

CRITERIA AND PROCEDURE OF SEARCH, IDENTIFICATION AND SELECTION OF PRODUCTION TECHNOLOGIES IN SECTOR OF ELECTRONIC SUPPORTING INDUSTRY

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Abstract:

Innovation of technologies for production of components and parts is inevitable needs of enterprises in sector of electronic supporting industry in context of presence of numerous FDI enterprises very strong in terms of capitals and technologies. This paper focuses studies for proposal of a set of criteria and procedures for search, identification and selection of production technologies as methods and tools for enterprises in sector of electronic supporting industry in Vietnam to orient effectively the selection of suitable technologies in their efforts for innovation of production technologies and creation of competitive advantages in product quality.

Keywords: *Technology; Search of technology; Identification of technology; Selection of technology; Innovation of technology; Supporting industry; Electronic industry.*

Code: 19081501

1. Introduction

Enhancement of technological capabilities and innovation of production technologies are crucial elements of an electronic enterprise of Vietnam in context of presence of large electronic corporations such as Samsung, LG, Canon and others with the total investment volume of USD20 billion. Strong manufacturing industries need to have large corporations and a system of supporting enterprises. The latter should have capabilities to meet standards for being members of global supply chains and integrating gradually into international markets. Limitations of majority of electronic enterprises, namely the ones producing electronic components and parts (jointly called afterwards as “parts”) of Vietnam, are the lack of capabilities and technologies with standards qualified for production of parts to meet requirements of large clients. Statistic figures show about 77% of the volume of components of electronic industry of Vietnam have to be imported from abroad. Local suppliers can meet only 16% and 18% of specific electronic parts and basic ones respectively which are fairly low. At present, some

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electronic supporting enterprises of Vietnam can produce only two-layer electronic boards. Those enterprises having the production of boards with more layers requiring investments for machines, equipment and technologies and local enterprises, are rather limited.

The inevitable trends for electronic supporting enterprises of Vietnam are to link with FDI corporations which would help them advance. Supporting industries for electronic sector make more than 80% of the total values of the sector including part-producing industry, material industry, mold industry, mechanical engineering etc. Among them, the share of micro semi-conducting boards make more than 70% of the supporting industry sector. In reality, the sector of electronic supporting industries remains low developed which leads to low localization rate, of only 20-30% averagely, and then remaining values come from non-electronic business such as supply of packages mainly with metallic and plastic parts.

At present, despite of investment efforts by Vietnam enterprises for machines, equipment and technologies, they experience a large gap with FDI enterprises in the same market segment of production and supply of electronic parts. The good signal recently, however, is they pay more attentions for search and selection of advanced production technologies to meet needs and requirements of clients.

2. Status of production technologies of Vietnam enterprises of electronic supporting industry

Some definitions of supporting industry can be listed. “Supporting industries are those industries which supply components, parts, machines, packaging service and control-check service for main industries”² (namely, the sectors such as mechanical engineering, manufacture of machines, production of car parts and production of electric-electronic parts are important supporting industries) or “Supporting industries are those industries which supply necessary parts such as raw materials, parts, capitals, etc. for assembling industries (including car manufacturing and electro-electronic industries)”³ and, in Vietnam, “Supporting industries are the whole group of suppliers of industrial products to support the production of main complete products. They are namely parts, auxiliary commodities, packages, paints, dyes and etc. They may also include products of intermediate segments, semi-products and half-processed materials. Products of supporting industries usually are made by SMEs with small

² By Thailand Bureau of Supporting Industries Development (BSID)

³ By Japan Ministry of Economy-Trade-Industry (METI)

production scale”⁴. So, from view of necessity and importance, supporting industries really play large roles in economic development, produce directly added values, help promote competitiveness, accelerate national industrialization, all being particularly important for Vietnam as developing country.

The general status of supporting industries of Vietnam during the last 5 years shows the limited scale and capabilities of supporting enterprises, namely: low number of supporting enterprises, low producing capabilities, shortage of resources and technologies for enhancement of productivity and low qualified human resources. Locally made products from supporting enterprises mainly are simple parts with medium-low levels of used technologies and limited shares in the global values of products (*Truong Chi Binh, 2014*). Many years passed, even with certain improvement, the production scale and capabilities of supporting enterprises of Vietnam remain limited.

Similarly to many other supporting industries, the main activities of majority of electronic supporting enterprises of Vietnam are to assemble finished products for companies with well-known trademarks. Recently, however, under pressure of needs of FDI enterprises to cut down costs of parts and to enhance added values of locally made products, many enterprises of Vietnam find out opportunities of investments for upgrading production scale and innovating technologies (*Le Thi Thanh Huyen, 2018*). They target to enhance quality of products and positions in competition with FDI electronic enterprises in Vietnam.

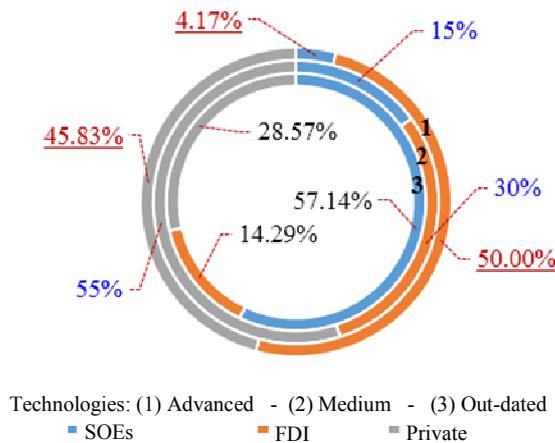
Survey data from the Office of National Council for Science and Technology Policy by 2018 (for the status of infrastructure, producing machines and equipments, human resources and production technologies) show a trend of segmentation among electronic supporting enterprises of Vietnam. Many enterprises which have “the State owned” status and are gradually equatized have huge values of tangible assets, namely lands, facilities, shops, big number of workers and etc. But the quality of the assets are low or downgraded (outdated machines, production lines, production technologies and etc.). As results, only a limited number of products are made with acceptable quality. Particularly, the sector of electronic parts remains idle without development for long years. In eventual cases they produce some products which, being of low quality, cannot meet requirements of large electronic corporations (Samsung, LG and etc.), even the ones of their Grade 1 suppliers. In another picture, however, the private

⁴ Data by Ministry of Industry-Trade (MOIT)

enterprises, newly established or business deviated, even facing initial difficulties, own relatively advanced production lines and technologies. Many products made by them gradually meet tough requirements of clients when they enter supply chains. Many private enterprises of Vietnam gradually take their positions through higher quality of products and higher management-production capabilities (4P Company, Thanh Long Company, VNPCB and etc.). Samsung, as another example, can be listed for illustration. Samsung started its investments in Vietnam since 1996 by setting up a small size joint venture. By 1997, Samsung started its USD650 million valued project for production of mobile phones, iPads and then home appliances (TV sets, air conditioners, washing machines). Actually the total registered capitals of Samsung are USD17 billion (the realized capitals are about USD10 billion) with 6 plants in Bac Ninh, Thai Nguyen Provinces and Hochiminh City. By 2017 the turnover by Samsung was over USD60 billion with the value of USD50 billion of products exported to 52 countries and territories, making about 25% of the total export values of Vietnam⁵. Since 2014, Vietnam Association of Foreign Invested Enterprises (VAFIE) and Foreign Investment Agency cooperate with Samsung for implementation of a plan to develop supporting industries. Some surveys were conducted and some workshops/exhibitions of Samsung made parts were held. By 2014 and 2015, there were 10 enterprises working as supporting enterprises for Samsung. They are mainly non-hightech enterprises and their products supplied to Samsung are auxiliary products such as packages, boxes, chargers and etc. But within two years of 2016 and 2017, the number of supporting enterprises experiences a fast growth. By February 2018 there were 225 supporting enterprises for Samsung including 25 Grade 1 suppliers. It is a very big advance forward of Vietnam enterprises in this field. Enterprises start investments for advanced machines, equipment and technologies with focus for R&D activities. They pay more attentions for innovation of technologies to produce electronic parts during recent time.

However, as shown by surveys, collected data and analyzed information for the status of machines, equipment and production technologies from some electronic enterprises of Vietnam, in the actual trends of development there is a clear difference between the three groups of enterprises: SOEs (State owned enterprises), FDI enterprises and private enterprises. Namely, Figure 1 shows the groups with different technological levels (advanced, medium and out-dated).

⁵ Special issue VietnamFinance <<https://vietnamfinance.vn>>

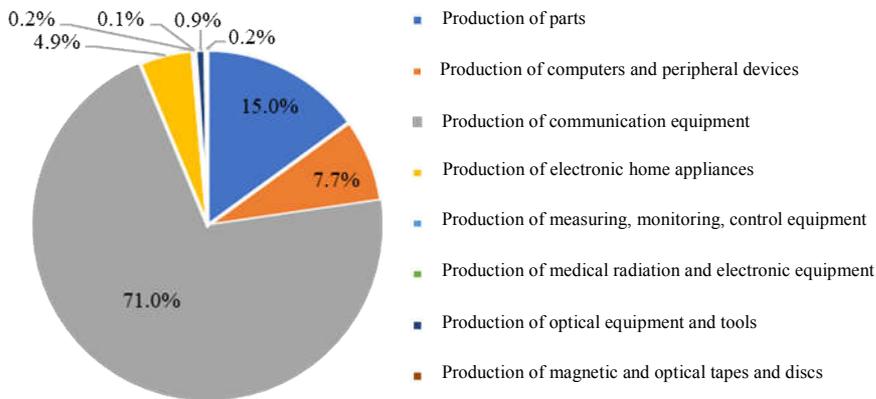


Source: Survey figures by the study team

Figure 1: Status of machines and production technology lines of some enterprises (SOEs, FDI enterprises and private enterprises) in sector of production of electronic parts

It is possible to see the structure of old and out-dated production technologies where the SOEs have the highest share (57.14%) then FDI enterprises (14.29%) and private enterprises (28.57%). For the structure of new and advanced production technologies, the highest one is of FDI (54.17%), then private enterprises (33.33%) and SOEs (4.17%). These results fit well the practical results collected through direct exchanges and on-field surveys from the above mentioned enterprises. Among the groups of technologies, majority of enterprises manage to master technologies for designing, simulation, control and patching of design errors before transfer to production segments. However, the production segments depend on machines, equipment and technological lines where only a few Vietnam enterprises can own the modern ones.

Globally, the status of local production of electronic parts by Vietnam enterprises takes very modest shares in the structure of produced values in this sector. According to data by *General Statistics Office 2015*, the produced value of parts makes only 15% of the total values of the sector (Fig. 2). This shows well difficulties in implementation of production activities as well as enhancement of technological level in this sector. But the active side of views hints certain potentials for development and exploitation of opportunities in future.



Source: General Statistics Office, 2015

Figure 2: Structure of values in sector of electronic production of Vietnam

Overall, the common trends show a more active shift of private enterprises in investment efforts for modern innovation of machines and production technology lines to meet practical requirements. Many SOEs in electronic sector, since being entangled with existing mechanisms, try to shift partially activities to other business activities. Existing facilities of these SOEs are shifted to other services to meet new business orientations of enterprises. Therefore, the mechanisms and policies need to be revised and amended for this group of enterprises to turn them to more efficient activities and integration into recent trends.

3. Needs of innovation of production technologies by enterprises in electronic supporting industries

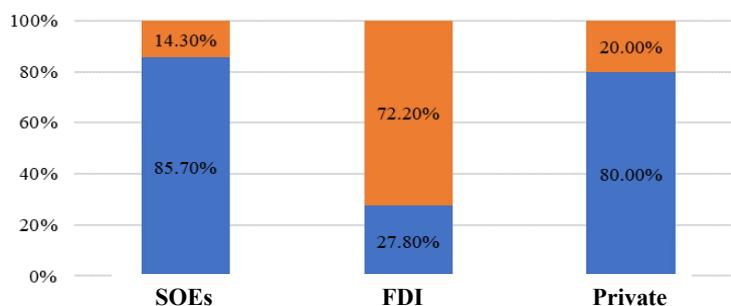
Majority of supporting industries of Vietnam in general and the ones in electronic sector in particular are SMEs with limited resources (working capitals, human resources, technologies and etc.) which cannot lead to strong moves of innovation of production technologies. As shown by survey results by the study team, only 20% of the surveyed enterprises conduct activities of technological innovation. Some objective reasons are indicated such as limited investment sources, lacked effective policies of financial supports and guaranty for loans to innovate technologies by enterprises. Subjective reasons are also indicated such as weak and short human resources with qualification and skills enough for absorption of new technologies. Even many enterprises do not know which technologies are appropriate for their production activities. Also the available supplying sources are limited and they are, in majority of cases, are linked with or owned by FDI enterprises (which control the transfer activities in this sector).

Under pressure from great needs of supply of parts for large corporations (Samsung, LG, Canon and etc.), all the operating enterprises need to innovate their production technologies. As shown by survey figures by the study team, 70% of the 30 Vietnam supporting industries under surveys have needs to innovate existing production technologies. But, in practice, this is not easy works due to the above mentioned reasons.

Without having long term strategies, the electronic market of Vietnam experiences a serious disbalance where the shares of home appliances account more than 80% of turnovers but make only about 30% of the total incomes of the sector. During long years many enterprises investment in this sector but the efficacy rate of the investments of the whole sector remains low. Majority of local enterprises participate mainly in segments of assembling operations and supply of simple service and parts which lead to low added values, low competitiveness and unclear orientations. Some enterprises investment for R&D works for development of production technologies of electronic equipments and parts but they are facing difficulties for outputs, particularly when participating in sub-contracts for fabrication of parts. In this competition, SOEs and private enterprises get disqualified due to failures to meet requirements for capabilities and experiences (*National Council for Science and Technology Policy, 2014*).

In reality, the supporting platform in sector of electronic parts comes from FDI enterprises but they, even owning numerous advanced and modern technologies, are not active in R&D activities in Vietnam. They are mainly to set up their production activities to take advantages of local cheap labor.

The reasons indicated very simple. *First*, the level and scale of production industries of parts are not considerable while enterprises need big capitals for investments. *Second*, for long years, the tax (5%) imposed to importation of parts is lower than the tax imposed to importation of materials to produce these parts which leads to increasing unbalance between assemblage of finished products and production of parts.



Source: Surveys by the study team

Figure 3. Shares of needs of innovation of production technologies among the groups of surveyed enterprises

Fig. 3 shows the shares of needs of innovation of production technologies by the surveyed enterprises: 7 SOEs, 18 FDI enterprises and 25 private enterprises.

So, exactly as shown by the surveyed status, the group of FDI enterprises have the best platform of production technologies which can meet well the actual requirements of parts (72% of them have no needs to innovate the existing production technologies). Only a few FDI enterprises need to innovate technological lines but, in this case, they bring them from original countries. Recently, Vietnam local private enterprises have increasing investments for production technologies but they are only close to requirements of large clients and then their needs are found still urgent (80%). Here they face some difficulties, namely: i) high investment capitals required for new machines, equipments and technologies and ii) identification of appropriate technologies for investment.

In summary, *the search, identification and selection of production technologies* by enterprises in electronic supporting industries face shortages and are not efficient. The question here is: problems come from internal factors of enterprises or from external factors. In fact, all the enterprises which produce electronic parts wish to take parts in supply chains for large electronic corporations actually present in Vietnam but they cannot be active for that due to their limited potentials and inefficacy of State policies for supports. *For searching activities*, they experience a great lack of technological information and database and feel embarrassed in identification of appropriate technologies. In many cases, enterprises get well information for machines and equipments but have no deep knowledge on the attached technologies. They can master well operations of machines and equipments but have little ideas for the next upgrading moves for technologies if needed. *For identification of technologies*, enterprises do analysis for identification of appropriate technologies for their production-business activities. However, being SMEs, they do not have information enough for evaluation and identification of the appropriately required technologies. In this situation, they need to ask clients for their consultations and requests to meet objectives of their indentifying works. *For selection of technologies*, enterprises mainly follow technical requirements or requirements by clients for products. In many cases, enterprises have to make direct exchanges with clients to get clear ideas for quality of products, particularly the technical one. From another side, enterprises have to assess their own absorbing and implementing capabilities for final decisions of choice. Here enterprises need rich information for analysis of decisions of choice.

As measures to support enterprises in these difficult activities, the paper proposes to build some sets of criteria and procedure for right approaches

including basic arguments, methodology and steps necessary for better works of search, identification and selection of appropriate technologies.

4. Criteria and procedure for search, identification and selection of appropriate technologies for enterprises of electronic supporting industry of Vietnam

It is difficult for Vietnam electronic enterprises to approach and own modern and advanced technologies due to the lack of information on technology supplying sources. All of them are oriented to production of higher added values in order to meet needs of domestic clients and requirements of export markets. Many enterprises do not know what they need as machines, equipments and technologies for development of products. Some aspects need to be defined for settlement of these problems of enterprises, namely:

- Existing sources of technological information are not enough for enterprises to update knowledge and to make right decisions for innovation of production technologies;
- Technological human resources are short and weak then they are unable to make right search, access, identification, transfer and then to master appropriate technologies for innovation of production technologies by enterprises;
- Supports from State policies and mechanisms are found ineffective for supporting enterprises to conduct technological innovation;
- There is no policy for transfer of production technologies from FDI enterprises to local enterprises in electronic supporting industry in Vietnam.

Therefore enterprises of supporting industry need to identify their own strong and weak capabilities to set up directions and plans for innovation of production technologies. As supports for enterprises to get access to information sources for appropriate production technologies, this paper proposes some criteria and procedures for search, identification and selection of technologies which can serve as initial indications for their efforts for innovation and enhancement of quality of products.

a) For criteria

The set up of these criteria is necessary and useful for enterprises to orient their works for search, identification and selection of production technologies in avoidance of intuition based decisions. These criteria if well

followed as professionally guided orientation will be the background for reaching the consensus for final decisions.

With the above noted necessity and importance and on basis of the surveyed information from supporting enterprises in electronic sector, the paper will set up the list of general goals for forming such criteria, namely:

- *First*, to ensure a background of theoretical consideration and methodology for enterprises to conduct works of search, identification and selection of technologies. Being provided with this set of criteria, the enterprises would not need more time and efforts for analysis of information concerning the goals, standards of the search, identification and selection of technologies;
- *Second*, to ensure the source of appropriate information related to nature and level of needed technologies facilitating enterprises in search, identification and selection of appropriate technologies;
- *Third*, to successfully prepare a tool kit guiding for survey methods, ways of search, identification and selection of appropriate technologies.

The overall goals noted above lead to the following groups of criteria.

- **Group 1. Search of production technologies** including 5 criteria, namely:
 - + *Criteria 1.* Appropriate level to meet actual needs for development, enhancement and innovation of production technologies of enterprises;
 - + *Criteria 2.* Feasibility of application and implementation in practical production activities;
 - + *Criteria 3.* Satisfaction of clients for quality of products and other related requirements.
 - + *Criteria 4.* Conformity to standards and conditions for technology transfer from abroad (if any) according to existing legal regulations;
 - + *Criteria 5.* Concrete information on production technologies supplying sources in the sector.
- **Group 2. Identification of production technologies** including 5 criteria, namely:
 - + *Criteria 1.* Information on names, specific features and level of technologies to be identified as appropriate for needs of producing enterprises;

- + *Criteria 2.* Appropriate level for practical production capabilities of enterprises;
 - + *Criteria 3.* Level of technologies to meet required quality of produced parts;
 - + *Criteria 4.* Level of qualification and expertise of human resources to master all the segments of the procedure;
 - + *Criteria 5.* Level of conformity to development and application trends of technologies.
- ***Group 3. Selection of production technologies*** including 5 criteria, namely:
- + *Criteria 1.* Satisfaction of needs and trends of innovation of technologies and enhancement of values of produced products;
 - + *Criteria 2.* Possibility to create a market for new products with higher competitive advantages;
 - + *Criteria 3.* Conformity to financial capabilities for transfer, application and implementation in practical production activities;
 - + *Criteria 4.* Conformity to capabilities to absorb and master production technologies;
 - + *Criteria 5.* Level to meet infrastructure conditions of enterprises for implementation of production activities.

So, with these groups of criteria, enterprises would have a better background for orientation of search, identification and selection works which would let enterprises approach target technologies. The remaining part of works is the method and procedure to receive the appropriate technologies as expected.

b) For procedure

Procedure is understood briefly as orders, modes/ways and concrete steps to conduct a regulated production actions and/or operations to meet certain target. For indication of appropriate technologies it is necessary to build up a concrete procedure with 3 steps of search, identification and selection on basis of the above noted criteria.

The procedure is presented in Fig. 4.

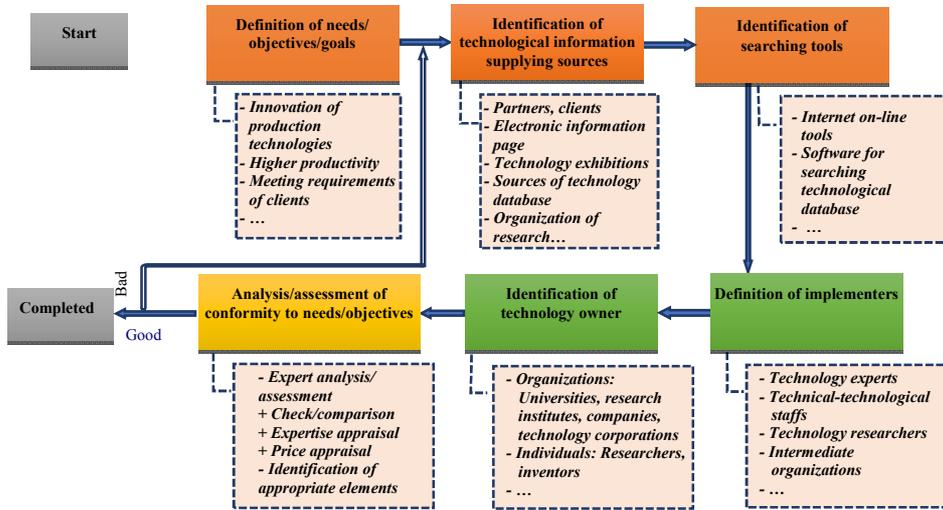


Figure 4. Procedure for search of production technologies

The procedure is proposed on basis of surveys results of the study team. It is a overall procedure applicable for different technology searchers. The procedure can be applied entirely or skip some steps depending on concrete conditions and requirements of search and also on decisions of searchers. For example, if the searcher for technology is an enterprise the technologies to look for are very well indicated and the objectives are well defined for the next products (higher productivity, requirements by clients and etc.). If the searcher for technology is a researcher, the scope of search would be broader for various purposes of considerations such as information and analysis of the technologies compared in serving the research and identification of the novelty of those technokogies.

The procedure of search is presented in Fig. 5.

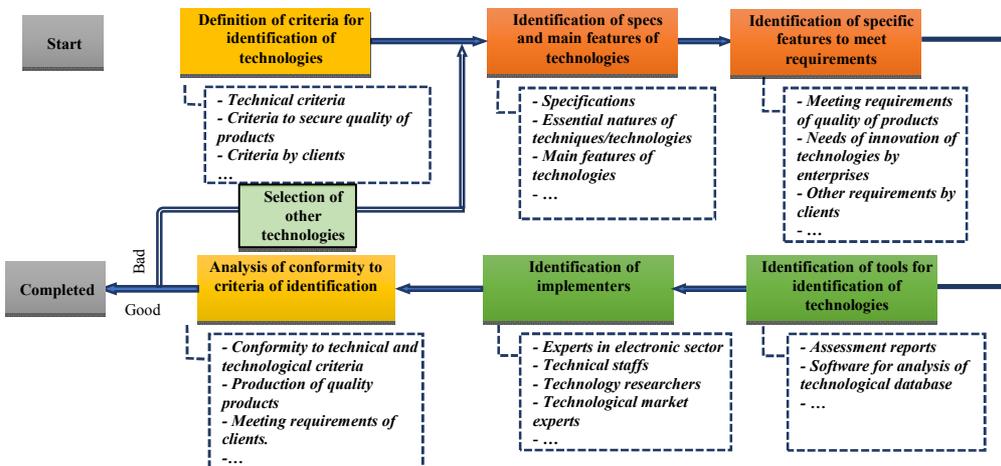


Figure 5. Procedure of identification of production technologies

The procedure of identification of technologies is based mainly on specific features of technologies, technical natures being analysed as platform for R&D, applications for development of products and conformity for production systems (if enterprises are implementors). It is the core point for identification of a technology (M.A. Pasha, 2018). The number of technologies identified as “Good” can be more than one when technologies under consideration satisfy the noted criteria. If there are more technologies satisfying all the criteria it is necessary to carry out another round for selection of the most appropriate one from initial qualifiedly recognized technologies (Ruba Osama Zalmout, 2013).

The procedure of selection of technologies is presented in Fig. 6.

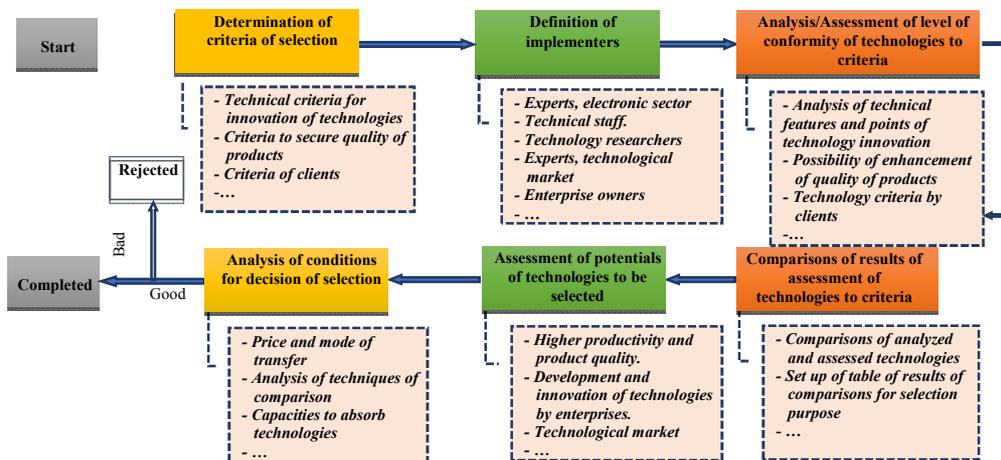


Figure 6. Procedure of selection of production technologies

Therefore, the final result of the procedure of selection of technologies is the choice of the technologies to meet defined criteria by implementors. The set-up procedure of selection of technologies would help enterprises or organizations/individuals make effective screening and list out the required technologies which would facilitate enterprises and implementors in their works for innovation of existing technologies. This procedure also helps search, identification and selection works of the newest and most updated technologies in avoidance of out-dated and inappropriate technologies (Lori Bocklund, Brian Hinton, Matt Morey, 2011).

5. Conclusions

The above noted presentation is the studies made from practical surveys by the study team in efforts to look for solutions to support enterprises of supporting industry in innovation of production technologies. The study outlines the procedures of search, identification and selection of rightly appropriate technologies in context of strong presence of big investments by large electronic corporations (Samsung, LG, Canon and etc.). The study

leads to the proposal of a number of criteria and procedures for search, identification and selection of technologies which provide enterprises with methodology and tools for effective implementation of works. For innovation of technologies in sector of production of electronic parts, Vietnam enterprises of supporting industries need to get various types of supports, from finances, human resources to technologies. The set up of these criteria and procedures would orient enterprises to right implementation for development of their technologies before receiving further support from the State in future time. The pilot application of these results in some enterprises had provided positive feedbacks. Nevertheless the time is required for a broader dissemination of the received results and the feedbacks will be useful for necessary adjustments more effectively in next assessments./.

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