STATISTIC SURVEYS OF INNOVATION AMONG ENTERPRISES IN PROCESSING AND MANUFACTORING SECTORS IN VIETNAM

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Abstract:

Statistic surveys of innovation[2] *by enterprises are activities of statistic collection of data conducted in science and technology (S&T) sectors of Vietnam. They are quite a new type of activities in practice of Vietnam. Actually, Vietnam is implementing the survey methodology among enterprises on basis of OECD guidelines for a pilot survey among enterprises in processing and manufacturing sectors of Vietnam. On basis of methodology of statistic surveys by OECD, an option of statistic surveys of innovation was designed and implemented for investigation of about 8,000 enterprises in processing and manufacturing sectors over 44 provinces and center-controlled cities. The outcomes of the survey confirm are: i) the methodology of statistic surveys of innovation can be applied for enterprises in Vietnam; ii) the statistic indexes of innovation are set up scientifically and have values for practical use; and iii) the statistic survey of innovation is feasible for the context of Vietnam. Some outcomes of the pilot survey, certain initial evaluations on basis of synthesis and assessment of the survey outcomes were noted to draw the global status of innovation activities of enterprises in processing and manufacturing sectors of Vietnam during 2014-2016 period. On this basis, some recommendations are proposed to promote and enhance effectiveness of innovation activities among enterprises in Vietnam.*

Keywords: *Enterprise; Research and development (R&D); Innovation; Statistic survey; Science and technology (R&D) statistics.*

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1. Method of measurement of innovation by enterprises

1.1. Theoretical background

Theoretical background and methodology of surveys of innovation applied for this pilot survey work are based on Oslo 2005 Guidelines which are similar to the methodology applied for Community Innovation Survey (CIS) in EU countries *(CIS, 2012)* or Malaysian National Innovation

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[2] In Vietnamese "Doi moi sang tao" means "Innovation" in English.

Survey (NIS) *(MASTIC, 2014)*, Korean Innovation Survey (KIS) *(KISTEP, 2015; Cho et al., 2014; Kawon Cho, 2016).*

1.1.1. Oslo Guidelines

Oslo Guidelines on the survey of innovation was made public by OECD and EU for the first time by 1992 *(OECD, 1992a).* This book was made for purpose to guide the collection of data on technological innovation in an unified and systematic manner with common standards for international comparison purpose.

Oslo Guidelines 1992 has two objectives: (i) Provision of a common survey framework for nations to set up their own survey implementations; and (ii) Supports of the countries which apply newly this methodology for collection and analysis of innovation data[3].

The publication of Oslo Guidelines, second edition by 1996 (called Oslo Guidelines 1996), *(OECD/Eurostat, 1996)* provides basic notions and definitions for analysis of innovation within enterprises, and proposals for design of surveys of innovation. The main objectives of these studies are the development of output indicators through which statisticians and analyzers of policy can recognize and measure the innovation through measurements of innovation of products, technological procedures and services from innovation activities.

The publication of Oslo Guidelines, third edition by 2005 (called Oslo Guidelines 2005), *(OECD, 2005)* provides some new contents such as a broader definition of innovation to include two new forms of innovation, namely innovation of management (organizational works) and innovation of marketing, more attentions paid to the roles of links with enterprises and other organizations in innovation activities, higher awareness of importance of innovation in industrial sectors with low R&D contents such as services and low tech production sectors and provision of one annex on surveys of innovation in non-OECD countries which shows high interests of surveys of innovation among non-OECD countries.

1.1.2. Community Innovation Survey

EU countries started the surveys of innovation among enterprises since 1990 and these surveys were named Community Innovation Survey *(CIS, 2012).* On basis of Oslo Guidelines (1992, 1996 and 2005), European Committee issued Regulations No. 1450/2004 on 13th August 2004 to guide

[3] (i) to provide a framework within which existing surveys can evolve towards comparability; and (ii) to assist newcomers to collect and analyze innovation data.

member countries to organize broad surveys of innovation - Community Innovation Survey. According to guidelines by this Regulation, the EU member countries would conduct the periodic review after two years of innovation activities by enterprises according to 9 groups of indexes (absolute values and percentages): (i) the number of enterprises conducting innovation activities; (ii) the number of enterprises introducing new products or improved products into markets; (iii) the turnover of new products or improved products (quite novel products) into markets; (iv) the turnover of new products or improved products (quite novel products for enterprises but not novel for markets); (v) the number of enterprises participating in innovation cooperation; (vi) the expenses made for innovation activities; (vii) the number of enterprises conducting innovation activities and being aware of importance of innovation; (vii) the number of enterprises conducting innovation activities and fixing important information sources for innovation; and (ix) the number of enterprises facing barriers in process of implementation of innovation.

1.2. Notions related to innovation activities by enterprises

According to Vietnam Law on S&T 2013, the innovation is the creation and application of advances, technical solutions, technological solutions, management solutions and marketing measures to enhance productivity, quality, added values of products and goods, and enhancement of efficiency of production-business activities[4].

Oslo Guidelines 2005 gives a definition: An innovation is the realization/completion of a product (good or service) or a new procedure or their considerable improvement, a new marketing method, a new method of organization and management in practical business activities, organization of production activities or external relations. The common essential feature of innovations is that the work must be completed and provides a ready-to-use result.

Therefore, according to Oslo Guidelines, an innovation activity gets realized when this activity can bring in a concrete effect (product gets sold, technological procedure gets successfully operated, marketing method or organization-management method get efficient in producing added values). And it is the official notion of the innovation used in this study.

The activities oriented to innovations but not bringing yet concrete results (not introducing yet new or improved products into market, not introducing yet new or improved technological procedures into production practice, not

[4] Vietnam Law on S&T 2013, Article 3, Item 16.

applying yet new marketing method or organization-management method into production-business practice, production organization or external relations) should not be considered as innovation activities.

Innovation activities are also defined in fields of S&T, organization and management, finance and trade for realization/completion of innovations.

The enterprises considered as conducting innovation activities are those enterprises which carry out innovation activities in certain stage of works including activities under implementation (not completed yet) or interrupted ones.

Innovative enterprises are those enterprises which have realized/completed an innovation within the observed stage.

In practice there are 4 types of main innovations including: (i) Innovation of products (good or service); (ii) Innovation of procedure, technologies and equipment; (iii) Innovation of organization and management; and (iv) Innovation of marketing.

The enterprises considered as to have innovations of products/innovation of management are those enterprises which have realized/completed a new product or procedure, or made their considerable improvements during the observed stage. It is a type of coupled innovations which are important in innovation activities by enterprises and here the member countries are guided by OECD to measure them.

The above provided definition of innovative enterprises was applied in surveys of innovation conducted by OECD members and other countries including Vietnam.

Innovative enterprises, in certain time stages, are the ones, first of all, which conduct innovation activities with main results such as products (new or technically improved) introduced to markets, technological procedures (new or technically improved) applied in production practice and new marketing methods or organization-management methods producing added values.

Innovation of products: It is the introduction of a new or technically improved product to users and clients including considerably improved states of technical specifications, composition, materials, integrated software, friendly interface or other functional features.

Innovation of technological procedures: It is the realization of new or considerably improved production methods including methods of transportation and distribution of products leading to reduction of production

and distribution costs, to enhancement of quality of products or to creation and distribution of new or technically improved products.

Innovation of organization-management methods: It is the implementation of a new organization-management method in production-business activities, arrangement of production facilities or external relations leading to higher efficiency, these new methods having not been used by the enterprise before.

Innovation of marketing methods: It is the implementation of a new marketing method related to considerable changes in designs, package and channels of distribution of products which lead to new images and valuation of products.

Innovative research and development (R&D): It is R&D activities which include innovative works realized in systematic ways to enhance the knowledge volume for creation of new applications, these works orienting to realization/completion of an innovation.

Considerably improved products: They are old products but added or improved with enhanced functions. A simple product can be improved (to get better specifications or reduced production costs) by applying changes in used materials, components and other specification features for higher specifications. Considerably improved products are also called "technically improved products".

New products: It is products (good and services) considerably distinguished in terms of technical features or functions of use in comparison to products produced by the enterprise previously.

1.3. Measurement of innovation

For measurement of the level of innovation by an enterprise, initially an indirect measurement method is applied on basis of indexes including activities of scientific research and technological development where the inventions are the most important indicator. Holland and Spraragen *(Holland, M., & Spraragen, W., 1933)* conducted measurement of innovation on basis of indexes reflecting scientific research and technological development. Afterwards, Schmookler *(Schmookler J., 1950, 1953, 1954)* built up a measurement method based on invention related indexes (indicators). The costs for R&D activities are the indirect indicators reflecting the input level of innovation activities and the costs for inventions mainly reflect output results of innovation activities (e.g. costs for commercialization of innovation activities).

Since 1970s, many direct measurement methods of innovation activities get popularized. Instead of focus on attention for input and output indicators, the

measurement methods applied during this time period view the innovation where the related activities and data are collected through surveys made for enterprises *(Meyer-Krahmer, 1985; Archibugi et al., 1987).*

On basis of the applied measurement methods, the first edition of Oslo Guidelines by 1992 harmonized these measurement methods and proposed standards of information measurement for innovation activities by enterprises. Since that time, the measurement methods by Oslo Guidelines were applied officially by OECD member countries and many other countries.

1.4. Innovation indexes for enterprises

By Oslo Guidelines 2005 *(OECD, 2005)* with reference to EU methodology *(CIS, 2012)* on innovation statistics, a set of innovation indexes for enterprises was prepared for application in this pilot survey in Vietnam. The set of indexes includes 4 groups of the following basic statistical indexes.

1.4.1. Indexes on innovation activities by enterprises

- *Innovation*: The number of enterprises having innovations (new and improved products), forms of realization of innovations by enterprises, the number of enterprises having innovation of technological procedures (new or improved technological procedures); forms of realization of technological innovations by enterprises, the number of enterprises having innovations of organization-management methods and the number of enterprises having innovation of marketing methods.
- *Informnation to serve innovation activities:* The number of enterprises using and conducting evaluation of sources of market information, the number of enterprises using and conducting evaluation of information sources from organizations, the number of enterprises using and conducting evaluation of internal sources of information.
- *Cooperation for innovation:* The number of enterprises conducting cooperation in innovation activities.
- *Intellectual property (IP):* The number of enterprises having inventions applied for patent granting, the number of enterprises possessing certificates of trademarks, the number of enterprises possessing certificates of protection granted industrial designs.

1.4.2. Indexes of basis conditions necessary for innovation

- *Human forces:* The number of labors having qualifications of higher education and up in enterprises and innovative enterprises, the number of R&D staffs in enterprises and innovative enterprises.
- *R&D units in enterprises*: The number of enterprises and innovative enterprises having R&D units.

- *Financial supports:* The number of enterprises and innovative enterprises having funds for R&D development.
- *Financial investment for innovation:* Investments for R&D activities in production-business activities, investments for R&D activities to serve innovation, investments to upgrade technologies, machines, equipment and software to serve innovation.

1.4.3. Indexes reflecting positive impacts of innovation to production-business activities by enterprises

- For realization of objectives to develop production-business activities of enterprises.
- For higher turnovers from new and improved products, shares of turnovers from market new products of enterprises, shares of values from export products by enterprises (in comparison to net turnovers of enterprises).

1.4.4. Indexes reflecting factors which prevent enterprises from conducting innovation activities

The reasons preventing enterprises from innovation activities are related to expected benefits, investments for innovation, qualified human forces, stimulating policies and low knowledege on innovation.

1.5. Questionnaires for collection of survey information

On basis of the prepared set of statistic indexes on innovation inside enterprises, the questionnaires for collection of necessary information from enterprises were designed. There are three questionnaires designed, namely Questionnaire 1 for collection of general information about enterprises, Questionnaire 2 for collection of information on innovation activities by enterprises and Questionnaire 3 for collection of information on R&D activities by enterprises.

1.6. Method of selection of enterprises for surveys

This pilot survey is the global check combined with a selection of samples from enterprises in processing and manufacturing sectors over the whole country.

1.6.1. Objects and organizations for surveys: They are those enterprises in processing and manufacturing sectors which Conduct independent economic accounting practice and fall under the governance of Law on Enterprises; and Conducting production-business activities before 1st January 2016 and still operating now (some exceptions deal with enterprises having operations during 2014-2016 period; Enterprises

conducting seasonal activities (less than 12 months per year); Enterprises halting production activities due to investment operations for innovation, operations of reparation or extension of production scale; Enterprises halting production activities due to dissolution requirements but still having management units on operation. These enterprises are accepted to reply the questionnaries.

Within processing and manufacturing sectors, according to data by Statistic General Department for two years of 2014 and 2015, the estimate number of small size enterprises is 18,500; the number of medium size enterprises is 1,000 and the number of large size enterprises is 2,800. About 8,000 enterprises from processing and manufacturing sectors were selected on basis of indexes of labor size of economic sectors and size of enterprises.

1.6.2. Indexes of selection of enterprises for surveys

- *Labor size based indexes*: The selection of small and medium enterprises (SME) for surveys is based on their labor size. Resolution No. 56/2009/ND-CP on 30th June 2009 by thge Government governs the indexes of small, medium and large sizes of enterprises, namely: small size enterprises have 10-200 labors, medium size enterprises have 200-300 labors and large size enterprises have more than 300 labors.
- *Economic sector based indexes*: The enterprises in processing and manufacturing sectors fall under Group C and Groups D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T and U according to the Classification of economic sectors of Vietnam issued by Decision No. 10/2007/QD-TTg on 23rd October 2007 by the Prime Minister, and The International Standard Industrial Classification of All Economic Activities - (SIC).

1.6.3. Scale of survey samples:

- *For medium size enterprises and large size enterprises*: The survey was conducted for all the enterprises listed in the 2014-2015 years survey. In case some of them stop existing or cannot be found, the new enterprises were selected as substitutions to complete the required number. The newly selected enterprises have to meet the same requirements for category 2 of enterprises, particularly in terms of the number of labors.
- *For small size enterprises:* The selection of survey samples would make 20-30% of the total small size enterprises in order to complete, together with the selected medium and large size enterprises, the required number of 8,000 enterprises for surveys. The enterprises as samples for surveys are selected in random ways. They need to cover equally the range of labor sizes and to be representative in national scale for category 2 of enterprises in processing and manufacturing sectors. They have to be operational up to 31st December 2016. Majority of them were present in

the list of the 2014-2015 surveys. The substitutions were selected in the same way as it was made for the above case.

1.7. Method of selection of survey information

The pilot survey conducts the collection of information directly from enterprises under surveys. The surveyors interview the representatives of enterprises for collection of replies and made notes in the questionnaires. The representatives of surveyed enterprises need to be aware of the contents required in questionnaires and authorized to provide information about activities of enterprises.

The team of surveyors was more than 100 experts. They get instructed in advance and fall under monitoring by 20 supervisors including the chief supervisors in charge of large size localities or groups of areas (North Vietnam mountainouse region and regions of Red River Delta, North Central Vietnam, South Central Vietnam, High Lands, East South Vietnam and Vietnam Mekong Delta Area). The surveyors contact the enterprises under surveys, arrange the interview and fill up questionnaires from provided information. The list of 8,000 enterprises under surveys covers 44 provinces and center-controlled cities (called afterward as localtities).

2. Pilot surveys of innovation among enterprises of Vietnam

The National Agency for Science and Technology Information, Ministry of Science and Technology was assigned to conduct the pilot survey of innovation among enterprises of Vietnam for 2014-2016 period and the survey was conducted in 2017. The pilot survey was the content of Sub-Component 1(b) “Improvement/completion of the system of statistic data, evaluation and measurement of Science-Technology-Innovation under Component 1 “Support background for planning of policies and pilot implementation of policies in S&T fields” which was realized in the framework of the Project “Fostering Innovation through Research, Science and Technology” (FIRST) chaired by Ministry of Science and Technology and financially supported by preferential loans from World Bank.

In total, finally, the survey was made for 7,641 enterprises in processing and manufacturing sectors including 1,892 large size enterprises (making 67.84% of the total of large size enterprises), 820 medium size enterprises (making 90.01%) and 4,929 small size enterprises (making 26.25%).

In the list of enterprises under survey, 221 of them are State-owned ones[5] (SOE), 2.366 enterprises have foreign capital contributions (FDI

[5] SOEs are those enterprises where the State owns more than 50% of the toil legal capitals (Item 22, Article 4, Law on Enterprises).

enterprises)[6] and 5,054 non-State-owned enterprises (non-SOE)[7]. Among 221 SOEs there are 77 fully State owned enterprises (making 34.8%). There are 2.252 enterprises (making 95.2%) with full foreign capitals from the list of 2.366 enterprises. Among 5,054 non-SOEs there are only 73 enterprises (making1.4%)[8] having foreign capital contributions. Therefore, the evaluations made for enterprises having foreign capital contributions remain right for the full foreign capital enterprises. And the evaluations made for non-SOEs remain right for Vietnam non-SOEs (Vietnam non-SOEs having no foreign capital contributions).

A summary of the status and results of innovation activities among enterprises in processing and manufacturing sectors, 2014-2016 period was made on basis of the pilot survey and is presented in the following remarks.

2.1. Innovative enterprises

Fig. 1 presents the strucutre of innovative enterprises and non-innovative enterprises classified by the size of labors of enterprises. The survey data show that averagely 58.5% of small size enterprises, 64.0% of medium size enterprises and 68.8% of large size enterprises are innovative.

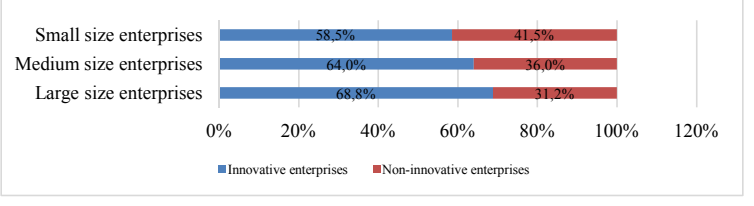

Figure 1. Structure of innovative enterprises and non-innovative enterprises according the size of labors

Analysis shows that the larger the enterprises have the size of labors the more the enterprises are innovative.

Fig. 2 presents the structure of innovative enterprises and non-innovative enterprises on basis of the legal status of enterprises. As it is seen, the SOEs

[6] Enterprises considered as having foreign capital contributions are those enterprises where the foreign sides have more than 51% of the total legal capitals (Item 1, Article 23, Law on Investment).

[7] Non-SOEs are the common name for those enterprises where the State owns less than 50% and/or the foreign capitals (of individuals or organizations) are less than 51% and/or capitals from other contributors (individuals or organizations).

[8] Among 73 enterprises having foreign capital contributions there are 16 enterprises having foreign partners with 40-50% of capitals; 17 enterprises having foreign partners with 30-40% of capitals; 12 enterprises having foreign partners with 20-30% of capitals, 7 enterprises having foreign partners with 10-20% of capitals and 13 enterprises having foreign partners with less than 10% of capitals.

hold the highest shares of innovative enterprises (71.04%), then non-SOEs (61.69%) and FDI enterprises (60.61%).

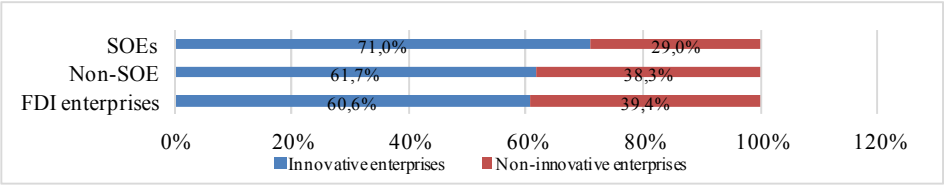

Figure 2. Structure of innovative enterprises and non-innovative enterprises according to legal status

2.2. Types of innovation by enterprises

Summarizing the forms of innovation of enterprises, Fig. 3 gives the main status types of innovative enterprises: product innovation, procedure innovation, marketing innovation and organization-management innovation and versions of their combination. In global views, 61.6% of enterprises conducted innovations during 2014-2016 period. Here the product innovation and/or procedure innovation" take the prevailing shares (49.0%). Among the 4 main types of innovative enterprises the procedure innovation keeps the top position (39.9%) and the marketing innovation keeps the last position (28.6%).

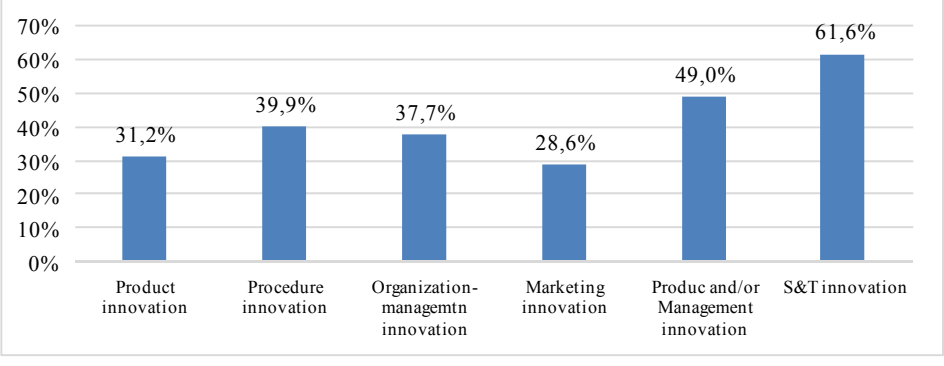

Figure 3. Types of innovative enterprises and respective shares

2.3. Positive impacts to innovation activities by enterprises from the size of labor forces with graduate qualification level and up

The survey shows that, for enterprises in general and for the groups of enterprises with similar labor sizes, the higher shares of high qualified labor forces make more positive impacts to innovation activities by enterprises, and then the fact is reflected through the shares of innovative enterprises

among them. This trend is right for all the three sizes of enterprises (small, medium and large sizes) (Fig. 4)

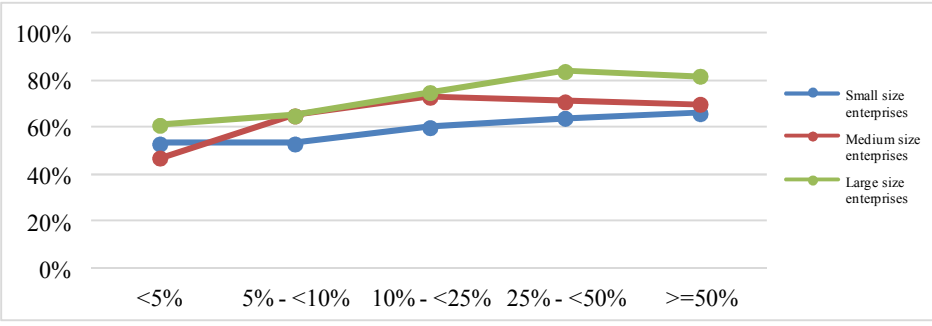

Figure 4. Shares of innovative enterprises classified by the shares of labor forces and the qualification level (graduates and up), 2016 data.

The survey data also show, however, a too low number of researching staffs in enterprises. Data by MOST, 2016 show that by 2015 among the total number of 131,045 researchers of the country only 15% of them work in sectors of enterprises while the same figure of South Korea by 2014 is 70% of the total number of 437,447 researchers (Fig. 5) *(KISTEP, 2015)*. Averagely in Vietnam 2 researchers/10 thousand habitants work in enterprises while the same figure of South Korea is 60 researchers/10 thousand habitants (30 times higher). Also the very low shares of post-graduate researchers are observed even in innovative enterprises: averagely 0.3 doctor grade researcher/10 labors and 17 master grade researchers/10 thousand labors.

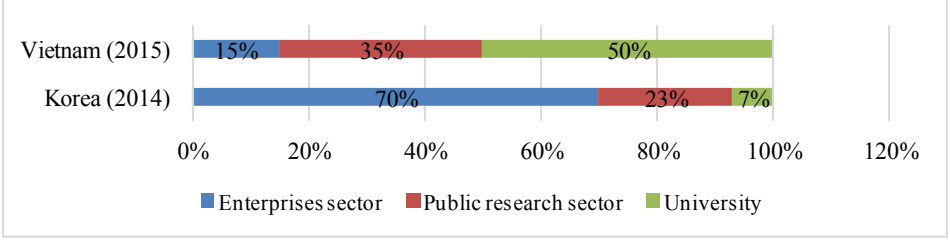

Figure 5: Structure of shares of researching staffs by sectors of Vietnam and South Korea

2.4. Modes of realization of product innovation and technological procedure innovation by enterprises

It is a main trend that innovative enterprises "confine themselves" within innovation activities for products and technological procedures, namely 86% for products and 78% for technological procedures. They have a very low rate of coordination in efforts to realize innovation activities, namely 13% for product innovation and procedure innovation; and a very much

lower rate of outsourcing moves, namely 1% for product innovation and 9% for procedure innovation.

In the group of product innovation, averagely 31.1% of enterprises replying the survey questionnaires state to have introduced one new or considerably improved product into markets. Medium size and large size enterprises do better in product innovation (38.2% and 37.6% respectively) than small size enterprises (29.0%). These data meet well the foundings observed in previous studies by World Bank "Vietnam: Enhancing enterprise competitiveness and SME linkages". These studies show that, by 2015, averagely about 23% of Vietnam enterprises are innovative enterprises where 12% of small size enterprises, 40% of medium size enterprises and 45% of innovative enterprises conduct innovation of products *(World Bank, 2017).* In practice, Vietnam enterprises focus more efforts on improvement of product quality which remain the top of their concerns with the score 2.59/3 by views of enterprises. The following concern of enterprises is the target for higher producing capabilities of goods and services with the score 2.5/3, then the concern for higher values of use of products with the score 2.48/3, the concern for improvement of vocational health and labor safety with the score 2.39/3. The third ranked group of concerns by enterprises includes the extension of scale of goods and services (2.39/3), the substitution of outdated products and procedures (2.38/3), the reduction of production costs per product (2.38/3). The last group of concerns by enterprises includes the participation in new markets (2.3/3) and the growth of market shares (2.27/3). This situation meets well the remarks made by World Bank in its study *(World Bank, 2017)* according to which the most specific target of new products Vietnam SMEs introduce into market is the higher quality of products. This concern is similar to the one of other countries in the region such as Laos, Cambodia, Malaysia, Philippines and Thailand. There is a difference in approach to innovation of products, however, where Vietnam enterprises focus more attentions on cutting down the production costs than for research for totally new specifications of products.

The shares of enterprises conducting technological procedure innovation are only 39.88%. This result meets well the observations made in previous studies by OECD and World Bank *(OECD&WB, 2014; World Bank, 2017: page 29),* according to them, by 2015, averagely 38% of Vietnam enterprises conduct technological procedure innovation.

The survey also shows 60% of innovative enterprises use various information sources for innovation activities. The sources of information most appreciated by enterprises are the enterprise internal channels, customer contacts and competitors feedbacks. Public research organizations

and higher education facilities have the lowest roles, by views of enterprises, in supports and provisions of information for innovation activities by enterprises.

2.5. Investments by enterprises for innovation activities

Among the 7,641 surveyed enterprises, 4,709 enterprises provide expenditures for innovation activities (figure by 2016) and, according to initial estimations by enterprises, these expenditures were about 5.61% of the total net turnovers of enterprises in processing and manufacturing sectors. Fig. 6 presents the structure of average expenditures for innovation activities by 2016 of enterprises in processing and manufacturing sectors which replied the questionnaires. According to it, in the total expenditures for innovation activities in 2016 by enterprises in processing and manufacturing sectors, the investments were made for purchase of technologies and machines, equipment and softeware (65.5%) and other activities including R&D activities inside enterprises (14.1%), purchase of R&D results from external sources (0,8%), training for innovation (9.9%), introduction of new and improved products into markets (4.4%), purchase of knowledge (copyrights and patents) (3.4%) and certain services for innovation activities (1.9%). The details are presented schematically in the following Fig. 6.

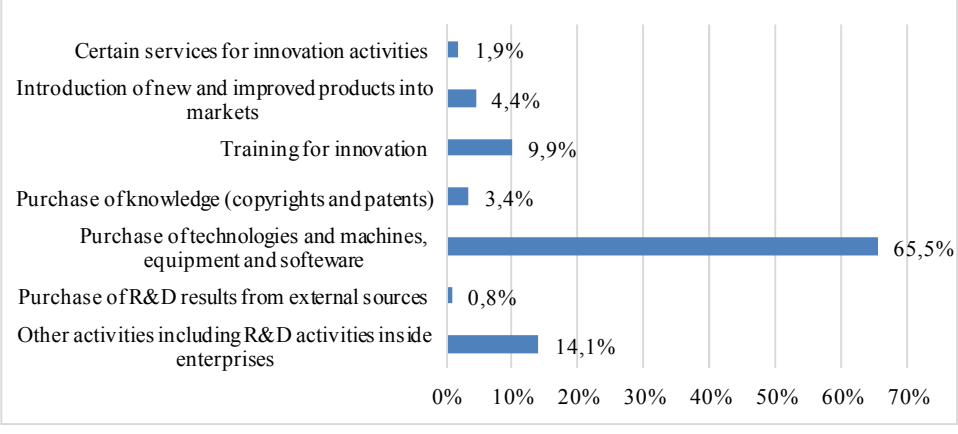

Figure 6. Structure of expenditures for innovation activities by 2016

The survey data show that 2/3 of the total expenditures for innovation mainly were used for purchase of technological accompanying machines and equipment or necessary technological upgrading/repairing activities of existing machines and equipment. Only a small part of expenditures was used for R&D activities or purchase of IP asset (trademarks and knowledge). This shows well that, at the present stage, innovative enterprises do not focus investments for development of their own intellectual assets as well as reserve efforts for R&D activities to develop new products and technological procedures to meet their own specific needs.

2.6. Sources of investment capitals for machines and equipment for innovation activities

Fig. 7 shows the average shares of innovative enterprises which mobilize capital sources for purchase of technologies, machines, equipment and software by 2016. According to it, 66% of innovative enterprises use their own sources of capitals for this purpose, 32% of innovative enterprises use credit loan channels, 9% of innovative enterprises make loans from mother companies, 5% of innovative enterprises use equipment-finance loan channels, 1% of innovative enterprises do it through JV channels, 1% of innovative enterprises get supports from State programs and the remaining 3% of innovative enterprises use other channels of supports. The details are presented schematically in Fig. 7.

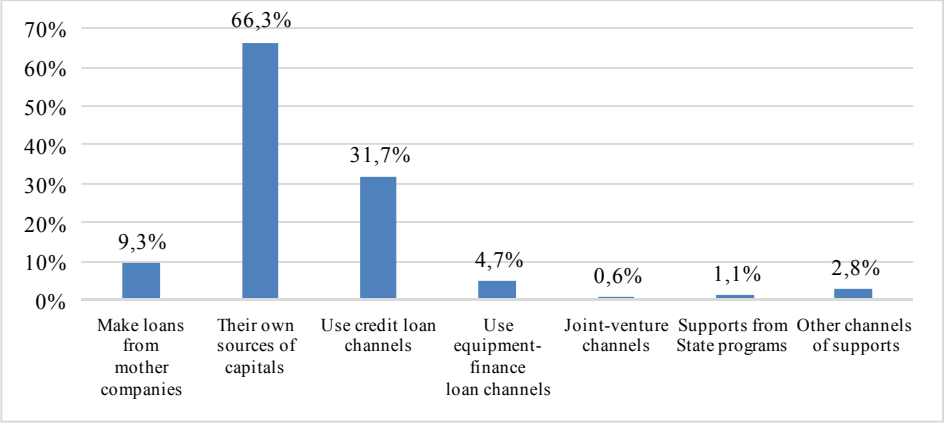

Figure 7. Mobilization of financial sources by enterprises for purchase of technologies, machines, equipment and software by 2016

2.7. Supports from State programs for innovation activities

Enterprises, in their innovation activities, get supports from the State. The survey data (Fig. 8) showed that averagely 23.6% of small size innovative enterprises, 27.7% of medium size innovative enterprises and 28.7% of large size innovative enterprises get benefits from various forms of State supports which means the corresponding increasing trends of State suppports the enterprises can get in relations to the increasing scale of their labors. The larger labor size the enterprises have the larger supports from the State they can get.

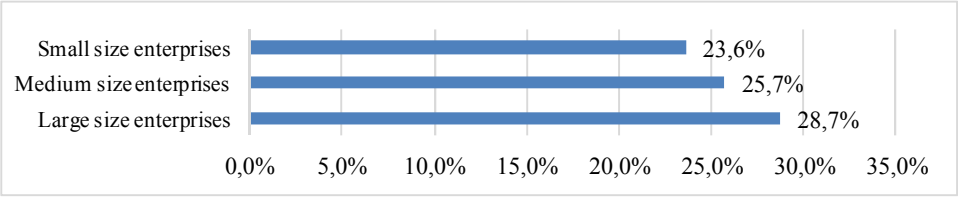

Figure 8. Shares of supports the innovative enterprises can get from the State for innovation activities

Fig. 9 summarizes the data on the shares the enterprises generally get various supports from the State in innovation activities. According to that, the group of policies offering the most supports comes from credit channels (financial supports through loans) (15.1% of innovative enterprises), the second ranked group comes from support policies for technological innovation (reduction of taxes, allocation for funds for S&T development, lower interest rates of loans) (12.1% of innovative enterprises), the third ranked group comes from supports through channels of technical consulting services (by experts and scientists from public organizations, research institutes and public universities) (only 4.6% of innovative enterprises) and the group of policies offering the lowest shares of supports for innovative enterprises comes from budgets for implementation of S&T tasks and programs (only 3.2% of innovative enterprises). The details are presented schematically in Fig. 9.

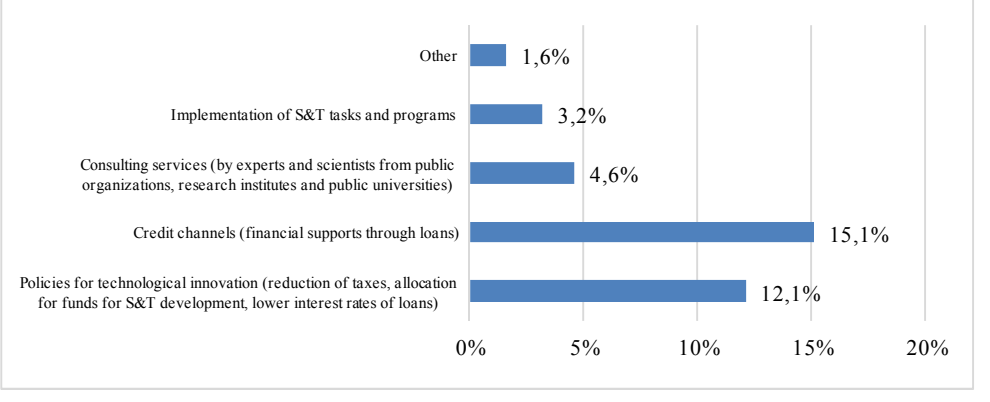

Figure 9. Innovative enterprises as beneficiaries of State supports for innovation

The main reasons the enterprises rarely get State supports for innovation activities come from: (i) enterprises do not get information about these policies; (ii) offered supports do not meet needs of enterprises; (iii) selection procedures for granting supports are too complex; and (iv) enterprises do not know how to get access to support sources.

2.8. Investments by enterprises for research, development and innovation of technologies

99% of the total investments by 2016 for innovation activities by innovative enterprises in processing and manufacturing sectors are focused on R&D and technological innovation activities where 12% of the total expenditures are used for R&D activities. More than 80% of the total expenditures for R&D and technological innovation are made by large size enterprises, 70% of the total expenditures for R&D activities and 77% of the total expenditures for technological innovation are made by FDI enterprises, non-SOEs make 27% of the total expenditures for R&D activities and 19% for technological innovation, SOEs make only 3% of the total expenditures for R&D activities and 4% of the total expenditures for technological innovation.

2.9. Effectiveness from innovation activities

Turnovers coming from innovation based products make 62% of the total turnovers by enterprises (average figure by 2014-2016 period). The highest shares come from FDI enterprises (65.6%), then non-SOEs (59.1%) and SOEs (3.4%).

In the total turnovers coming from innovation based products, large size enterprises make 86%, medium size enterprises make 5% and small size enterprises make 9%; FDI enterprises make 64.2%, non-SOEs make 32.4% and SOEs make 3.4%.

2.10. Main factors preventing innovation activities by enterprises

In practice, there are certain factors preventing enterprises from conducting innovation activities. The survey made investigations on evaluation of the level of impacts from the main factors preventing enterprises from conducting innovation activities. The level of impacting factors is measured by scores in the flowing scale: 0 - not related; 1 - inconsiderably related; 2 - related in medium rate; 3 - much related and 4 - highly related.

The conducted analysis leads to the following order (form high level to low level): (i) “Too high costs of technological innovation activities” (score 2.29); (ii) “Lack of qualified expertise for participation and realization of innovation activities” (score 1.89); (iii) “Lack of really attractive supports and stimulation measures from State policies and legal regulations” (score 1.87); (iv) “Benefits from innovation activities not high as expected” (score 1.43); and (v) “No information about technological innovation activities to meet the production-business needs of enterprises” (score 1.28). The details are prevented schematically in Fig. 10.

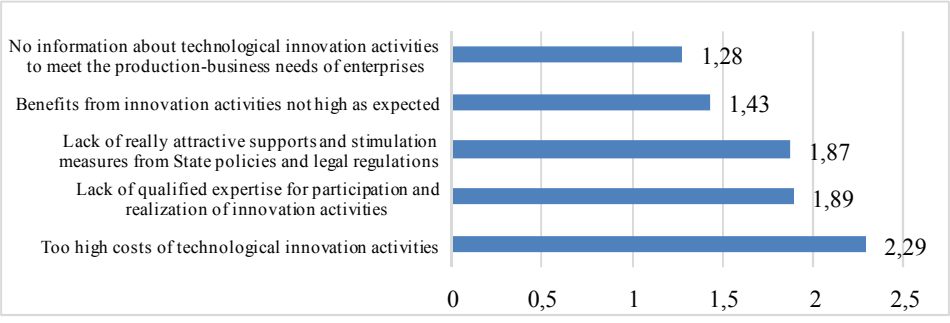

Figure 10. Evaluation by enterprises for the level of the main factors preventing enterprises from conducting innovation activities

From visions of both the labor size or the economic legal status, the top three factors preventing enterprises from conducting innovation activities are: (i) "Too high costs of technological innovation activities" (enterprises have no ways to meet); (ii) "Lack of qualified expertise for participation and realization of innovation activities"; and (iii) "Lack of really attractive supports and stimulation measures from State policies and legal regulations".

3. Conclusions and recommendation of solutions for promotion of innovation activities by enterprises

3.1. Conclusions on the pilot survey

The analysis of the 7,641 replies to questionnaires shows well the actual status of innovation activities by enterprises in processing and manufacturing sectors, 2014-2016 period, namely:

(1) The methodology of the pilot survey of innovation by enterprises in processing and manufacturing sectors is evaluated as scientifically based, providing practical values and, most of all, highly feasible. The set of statistic indexes for innovation by enterprises relies on real and practical backgrounds; the collected replies reflect the authentic status of innovation by enterprises in processing and manufacturing sectors.

(2) The collection of survey data was based on the global investigation combined with a selection of sample enterprises in processing and manufacturing sectors over the whole country. The collection of survey data was conducted directly from enterprises under surveys: interviews were made by surveyors directly with the fully authorized representatives of enterprises and the collected information was noted immediately on reply sheets. This fact shows well the feasibility and authenticity of this method

of collection of information. The surveyors were selected to meet the tough cooperation with officers from local statistic agencies. The objectives and requests for the contents of the survey of innovation were conveyed fully to the enterprises under survey and the enterprises get interested to be involved into the survey and then provided necessary information. This fact shows well the feasibility of the questionnaires and practical nature of designed statictical indexes.

(3) The collected data were set up as a background data of innovation survey. The total 140 data tables, as designed initially, were set up on basis of collected information and they provide a great source of full, logically based and practical information (7,641 records x 208 fields = 1,589,328 data cells).

(4) The total 140 data tables summarizing the innovation survey data of Vietnam enterprises of 2014-2016 period allow to analyze and identify the actual status of innovation activities by enterprises in processing and manufacturing sectors as well as to draw the trends and behaviors of enterprises in their production-business activities in systematical ways for innovation activities in national scale.

(5) The designed indexes for innovation surveys meet the requirements of international standards which means that they can be used as references for comparison to the actual status of innovation of other countries.

3.2. Solutions for promotion of activities and level of innovation by enterprises in Vietnam

(1) More attentions and promotions for larger propagation of innovation activities for higher awareness by enterprises for innovation. A better organization of provision of detail and necessary information on innovation as well as achievement of innovation by enterprises is needed. A hub organization is required for collection, synthesis and distribution of information about innovation by enterprises. On basis of services by this hub organization, enterprises would get innovation related information for their better orientation of innovation activities for production-business activities. S&T organizations also can identify demands for innovation by enterprises and then better positioned to offer their services (proposal of solutions, introduction of technologies and technical advances for innovation).

(2) Offering better conditions and environment for healthy competition in production-business activities and, on basis of that, stimulating enterprises to promote innovation activities for higher technological levels of enterprises. Here, in environment of healthy competition, the IP rights of

innovation based products by enterprises get "better secured" and then they stimulate further innovation activities by enterprises. Practice show that the innovation activities give contributions to enhancing the technological level of enterprises and, inversely, the higher technological level makes appear more innovative enterprises. Namely, only 34% of non-innovative enterprises possess the "advancing middle level of technologies" and up while the respective figure of innovative enterprises is 56.3% (almost double values).

(3) Concrete policies needed to support enterprises to produce new products, to apply new technological procedures (covering a large range of operations from R&D works to marketing and commercialization of products). Actually, only 32.08% of enterprises have innovation of products; however: majority of Vietnam enterprises focus more efforts to cut down costs and less attentions for research and development of new specification of products. Therefore, policies are to be issued to grow up gradually capabilities of enterprises to produce new products. The policies may offer credit supports for technological innovation but also mobilize experts and scientists as technical consultants for innovation by enterprises. In this approach, some S&T programs can be shifted to innovation supporting programs.

(4) Fostering cooperation activities between enterprises themselves and between enterprises and research institutes/universities. Recent practice show that enterprises remain "confined" within their efforts for product innovation and procedure innovation. The cooperation of enterprises and external organizations for product innovation and procedure innovation remains very low. Also, in this optics, enterprises do not appreciate the roles of public research and higher education organizations in activities of cooperation and supports for innovation activities by enterprises. This gap is needed to be filled up by adequate policies. Studies are also needed to issue indicators for evaluation of level and effectiveness of cooperation between enterprises and research institutes and universities for ranking S&T organizations.

(5) Policies needed to support enterprises in enhancing R&D, management and technological innovation capabilities. The second factor among the three factors preventing enterprises from conducting innovation is the "Lack of qualified expertise for participation and realization of innovation activities". The survey data, in practice, show that only 15% of researching staffs of the country work in enterprise sectors (figure by 2015) and only 2 researchers/10 thousand habitants work in enterprise sectors (1/30 of the figure of South Korea). In addition to that, 2.89% of enterprises have funds for S&T development which is focused mainly in innovative enterprises. The greater number of enterprises having funds for S&T development is observed in enterprises having the bigger number of labors with higher

education level and up. Therefore, it is neccesary to complete policies for higher R&D capabilities of enterprises such as: promotion of cooperation with research institutes/universities for realization of innovation projects, more consulting services from experts and scientists for enterprises, more active practical activities by under-graduate students in enterprises of the same profile and more measures to stimulate engineers and researchers to work in and with enterprises (partial time).

(6) Easing credit policies (supports for loans) for more chances of enterprises to access to financial sources for technological innovation. Recently, many enterprises get the highest benefits from credit policies among the ones offered by the State. Even so, many enterprises state the lack of capitals for technological innovation. The survey data show that the average time needed for enterprises to renovate 100% of their machines and equipment is 5.4 years, where the non-SOEs do it after 4.9 years, 5.1 years for FDI enterprises and 22.2 years for SOEs. Therefore, credit policies are to be completed to support enterprises to renovate more effectively their technologies, particulalry in priority industrial sectors.

(7) Fostering R&D activities and investment for technological innovation (including purchase of intellectual assets) in enterprises and other supports to make these activities more efficient in production-business activities by enterprises. Greater expenditures for R&D activities and investment for technological innovation are observed in large size enterprises which have FDI shares. Therefore policies are to be completed to support and stimulate R&D activities and investment for technological innovation in sector of non-SOEs. Actually the structure of capital sources from State budgets is not really attractive for enterprises. The highest share (99.6%) of S&T tasks is assigned to the grass-root level (other levels include national, ministerial and provincial ones) and 95.2% of the S&T tasks get realized in FDI enterprises. By 2016, averagely every FDI enterprise realized 14.6 S&T tasks, every SOE realized 3.2 S&T tasks and every non-SOE realized 0.2 S&T tasks of grass-root level. For enterprises, the level of S&T tasks gets less attentions. They focus more attentions on doing more innovations through granted S&T tasks. Therefore, the policies to be completed should be of dual nature: from one side, enterprises need to identify better the area of S&T tasks they would target and, from another side, the State defined S&T tasks should be more oriented to enterprises. The production-business activities by enterprises should be focal targets of S&T programs.

(8) More supports and stimulation for development of innovation culture in enterprises to create an environment for creative eagerness, respects of IT rights and high stimulation for creation of specific products of enterprises. The innovation culture should be promoted in environment of healthy

competition and measures are needed for the propagation of this spirit (honors, bonuses, tough and effective enforcement of IP rights).

(9) In promotion and implementation of policies, more attentions should be focused on SMEs for more innovations, extension of production-business scales and higher rate of turnovers from every group of products. Practice data show that the shares from new and improved products of SMEs are only 14.2% and the remaining shares come from large size enterprises which leads to a situation that the total turnover of the sector of SMEs make only 1/7 of the one by the large size enterprises while the number of SMEs is 7 times greater than the one of large size enterprises. Also, majority of FDI enterprises have a large size of labors and they keep the prevailing shares (74%) in the total turnover from new and improved products. Therefore, more supports are required to support SMEs (Law on Small and Medium Enrerprises, 2017) for a better share of new and improved products and their turnover from SMEs./.

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