Policy Process As Hierarchy For Supporting Technology Upgrade of National Aircraft (Lessons of The Failure of N 250 Aircraft Program-Indonesia Aircraft Industry (IPTN))

M. Athar Ismail Muzakir[1], Martani Huseini[2], Sudarsono Hardjosoekarto[3]
{muhammad.riptek@gmail.com[1], martani0703@yahoo.com[2] , sudarsono.h@ui.ac.id[3]}

Department of Administration Science, Universitas Islam Syekh Yusuf, Tangerang, Indonesia[1], Departement of Administration Science, Universitas Indonesia[2], Department of Sociology, Universitas Indonesia[3]

Abstract. This study reconstructs the framework of policy process as hierarchy for supporting technology upgradeof Aircraft which developed through technology development capability. By employing Soft Systems Methodology (SSM), this research result shows that combination between the framework of policy process as hierarchy and Global Value Chain (GVC) with typology of hierarchy includes: firstly, the relations between the three levels in theframework of policy process as hierarchy, particularly between policy level and organization level is not completely hierarchical and linear. In reality, each of the two levels sends feedback, especially in the participatory process of designing of National Development Planning. Secondly, political support from the government is also required. Thirdly, Indonesian Aerospace (IPTN/PT DI) should also strengthen product codification, production, marketing and networking with both national and international partners. The fourth finding is that in development of N 250, the relation is not completely hierarchical since active and long-term government intervention should be counterbalanced by codifiabilityand supplier competence to meet the requirements of the lead firm. The Government and Industry will obtain lesson learnt on how the strategy for supporting the aircrafts manufactured through technology development such as program of N 219 or R 80 which developed at present.

Keywords: policy process as hierarchy, technology upgrade, soft systems methodology.

1 Introduction

Since the reformation era until now, policy support, viewed from the perspective of policy process as hierarchy (Bromley, 1989) is relatively weak compared to the period of the New Order [1].

WMA-1 2018, January 20-21, Indonesia

DOI 10.4108/eai.20-1-2018.2281905

At the level of national policy, both in the Law of The Republic of Indonesia Number 17 of 2007 on the National Long Term Development Plan (RPJPN) 2005-2025 and Presidential Regulation No. 2 of2015 on the National Medium-Term Development Plan (RPJMN) 2015-2019, the policy direction of aerospace development has not been explicitly stated and prioritized. Whereas, as stated in Law of The Republic of IndonesiaNo. 25 of2004 on National Development Planning System, that the inclusion of policy direction on aerospace in RPJPN and RPJMN is a guarantee forthe sustainability of aerospace programs in national development. Especially considering that the development of the aircraft industry requires government commitment for long term, both in terms of funding and political.

At sectoral level, policy support for aerospace technology development is still very limited. The science and technology developmentplan (JakstranasIptek) 2015-2019 or National Research Agenda (ARN) 2015-2019 are not explicitly aimed at supporting of the development of aerospace sector. Even, until now, some testing labs facilities for a national program of N 219 or R 80 are not currently available, namely: Drop Test, Flight Simulator Engineering (EFS), Composite Test, Runway test, and Telemetry System.

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. 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, 2015b, a). All the more, 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 [2],[3],[4],[5].

In addition, the existing of research fund such as research grant (insentif riset SIN as) and research grant for higher education under coordinated byThe Ministries of Research, Technology, and Higher Education Republic of Indonesia (MoRTHE), The Indonesia Endowment Fund for Education (*Lembaga Pengelola Dana Pendidikan*, LPDP) which organized by Ministry of Finance (MoF) and Indonesia Science Fund (Dana Ilmu Pengetahuan Indonesia, DIPI) under the auspices of the Indonesian Academy of Sciences (AIPI) did not synergy among them to stimulate the aerospace research development.At the industry level, financial condition of PT DI still weak till now.

In 2013, PT DI allocated research fund is only about 1% of the total turnover (3 Trillion Rupiah) which is about 30 Billion rupiah (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 [6].

Need of engineers for upgrading N -250 to R-80 is about 1.000 people, or approximately 2 million man hours. Meanwhile, in the next 3-4 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.

A numerous policy studies on encouraging the development of the aerospace sector have been done by some researchers, including research ofJones (1999) on the WACO Aircraft Industry over the period 1919-1963. In that study, it was concluded that the role of

government in promoting aerospace industry research activities even became the first market of aircraft industry was a key determinant factor in the success of WACO Aircraft Industry.

A comparative study of Franzis and Alex (2006) on Airbus and Boeing Industry concluded that some kind of government assistance for the aircraft industry namely: research and development funding, funding or facilitation of the construction process [8] human resources supporting, marketing, security assistance of sales contract from abroad etc. In addition, they stressed that industrial policy for the aircraft industry should be long term.

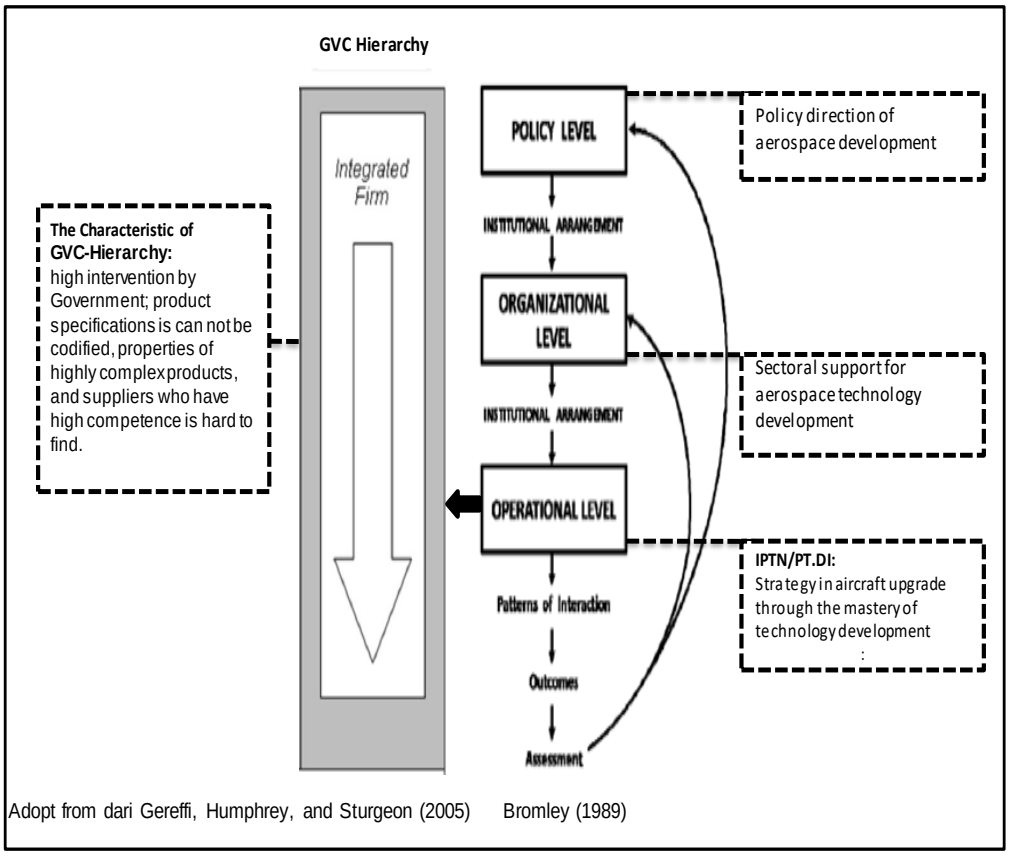

Fig. 1. Theoretical framework for Global Value Chain with typology of hierarchy and the policy process as hierarchy study

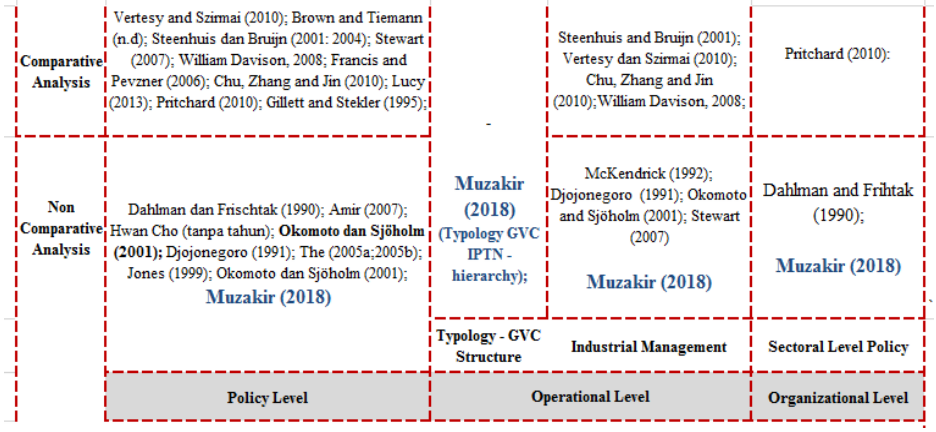

Fig. 2. Map of the previous research on upgrading technology of aircraft and research contribution.

Research of Stewart (2007) on China's Industrial Subsidies Study: [9] High Technology, reported that the policy direction of aircraft Industry expressly stated well whether in a master plan for National Economic Development Plan (2006-2010) and also in the guideline for the long-term Technology Development Plan (2006-2020). In addition, they inferred that China's economic policies that encourage manufacturing of aircraft product is cross-industry subsidies for the High Tech Industry.

Pritchard (2010) examined on a number of aircraft industry namely Boeing industry of US, the Airbus industry of UE, Bombardier industry of Canada, United Aircraft Corporation (UAC) of Russia, COMAC industry of China, Embraer Industry of Brazil, Mexico Aircraft Industry and the Alenia Aeronautic Company of Italy [10]. The results of this study explained that government support either directly or indirectly is very important for the aircraft industry, especially when they launched new aircraft on the market. However, except Brazil, these studies are very less describe in detail how the shape of the government's role in each of these countries.

Research of Brown (no date) in their research on Air Bus Industry, concluded that government support is success factor of Airbus. In addition to subsidies, other government support is political will, especially penetration strategies in global markets [11].

In 2013, Suijun (Lucy) Yi done study on A Boeing Strategy to Shape a Competitive Advantage: A Phenomenological Study on Boeing Industries, recommended that Boeing should strengthen cooperation in technological innovation, especially with the US Government [12].

A study of Steenhuis and De Bruijn (2001) on *Developing countries and the aircraft industry: match or mismatch*?recommends that the national government support in commercialization of aircraft is very important [13]. In this study, they found that in the case of Avic Aircraft Industry- China, despite of the international markets is still failing, but the government of China encourages the use of aircraft for its domestic market.

Similar result was found in a study done by Vertesy and Szirmai (2010), mentioned that the lack of government supporting was a key factor the failure of some aircraft industry such as FAMA Aircraft Industry- Argentine, Romaero_Rumania and IPTN-Indonesia [14]. Moreover, they also found that the success of Embraer Brazil is because the government supporting is very high. Further, they said that even in the 1980s Embraer faced with the

economic crisis, but the Brazilian government kept to support to the company. After passing a critical period during 1990-1993, finally in 1994, Embraer back make profit. In addition, they also found that another success factor of Embraer especially for Embraer ERJ-145 aircraft was the policy of the Brazilian government which known as Programa de FinanciamentoàsExportações (ProEx). The policy give incentives for reduction of about 3.5% interest on loan for overseas buyer. According to Wall (2013), the policy of ProEx had been enforced since June 1991 [15]. Although in 1999-2000, the policy was considered illegal and eventually stopped by Word Trade Organization [16].

Based on numerous studies described above indicate that the key success factor in upgrading aircraft was not enough to rely solely on the ability of the industry level alone such as upgrading capability or codifiability of aircraft product etc. Even largely determined by harmonization of all level policies, namely policy level, organizational level and operational level or industrial management.

Figure 2 shows that the previous research on technology upgrading of aircraft only focused on separated analysis of the three level of policy process. Either, those research did not cover the combination between the framework of policy process as hierarchy and GVC. This research will full fill that gap (shown in blue colour), in addition it also enhanced with the comparative analysis especially with Embraer Brazil.

In the concept of policy, the relationship among the level of the policy is known as policy process as hierarchy concept as described by Bromley (1989). Moreover, the upgrading capability or codifiability of product is part of GVC concept as described by Gereffi, Humphrey and Sturgeon (2005); Staritz and Morris (2013); Gereffi (2012) and Kaplinsky and Morris (2000) [20]. As far as the literature review, policy studies on upgrading aircraft technology, especially integrating the concept of GVC and the policy process as hierarchy is not yet found [17],[18],[19].

However, on one hand, the classification of Aircraft Industry as GVC with typology of hierarchy is based on aspects of high intensity of government support which explained [17]. Though, on an other hand, Gereffi et.al (2005) also said that codifiabilility is character which not attached to typology of Hierarchy. But it attached to the three others of typology of GVC namely: market, modular and captive. This shows that the structure of the GVC determined not only by the level of coordination between the firm with suppliers but also because the combination with aspects of the government support level is needed.

The theoretical framework that integrating the concept of upgrading in Global Value Chain with typology of hierarchy and the policy process as hierarchy described in figure 1.

The situation problematical of policies for supporting aircraft upgrade through the mastery of technology development capabilities in Indonesia with reference to the failure program aircraft N 250 is placed on the conceptual framework that combines policy process as hierarchy (Bromley, 1989) and the GVC with typology of Hierarchy (Gereffi, Humphrey and Sturgeon, 2005) and use to improve the situation problematical faced as well as lessons learned for program of upgrading technologies that are currently being or will be taken by the government and industries, such as program of N 219, CN 235 and R-80.

2 Method

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 supporting aircraft upgrade through technology development capability of GVC with typology of hierarchy.

Second, this study focuses on Human Activities System (HAS) which is many of conflicting worldviews between actors [21],[22],[23],[24]. It is seemed in the policy process of aircraft upgrade through technology development that need support not only from various sectoral actors with different perspective, but also it needed political will for long term.

Based on those characteristics, Soft Systems Methodology will be used to reconstruct the policy conceptin supporting aircraft technology upgrade in aircraft industries with a hierarchical typology.

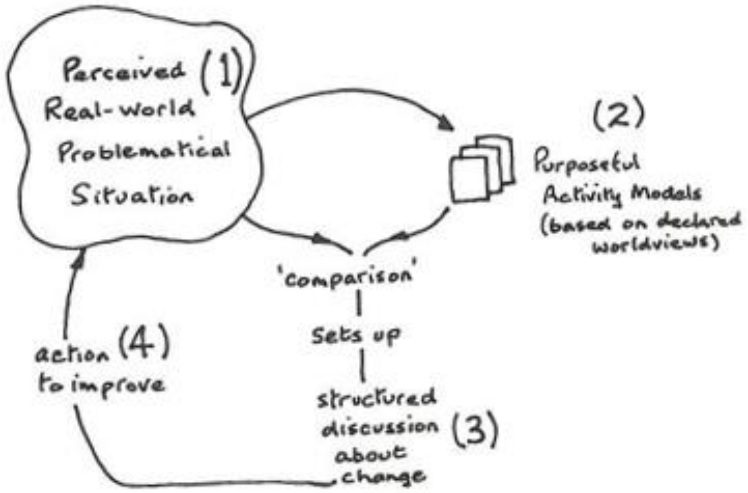

Fig. 3. The iconic representation of SSM's learning cycle. (Checkland and Poulter, 2006)

In order to achieve those transformations, Softs Systems Methodology (SSM) included four steps as learning cycle: (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 requirementsand 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 Embraer Brazil, (4) Define/take the action to improve the situation [24],[25].

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 both, problem of technology upgrading process of aircraft which produced

	by IPTN such as NC 212; CN 235 and N 250 and problems in the perspective of policy process as hierarchy Bromley (1989)
2	-Review of documents, interviews to identify the transformation that is required at each level of policy process as hierarchy Bromley (1989). -Informal discussion, interview, and assessing documents to draw up a conceptual model in the context of the transformation that is required at each level of policy process as hierarchy Bromley (1989)
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 such Embraer Brazil

The data collection of the both interviewing and discussing or FGD for all steps of SSM accessible completely in Muzakir, M.A.I. (2015b) page. 306-322.

2.1 Finding Out

On this step identifiedthe situation both the social and political aspects. In addition defining research questions, namely:

How does the concept of the policy process as hierarchy (Bromley, 1989) to encourage technological upgrading through the mastery of technology development capabilities in the global value chain - PT DI with reffering to the failure of N 250 as lesson learnt for next similar program such program of N 219 or R-80?

2.2 Model Building

In this stages produced Root Definition, namely: The system is owned and operated by researchers in order to use the the framework of policy process as hierarchy for supporting technology upgrade of aircraft through the mastery of technology development in the Global Value Chains with typology of hierarchy PT DI with reffering to the failure of N 250 as lesson learnt for next similar program such program of N 219 or N 245 or R-80 (P) through research-based action research interest SSM (Q) to guarante the framework of policy 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, Aircraft Industry, Government and Academia

A: Actor: *who would do T*	Researchers team
T: Transformation *the convertion of input to output*	Reconstructing the framework of policy process as hierarchy for supporting technology upgrade of aircraft through the mastery of technology development in the Global Value Chains with typology of hierarchy PT DI with reffering to the failure of N 250 as lesson learnt for next similar program such program of N 219 or R-80?
W: Weltanschaung/ *the worldview which makes this 'T" meeaningfull*	The policy 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

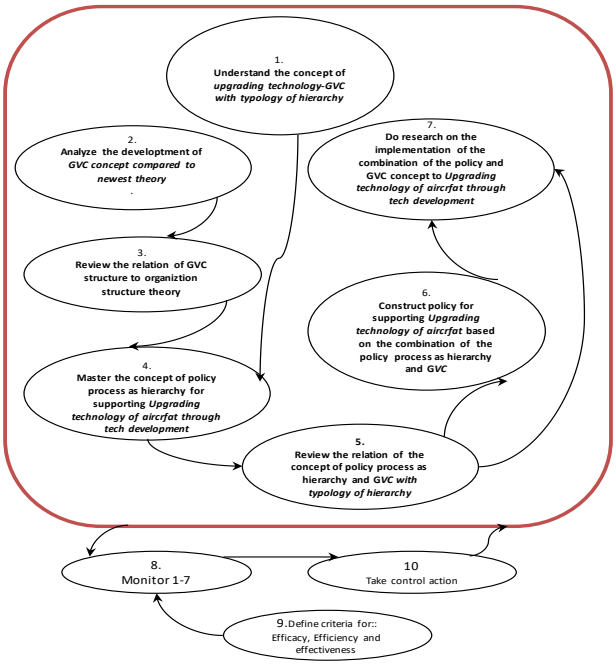

Fig. 4. Conceptual Model of Reconstructing a concept of Policy Process in Promoting technology upgrade of Global Value Chain with a Hierarchical Typology of Indonesia Aircraft Industry.

2.3 Discussing/Debating

In this step, the conceptual model shown in figure 4 will be debated with some relevan theory and/or with best practice of aircraft industries, especially Embraer of Brazil.

Taking Embraer as benchmarks in this study, due to some reasons: firstly, both IPTN and Embraer are companies founded on initiation and owned by the state, although finally in 1994,

Embraer was privatized [14],[26]. Secondly, the upgrading stage of the plane taken by Embraer is also the same as IPTN that is from the license, joint venture till technology development [27]. Thirdly, Embraer EMB-120 and ERJ 145 are respectively on the same class with CN 235/N 250 and N 2130. In addition, the development of EMB 120 just two years before of development of N 250.

This step done for acquiring any improvement or changes which are both desirable and feasible for each activity of conceptualmodel. Finally, the final conceptual model that consists of ten activities as described in figure 4will be defined for doing the transformation as stated above.

3 Results/Definig The Action

There are four research findings of combination between the framework of policy process as hierarchy and GVC with typology of hierarchy for supporting upgrading technology as shown in figure 5. It includes conceptual finding and problem solving recommendations namely: firstly, after the assessment, the relations between the the three levels in the framework of policy process, particularly between policy level and organization level is not completely hierarchical and linear. In reality, each of the two levels sends feedback, especially in the technocratic process and/or participatory process of the national development planning which are both RPJPN and RPJMN.

Secondly, in addition to support at the level of regulation in national development, political support from the government is also required. This finding actually supports the conclusion pointed out by (Grindle, 1980) which stated that political force of the program implementers will lead to the success of a program [28]. Thirdly, it is found that improvement is not only required at the policy and organization levels, but also at the operational or industrial level. The fourth finding is that in the GVC of IPTN, especially in the development of N 250, the relation was not completely hierarchical since active and long-term government intervention should be counterbalanced by codifiability and supplier competence to meet the requirements of the lead firm. This finding also criticizes the theory proposed by Gereffi, Humphrey and Sturgeon (2005) about two criteria of GVC with a hierarchical typology, namely the lack of codifiability and low level of supplier competence. In the context of upgrading aircraft through technology development, the lead firm codifiability and supplier competence are very high [17].

Compared to Embraer-Brazil, especially when they were developing EMB 120 aircraft, it is known that: first, like IPTN, Embraer-Brazil also gained much support from the government through the inclusion of aerospace policy directives in the national development plan [29]. Nevertheless, unlike IPTN, in addition to government support, Embraer-Brazil also had generous fiscal support from funding institutions for science and technology such as FINEP (Agency for Financing Studies and Projects), Pro Ex (Programa de FinanciamentoàsExportações), The Special Sectariat for Science and Technology (Pritchard 2010, Vertesy and Szirmai 2010, Dahlmanand Frischtak, 1990), and The Brazilian Development Bank-BNDES [30],[31]. The considerable support made Embraer very successful both nationally and internationally.

Secondly, IPTN and Embraer share similar stages in upgrading aircraft technology, from developing under license aircrafts, turboprop aircrafts, until jet aircrafts. However, what

distinguishes the two companies are: first, both EMB 110 and EMB 120 aircrafts as well as ERJ 145 jet aircraft only played at class 19 sheeters until below 50 sheeters [32].

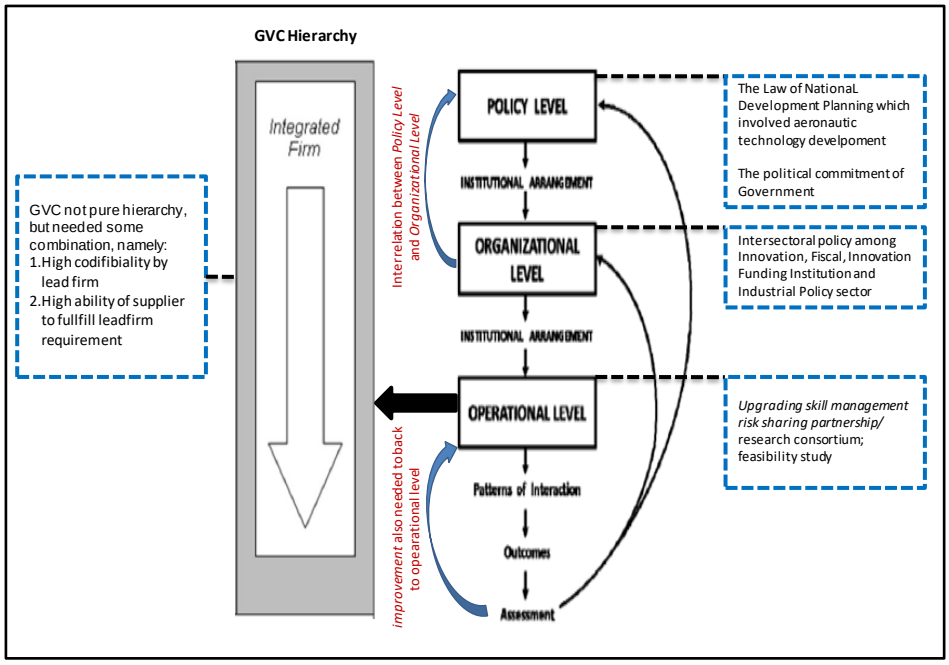

Fig. 5. Result of reconstructinga concept of Policy Process in Promoting technology upgrade of Global Value Chain with a Hierarchical Typology of Indonesia Aircraft Industry.

On the contrary, in the case of IPTN, either NC 212, CN 235 or N250 aircrafts has the capacity of 24 sheeters, 35 sheeters, and 50-70 sheeters respectively. Second, in terms of product differentiation, Embraer did not rush to use advanced technology such as fly by wire (fbw) even in ERJ 145 aircraft, whereas IPTN had installed fbw technology in N 250 aircraft. Not only the strategy boost the price of the aircrafts, it also made the certification process to be more complicated [14].

In terms of operational capability, IPTN production capacity was regarded very low, within a period of 10 years, since 1987, IPTN only managed to produce no more than 40 units of CN 235 aircraft from the target of 36-40 units per year [33]. One of causes of the low level of productivity was the company's poor management. The management style during that period is considered top-down and single-handed.

Metaphorically speaking, if IPTN was a symphony orchestra, Habibie was the conductor and also the composer. Unfortunately, the management style was not counterbalanced by the sense of responsibility from the board directors [33]. The company's poor management had caused the practice of rent seeking or opportunistic behaviour done by some IPTN employees at that time [34].

Compared to Embraer-Brazil, in 1969, when Embraer started the production of an EMB-110 Bandairente turboprop plane under Italian company licenses, the 19-seater aircraft had been produced 3,983 planes or 265 aircraft per year, mostly for the domestic market. In 1975, Embraer became sole supplier for domestic market needs.

In the period 1985-1999, EMB 120 which has same class with CN 235/ N 250 has been produced about 354 aircraft and successfully obtained the FAA certificate in 1985 and European Certification in 1986. Although EMB 120 aircraft has decreased production due to problems corporate finance which affected by global recession, but the aircraft is quite successful even fulfil a third of the total world class aircraft market.

To make sure that transformation at each level of hierarchical policy process are successful, in the conceptual model that has been arranged before, it will be involved some activities such as following: firstly, in order to incorporate science and technology policy directive into the national development agenda, related sectors such as MoRTHE, The House of Representativesof The Republic of Indonesia (DPR-RI), Ministry of National Development Planning (BAPPENAS), and the President should supporting consensus for incorporating aerospace technology development into both, RPJPN and RPJMN.

In supporting the effort, the MoRTHE should mainstreaming science and technology development, particularly the aerospace sector in the designing proses of national development planning whether through technocratic process and participatory process. In the both process must be supported by National Strategic Policy of Research, Science and Technology (JakstranasIptek) and in National Research Agenda (ARN) which also containing the roadmap of science and technology policy, especially the aerospace sector.

Still in the innovation sector, needed to harmonize among the existing innovation financing institution namely research grant (insentifrisetSINas) and research grant for higher education which coordinated by MoRTHE, LPDP which organized by Ministry of Finance (MoF) and DIPI under coordinated by AIPI. Those research financing institution should be directed as synergy to support for aeronautic technology development.

The model of synergy of those fund in aerospace respectively: Research Grant-InsentifSINas and LPDP for financing research of mastering key technology for aircraft technology. Grant of LPDP also for research of technology policy, governance, and infrastructure procurement. Research fund of DIPI for supporting matching fund that mixing between National Government Budget and International Budget for research of aerospace development especially for national aircraft development.

However, policy support at the level of national regulation is not enough. The success of Embraer Brazil in the period of 1990-1997 was because Government committed to continue to provide assistance even though the company was faced with a financial crisis as an impact of global recession. On the contrary, when IPTN was faced with the economic crisis in 1998, the government cut their political support through the sign of a Letter of Intent (LoI) between Indonesian Government and IMF which was then followed by Presidential Instruction No.3/1998 on the termination of funding support for IPTN, especially for N 250 development program. Ignoring the fact that Indonesian government had spent about USD 650 million on the program. When the program was terminated, N 250 aircraft had 800 flight hours and only required 700 hours more to achieve Federal Aviation Administration –FAA and Joint Aviation Authorities- JAA certification [35],[36],[37].

Secondly, to improve synergetic cooperation among institutions, it is necessary to reestablish synergy among institutions based on the core business of each institution. Synergetic institutional cooperation is not only limited to four major sectors, human resources and infrastructure testing sector, research and innovation sector, industrial sector, and financial/banking sector, but as a national program, it should also be a matter of concern for all sectors such as the Ministry of State Owned Enterprises and the Ministry of Transportation, they should respectively support on the development of air craft industry and facilitating the certification procedures for the aircrafts manufactured by the industry.

In addition, support from Bank of Indonesia or from Financial Service Authority in the commercial endeavor is still badly required, particularly with the issues related to leasing policy and procedure in national banks or export credit grant for overseas purchase. The leasing will aid technology-based industries such as PT DI or IPTN in marketing its products both nationally and internationally. Government regulations on 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 should be realized as soon.

Thirdly, to improve business management especially strategy of technology upgrade of aircraft through technology development, PT DI should include the following activities in the conceptual model: first, PT DI should have professional board of directors who, not only understand technology, but also business management, especially in aerospace industry. Second, PT DI should have competitive market segmentation, particularly in determining aircrafts that fit for airports with unsophisticated infrastructure. Third, PT DI should be able to enhance cooperation through innovation consortia.

Fourth, to boost production capacity, PT DI should improve its marketing and minimize the risk of failure, which can be done by improving its network both with national and international industries through risk sharing partnership. To facilitate the success of business strategy implementation mentioned above, the company should support it by undertaking feasibility studies on the aircrafts to be manufactured.

4 Conclusions

By applying SSM, reconstructing the concept of policy for upgrading technology in GVC (Gereffi, Humphrey and Sturgeon, 2005) through improvement in the three-hierarchical level of policy process (Bromley, 1989) as showed in figure 6 comprise: Firstly, in addition to regulation support of the national development direction, political support from the government is also required. Second, a two-way communication is required between policy level and sectoral level, especially science and technology research sector, in the effort to mainstream aerospace technology development in the national development planning. Third, model reconstruction also demands improvement at operational level. Fourth, a GVC typology of aircraft industry which is effective for aircraft technology upgrade program is not completely hierarchical since lead firm codifiability and supplier competence in complying with the lead firm requirements are very high. Conceptually, there are two findings, first, the relations between the three levels of policy process, particularly between policy level and organization level is not completely hierarchical and linear. In actuality, each of the two levels sends feedback, especially in technocratic and participatory process of both, RPJPN and RPJMN. Second, regarding to the success story of Embraer-Brazil, in addition to support at the level of regulation in national development, political support from the government is also required. It included the government regulations governing the mortgage of aircraft as a guarantee of repayment of debt.

This study recommends in supporting technology upgrade program for the aircrafts manufactured through technology development such as N 219 or R-80 Air Craft Program, besides supporting by policy level in the Law Number 17, 2007 on RPJPN and in Presidential Regulation on RPJMN, Indonesian Aerospace (PT DI) should also strengthen its value chain, especially improving the management system in terms of product codification, production, marketing and networking with both national and international partners.

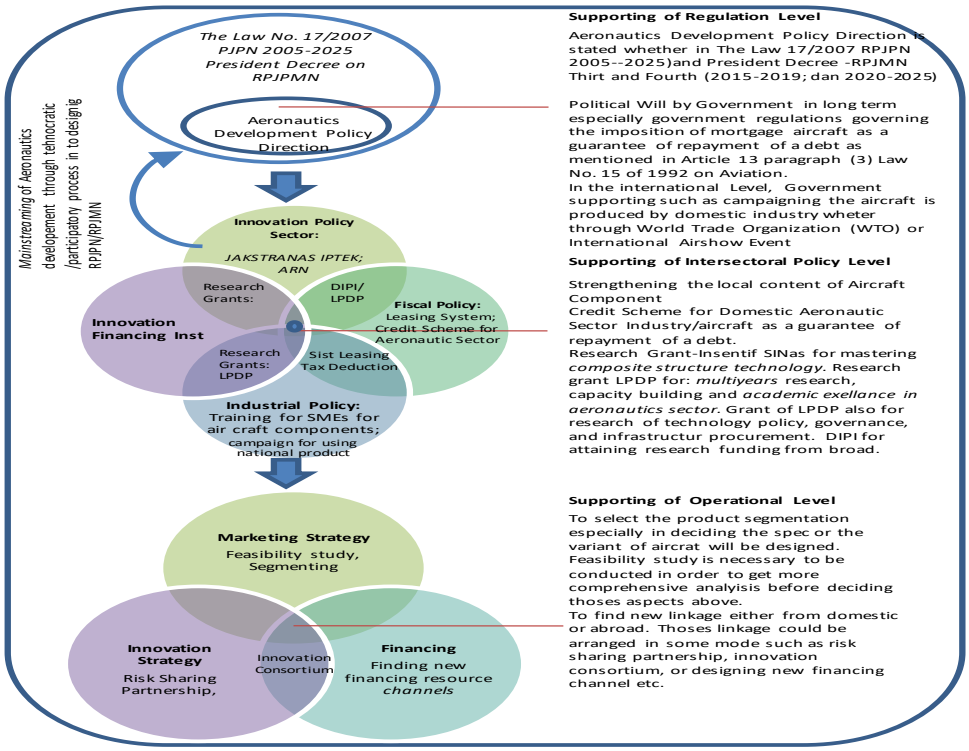

Fig. 6. Model of Policy Process as Hierarchy for Supporting Technology Upgrade Program for The Aircrafts Manufactured through Technology Development such as N 219 Air Craft Program or R-80 which is Upgrading of N 250.

Acknowledgements. We would like to thankThe third President of Republic of Indonesia Prof. B.J. Habibie as our main informant, personally I thank you for your time to be interviewed at your residence-Patra Kuningan. The meeting was very proud and beautiful to me. Once, may God bless you always.The Ministries of Research, Technology and Higher Education Republic of Indonesia for the postgraduates scholarship program, to all IPTN/PT DI officials and ex-officials for the valuable information, Mrs.WidyaHabibie who made my interviewing with The third Prof B.J. Habibie arranged and to all parties who are directly and indirectly involved inwritingthispaper.

References

[1]D. W. Bromley, Economic Interest and Institution: The Conceptual Foundations of Public Policy. New York: Basil Blackwell Inc, 1989.

[2]Muhammad Athar Ismail Muzakir, Proses Kebijakan Sebagai Hierarki dalam Mendorong Upgrading Teknologi pada Global Value Chain-Industri Pesawat Terbang Nasional (Analisis Kegagalan Program Pesawat N 250 IPTN), Phd. thesis. Jakarta Indonesia: FISIP UI, 2015, 2015.

[3]Muhammad Athar Ismail Muzakir, “Belajar dari kegagalan program pesawat N 250,” Media Indonesia, Jakarta Indonesia, 2015.

[4]Muhammad Athar Ismail Muzakir, “Kelangkaan Generasi Dirgantara,” Republika, Jakarta

Indonesia, 2017.
[5]Muhammad Athar Ismail Muzakir, “Sektor Maritim dan Political Will untuk N-219,” Media Indonesia, Indonesia, 2017.
[6]P. RAI, “Pengembangan R 80,” Jakarta Indonesia, 2014.
[7]I. Howard G. Jones, Entrepreneurial Success and Failure in The Aviation Industry: The History of The Waco Aircraft Company, 1919-1963, Phd. thesis. Baltimore, Maryland United States: Bell & Howell Information and Learning Company, 1999.
[8]P. Franzis, G. Jhon and Alex, “Airbus and Boeing: Strengths and Limitations of Strong States,” J. public Int. Aff., vol. 121, no. 4 Winter 2006, pp. 629–651, 2006.
[9]T. P. Stewart, T. Lawyers, and A. Group, “China’s Industrial Subsidies Study: High Technology,” 2007.
[10]D. J. Pritchard, “The launch process for the Bombardier C-Series regional jet : Implications for Canadian Trade and Employment By,” New York. 2010
[11]T. T. Kayleigh Brown, “EU State Aid Policy.”
[12]Suijun (Lucy) Yi, A Boeing Strategy to Shape a Competitive Advantage: a phenomenological study, no. July. United State: Published by ProQuest LLC (2013), 2013.
[13]H. J. Steenhuis and E. J. De Bruijn, “Developing countries and the aircraft industry: Match or mismatch,” Technol. Soc., vol. 23, no. 4, pp. 551–562, 2001.
[14]D. Vertesy and A. Szirmai, “Interrupted Innovation : Innovation System Dynamics in Latecomer Aerospace Industries,” 2010.
[15]S. . Wall, Programa de Financiamento às Exportações: An analysis of Brazil’s PROEX export financing program. 2013.
[16]W. T. Organization, “Brazil – Export Financing Programme for aircraft: Report of The Panel,” 2003.
[17]G. Gereffi, J. Humphrey, and T. Sturgeon, “The governance of global value chains,” Rev. Int. Polit. Econ., vol. 12, no. 1, pp. 78–104, 2005.
[18]C. Staritz and M. Morris, “Local embeddedness , upgrading and skill development : global value chains and foreign direct investment in Lesotho ’ s apparel industry February 2013 Working Paper 20 Keywords :,” no. February, pp. 1–25, 2013.
[19]G. Gereffi, “Latin America’s Prospects for Upgrading in Global Value Chains,” pp. 1–47, 2012.
[20]R. Kaplinsky and M. Morris, “A Handbook for Value Chain Research,” Inst. Dev. Stud. Bright. UK, no. September, pp. 4–7, 2000.
[21]S. Hardjosoekarto, “Dual Imperatives of Action Research : Lessons from Theoretical Research Practice to Construct Social Development Index by Using Soft Systems Methodology,” vol. 3, no. 1, pp. 49–53, 2013.
[22]S. Hardjosoekarto, “Construction of Social Development Index as a Theoretical Research Practice in Action Research by Using Soft Systems Methodology,” Syst. Pract. Action Res., vol. 25, no. 6, pp. 493–509, 2012.
[23]P. and S. Checkland, Soft Systems Methodology in Action. John Wiley & Sons Ltd, 1999.
[24]J. Checkland, P., Poulter, Learning for Action: A Short Definitive Account of Soft Systems Methodology and its use for Practitioners, Teachers, and Students. England: John Wiley & Sons Ltd, 2006.
[25]M. Westcombe, “Soft Systems Methodology,” 2017.
[26]C. J. Dahlman and C. R. Frischtak, “National Systems Supporting Technical Advance in Industry; The Brazilian Experience,” Natl. Innov. Syst., pp. 414–50, 1993.
[27]B. . Habibie, Ilmu Pengetahuan, Teknologi dan Pengembangan Bangsa: menuju dimensi baru pembangunan bangsa. Jakarta Indonesia: Cidesindo, 1995.
[28]M. S. Grindle, Politics and Policy Implementation in the Third World. United Kingdom: Princeton University Press and Princeton New Jersey, 1980.
[29]E. Balbachevsky and A. Botelho, “Science and Innovation policies in Brazil: a framework for the analysis of change and continuity,” in IPSA-ECPR Joint Conference: Whatever Happened to North-South?, 2011.
[30]P. N. Figueiredo, “Extending Sanjaya Lall’s Explanatory Framework: Variability in Micro-level

Innovation Performance, Changing Institutional Frameworks and the Mediating Role of Strategy Embeddedness in an Emerging Economy Context," pp. 1–58, 2011.
[31]L. M. de M. and M. G. P. de M. Michael Kahn, Financing innovation, vol. 194. India: Routledge, 2014.
[32]H. Steenhuis and E. Bruijn, "High technology in developing countries: Analysis of technology strategy, technology transfer, and success factors in the aircraft industry," pp. 1–13, 2004.
[33]Yuwono, Membedah PT Dirgantara Indonesia, antara visi, strategi, harapan, dan kenyataan. Bandung Indonesia: Mitra Prima, 2001.
[34]D. Djamarin, PT IPTN yang saya tahu dan PT DI yang saya harapkan. Bandung Indonesia: Mitra Prima, 2001.
[35]A. Alisyahbana, "Beberapa catatan bagi arah pengembangan Teknologi Transportasi Tepat Butuh Indonesia," Jakarta Indonesia, 2014.
[36]B. . Habibie, "Innovation Lecture Bacharudin Jusuf Habibie: Hari Kebangkitan Teknologi Nasional, 2012," Bandung Indonesia, 2012.
[37]Ishak Rafick, Catatan Hitam Lima Presiden Indonesia: Sebuah Investigasi 1997-2007, Mafia Ekonomi, dan Jalan Baru Membangun Indonesia. Jakarta Indonesia: Ufuk Publishing House: PT Cahaya Insan Suci, 2007.