTHE. MoRTHE revitalize the laboratories which distributed to BPPT, LAPAN and University and also do coordinating the utilization of those facilities. MoT facilitate the certificate program of air craft as professionally. BAPPENAS support the development of airport as maintaining the market for domestic air craft such as N 219.

The role of PT DI as representative of Industry is to conduct the utilization of facility for aircraft and facilitate the transfer of knowledge in using the facility for aircraft. In addition, the role of ITB is to build research and design Centre which supporting aerospace development.

Government Pulled Triple Helix Model in designing Aircraft Financing Policy

The government actors are consisting of BAPPENAS, MoRTHE, Ministry of State Own Enterprise (MoSOE) and MoF (Figure 7). MoRTHE allocate budget of research on aircraft financing model through grant of research. BAPPENAS endorse to release the financing policy or leasing for aircraft as mandatory of act no.15/1995 on Aerospace. MoE release the financing or leasing scheme for aircraft. MoSOE get the financing resources of capital market and release the financing scheme or leasing for aircraft.

Moreover, the role of PT DI is to conduct collaboration with international partners especially with bank of mid east for attaining the financing aid. In addition, the role of ITB is to study on financing model for aircraft industry.

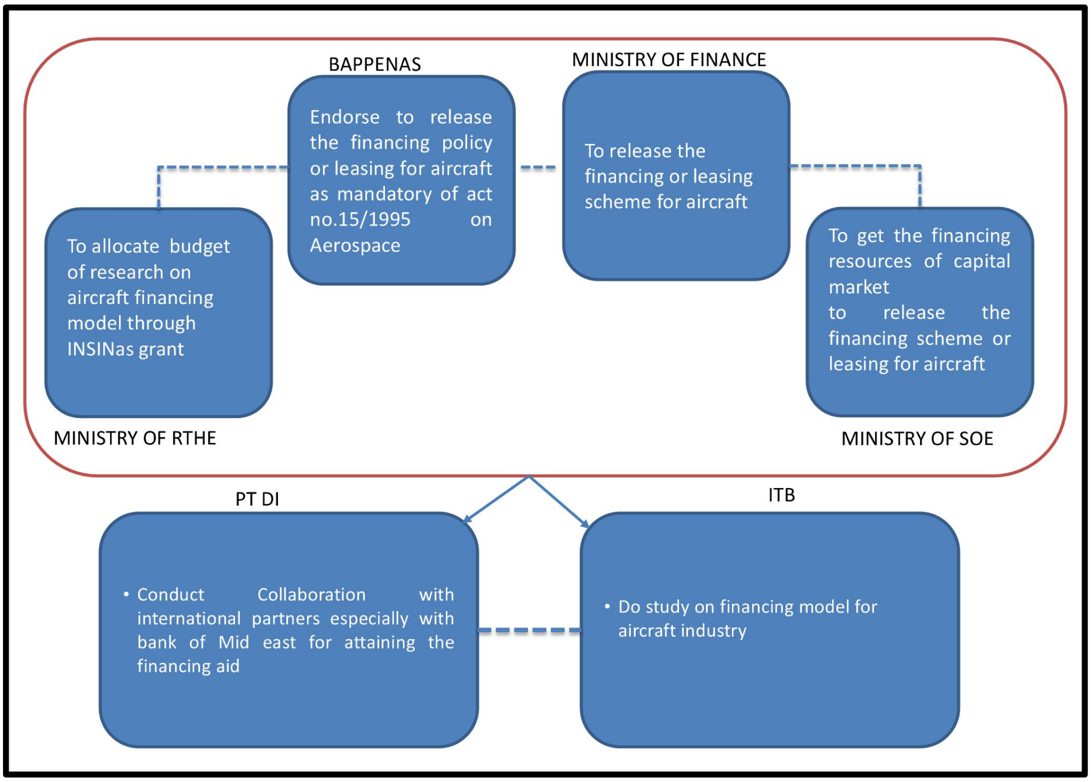


Figure 7 Government Pulled Triple Helix Model in designing Aircraft Financing Policy

Government Pulled Triple Helix Model for empowering Supporting Industry

The government actors are consisting of MoI and MoSOE (Figure 8). MoI coordinate technological concealing for small -medium sized supplier component and parts as well as to build industrial cluster for aerospace industry especially basic chemical and basicmetal industry. Furthermore, MoSOE endorse State owned Enterprise PT ANALUM (Indonesia Alloy Sharpening Industry) to build chemical and basic metal industry.

The role of PT DI is to empower relation with aircraft industry association and give technical coaching/mentoring to small/medium industry. In addition, the role of ITB is to design curriculum for supporting aircraft industry development and to conduct the immersion program with aircraft industry either domestic or international.

Government Pulled Triple Helix Model for empowering Human Resources

The government actors are consisting of MoRTHE and Ministry for Empowerment of State Apparatus and Bureaucracy Reform (MoESA) (Figure 9). MoRTHE design scholarship or non scholarship program for improving aerospace human resource and give permit for industrial expert without having Master/Doctor’s degree for becoming lecture at university. MoESA coordinate for releasing a regulation on supporting mobilization of researcher into industry

The role of PT DI as representative of Industry is design exchange program and join research with university and/aircraft industry and give technical coaching and mentoring for small -medium sized supplier component and parts

Furthermore, the role of ITB is to design exchange program, immersion program and join research with university and/aircraft industry

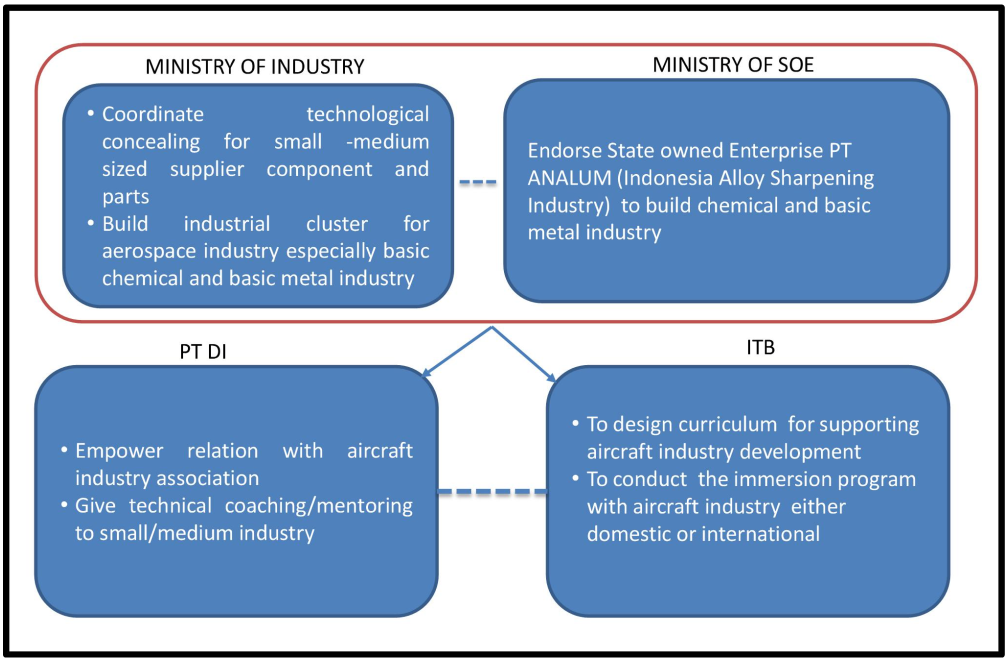


Figure 8 Government Pulled Triple Helix Model for empowering Supporting Industry

C. CONCLUSION

Based on the results of the research conducted, Government Pulled Triple Helix Model for development aircraft industry in the Global value chain of Aircraft Industry with typology of hierarchy directed to design Macro Policy, revitalize test laboratories, strengthen aircraft financing policy, building supporting Industries and empower aerospace human resources.

Government Pulled Triple Helix Model for attaining the support of macro policy as effective for aircraft national development are consisting of the six spheres where four are representative of government and two others are representative of industry and university.

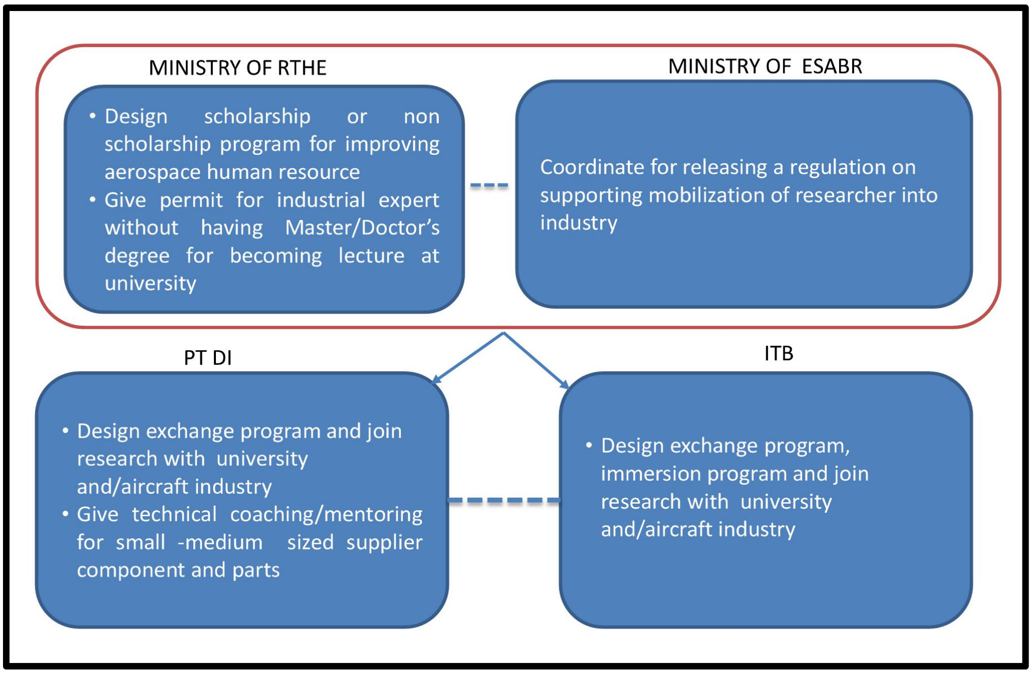


Figure 9 Government Pulled Triple Helix Model for empowering Human Resources

Design of government pulled triple helix for revitilizing test laboratories for aircraft national development are consisting of the five spheres where three are representative for government and two others are representative of industry and university.

Government Pulled Triple Helix Model for strengthening aircraft financing policy are consisting of BAPPENAS, MoRTHE, Ministry of State Own Enterprise (MoSOE) and MoF and two others are ITB and PT DI..

Government Pulled Triple Helix Model for building supporting Industries are consisting of MoI and MoSOE, ITB and PT DI. Finally, Government Pulled Triple Helix Model for empowering aerospace human resources are consisting of MoRTHE and Ministry for Empowerment of State Apparatus and Bureaucracy Reform (MoESA), ITB and PT DI.

Conceptually, the government pulled triple helix model has overlapping role played by ABG in the development of the aircraft industry. On the contrary, according to Etkowitz, H. (2008) role overlapping only occurs in university pushed triple helix model. The configuration of actor G (government) needed in the development of the national aircraft industry is not generic but it based on specific context.

In aircraft development, especially for strengthening the aerospace industry cluster, the role of actor beyond ABG namely the association is also important. In the Global value chain of Aircraft Industry with typology of hierarchy, in addition to the need for high and long-term government support, as a leadfirm, PT DI is required to be able to build networks with industry partners, domestic and foreign research institutions as well as aircraft component industry associations.

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