International Journal of Economics, Commerce and Management
United Kingdom Vol. V, Issue 6, June 2017
http://ijecm.co.uk/ ISSN 2348 0386

CONTRADICTIVE CONTRIBUTION OF PATENT AND NATIONAL STANDARDS ON TRADE PERFORMANCE – EVIDENCE FROM INDONESIA

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Abstract

Some of the related literatures, on the subject of patent and national standards on trade performance, reveal that there is a strong correlation between innovation and standardisation, while others believe in the standard hampers innovation. However, standards tend to limit the movement and inhibit creative activities for the innovator. This analyses the data using a concordance. The author found the effect of patent growth greater than the national standard development, on the performance of imports in Indonesia. It was also found that the patent growth is more influential than the national standards development on the performance of the trade. Among data variables, the impact of patent growth is greater than the development of national standards on trade performance. In the best regression models for both variables, around 75% of the exports performance and 100% of imports performance go in opposite directions. This is in accordance with the national standards development policy guidelines, to avoid the use of patents or part of patents on the standard. In this paper, the authors also found a sector wherein innovation and national standard positively contribute to the total value of export. This activity was identified as the construction and civil engineering sector.

Keywords: Trade Performance, National Standards, Patent, Innovation

INTRODUCTION

Several human activities depend on the demand for a product. The product has the technical specifications for raw materials, processes, and end products. The technical specifications constitute the generally referred standard. Standards greatly affect our lives; even though we sometimes do not realise it, it is evident in our economic activity, such as trade (WTO, 2005).

In the last two decades, the development of information technology has grown rapidly, and strongly supports the advancement of technology in various sectors and facilitates the human life activities, including standardisation and innovation activities. The growth of standard and innovation has thus been more rapid and effective. Hence, the role of standards and innovation on trade cannot be ignored. Most of available literatures have conducted an in-depth study of these two aspects.

In some studies, literature revealed a strong correlation between innovation and standardisation (Blind, 2006), and most people believe standards hinder innovation (Swann, 2010a). Some argue that the standards encourage innovation in their companies. Specifications in the standards provide information for those who are not aware of and have no experience on such products and services. Nevertheless, it tends to hinder the movement of those who are already proficient and have experience in these products. The provisions in the standards restrict the innovative activities of companies (innovator) in providing products that conflict with those specifications.

Innovation and Standardisation

Understanding of innovation for the company, according to Luecke and Katz (2003), is the success of the new things or methods that are embodied in the production process or a new product. It is creativity and ideas, that are useful in making the actions / decisions that lead to significant progress, wherein the company is able to produce a product, service, or new internal business process. Those very same creativities are often interpreted as the basis of innovation, and the company is able to produce integrated innovation in management, ranging from product innovation, business processes, to marketing methods. As evidenced from Germany's example, standardisation is an important part of the national innovation (Blind and Grupp, 2000).

In some cases, companies use innovation to increase the volume of their products in the market, and often produce new products to dominate in a market segment, such as was done by Chrysler in 1983, that produced a minivan and consumers responded positively. Design innovation should be harmonised with the standards that have been accepted in advance by the market in order to comply with the regulatory requirements as relevant. However, there is no guarantee that a design innovation will get a positive response in the market (Dr. Howard

Crabb, Interactive Computer Development). Until now, the producer's attention is still focussed on the production volume, capacity, and pricing. The development of innovation can occur at any stage of the production process and product sales. Thus, this function in the company became the basis of a standard grouping.

There are conditions in the development of innovative products that must be met in order to sustain. Hence, a company must have intellectual property rights, try to focus on the customer's wishes, and be ready to face the competition, while maintaining the lead to be the first to implement the standard. However, to have a patent is not easy, as the process of obtaining patent recognition requires considerable time and annual costs that are also not small. Competitive rivalry among companies raises a lot of pressure to innovate (Swann, 2010a). Competition is beneficial and attractive to consumers, because it engenders competitive pricing and attracts more and more innovative ideas to challenge the company in generating new products. Companies tend to want to produce product quality levels received by customers. In addition, the product must be able to fulfil all the provisions of the legislation in force as a function of environmental sustainability, in order to be accepted by the market.

Fluctuations in standards development and innovation in each country will affect trade transaction for both, exports and imports. When the amount of innovation grows, uncertainty about the products will also increase; this will harm consumers due to the lack of information regarding new products. At times, the standard can substitute this role. In some sectors, standards are relatively slower in growth than innovation, but this is not so for other sectors such as information technology and communications (ITC). The time needed for the preparation of standards and the development of infrastructure related to these standards, is far too long. These differences are often seen as less profitable by the producers (Swann, 2010b). However, the standards they promote toward innovation are mostly not the latest.

The Legal Basis for the Development of Innovation and Standardisation

The term innovation, in Indonesia, is based on Law No. 18 of 2002, on the national system of research, development, and application of science and technology wherein innovation involves research, development, and / or engineering. This aims to develop the practical application value and context to new knowledge, or new ways to apply the science and technology which have existed in the product or production process. The rate of innovation in the process within the company determines the ability of human resources owned by the company in each division. Standardisation is supported by Law No. 20 of 2014 which is concerned with standardisation and conformity assessment, and aims to improve the quality assurance, production efficiency, national competitiveness, competition and transparency in the trade, business assurance and

capability, and potency of technological innovation. It also aims to improve protection for stakeholders both from the aspect of safety, security, health, and environment conservation; increase certainty, as well as the smoothness and efficiency of trade transactions. An assessment of conformity should be developed in a sustainable manner and in line with standardisation, especially in conforming with and enhancing the competitiveness of national products, flow of trade while protecting public interest. Development of national capabilities in the field of standardisation and conformity assessment is done in anticipation of the globalisation era of world trade, AFTA, and APEC (bsn.go.id).

Impact of Standards

Many previous studies, such as Swann et al (1996), have examined the effect of standards on trade performance. The Swann study found that the standards development in the agricultural sector limited the export performance. Research conducted by the DIN (2000) also found a positive effect on the export standard. In previous studies, the effect was derived from the development of national standards on the export value increases from year to year (Tampubolon, 2016). The effects of the adoption of international standards on the standard development programme have been shown to increase the value of imports, except in some sectors such as agricultural products. For agriculture, the developed countries tend to tighten and restrict imports from developing countries, specifically with regard to the design or production process. Standards play a significant role in reducing variation, benefiting both producers and consumers, so that the competition faced by suppliers is reduced (Swann, 1985). Each stage in the standardisation process limits the product with provisions in the specifications. However, the opportunity for innovative producers in gaining profit by product differentiation or innovation, produce results that are very limited. Disclosure of information on standardisation increases the competition for producers and is beneficial for consumers. Besides, it is the standards that build the market and the service of the products; hence, the infrastructure of conformity assessment based on these standards needs to be developed.

Peter Swann (1985), in his study, found that the role of standards focus upon: maintaining a minimum standard of quality, to reduce any variation in standards compatibility, and to facilitate market development and trade The standard enables compatible products or products that belong to a particular network, to enter the market. Standards lower the transaction costs and foster consumer confidence in the products or services, as they will always strive to meet the needs of consumers. Conformance to the standard specification serves to limit the amount of product range but will expand the market. It not only makes it easier for buyers or suppliers to search for a product but also reduces the cost of testing. In

trade, reduction in the search and testing costs, consequently expedite the process of market transactions.

The information contained in the standard of benefit to the company helps in the effective division of labour as well as building workforce competencies in the company directly. This information also increases the product assurance to trading partners while minimising the barriers to market its products indirectly. The researchers, engineers, and practitioners use the standard as a source of information on the current state of technology (Jaffee and Henson, 2004). Among other functions, the standard is also used for research and internal communications.

The Relationship between Innovation and Standards

Based on the research results, Blind (2004) found a strong correlation between the level of research and development and the patent of the standard amount, as an indicator of innovation. Therefore, the standard is an important part of the infrastructure in the development of innovation (Swann, 2000). According to the Temple (2004), in general, the standard supports innovation growth. The standard is also not a constraint for product development and innovation (Bailetti and Callahan, 1995) but is instrumental in the development of technology-driven markets (Swann and Watts, 2002).

Both patents and standards play key roles in innovation. In some references, the development of Rights Intellectual Property and standardisation, have often led to conflict, thereby of leading to the development of innovation (Swann, 2000). According to the study WTO (2005), standardisation enables the development of innovation while still limiting the undesirable results, so that it becomes an important part of micro-economic infrastructure development (Link and Scott, 1998; Monteiro and Hanseth, 1999; OTA, 1992; Tassey, 1995; Tassey, 2000).

In addition, loyal consumers contribute in the process of standardisation and innovation through their requests or feedback on the product (Hippel, 1988). Some previous studies found that standard played an important part in the growth of innovation infrastructure (Branscomb and Kahin., 1995; Knie, 1992; Krechmer, 1996a; Link and Scott, 1998; Monteiro and Hanseth, 1999; Semerjian and Watters, 2000; Tassey, 1992, 1995, 2000, Trebing, 1994). In a study conducted by the DIN (2000), it was found that innovation cannot increase competitiveness without the role of standardisation, and standards became a stimulus for innovation. Although the nature of both is very different, the standard is open, and part of the public infrastructure, while the patent is exclusive and associated with ownership or is proprietorial. Standards and patents contribute to economic growth. A patent plays a major role in innovation and can open

up a new area of technology (Lea and Shurmer, 1994, Shurmer, 1996). Innovation also opens up new opportunities for the development of other innovative products in new ways.

In addition, the perspective of infrastructure is that innovation and standard have a very close relationship and fosters the availability of a robust infrastructure for an open market opportunity. This is the basis for future innovation growth. Business players, especially manufacturers, get to benefit from the development of this infrastructure, while simultaneously reducing the cost of market risk and technology, and improving the quality of its products. An enterprise can also reduce the cost of research, product development, and cost of conformity assessment before the product enters the market. The development of infrastructure in every sector of the standard is different; sometimes, it is too much and at other times, too less. According to some authors, standard infrastructure is still incomplete, and uneven, for all products (Swann, 2000). Standard infrastructure, such as conformity assessment, enables manufacturers to demonstrate an innovative product line with their expectations (Tassey, 1995). This affects the effectiveness of the implementation of standards in trade deals.

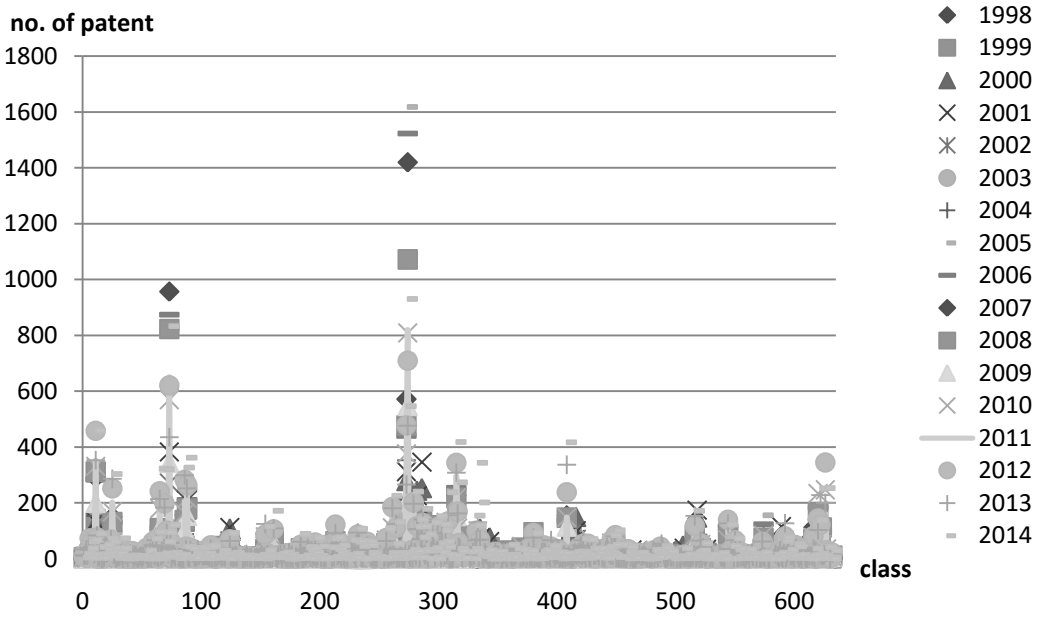
This study also states that the activities of standards reduce imports, due to increased barriers against an unwanted product; however, it also increases competitiveness and exports. This is consistent with the rational trading. According to some references, national standards are often a bottleneck in the trade (David and Shaimen, 1996; Lecraw, 1984, 1987; McIntyre, 1997; Spillenkothen and Renner, 1970; Stern, 1997; Tanabe, 1997; Warshaw, 1997). Many factors can influence the standardisation activities in addition to standards such as consumer attitudes. Consumers in the UK are more likely choose the British national standard over the international standard (Hudson and Jones, 2003).

RESEARCH METHODOLOGY

In this study, the authors use the annual dataset of intellectual property right in Indonesia since 1998-2014, issued by the General Directorate of Intellectual Property, Kemenkumham. The determination of the period of IPR data is adjusted to the available national standard and extant trade data. From the raw data obtained, using the patent classification codes International Patent Classification (IPC), there are 28 619 subgroups of very detailed data. In the structure of the classification of IPC, there are derivatives up to the fifth level, namely Section-Class Subclass-Group-subgroup. In the data subgroup, there are a number of different digits, e.g. A01B1/00, A61B17/3205, F02M35/02408 (or in 7 digits to 11 digits). Thereafter, the patent data are classified into subclasses; there are 5504 different subclasses. As this data will be correlated with other data (such as data industry, trade, standards, etc.), the patent data is

processed class-wise, and there are 632 classes. The distribution of patent data, based on class for the last 15 years, can be seen in the following figure.

Figure 1: The distribution of patents in Indonesia by class since the year 1999-2014



In addition to the above patent data, other data, such as data standards of national development, as can be seen in Figure 2: Stock of Indonesia National Standard 1987-2014, export the data in Figure 3: Indonesia National Export to Worldwide 1999-2014 previous studies (Tampubolon, 2016) and import data (bps.go.id).

In this research, there are two independent variables and two dependent variables. The dependent variable is the value of export or import (in units of US dollars per year). The independent variable is the variable development of national standards and patents for 18 sector groups in Indonesia, from 1999 to 2014. Two sector groups have been eliminated from the initial group of 20 sector groups, which is the result of concordance between patents and standards, because these are two groups of sectors that have no standard growth or because there they had no standard amount within the last 15 years.

Before continuing the analysis process, the authors need concordance to connect between the patents, the standards, and the trade classification. Media conversion is used in the Statistical Classification of Economic Activities in the European Community (NACE) 2 revised version, adopted by the EU at the end of 2006. Additionally, this classification has had a conversion with the International Standard Industrial Classification (ISIC) revision, version 4.

Table 1: Concordance between NACE Rev.2/ISIC Rev.4, IPC V8, ICS 6 Ed. and HS 2012

NACE Rev.2/ ISIC Rev.4	IPC V8	ICS 6 Ed.	HS 2012
10,11	A01 H, A01 J, A21 D, A23 B, A23 C, A23 D, A23 F, A23 G, A23 J, A23 K, A23L 1/*, A23L 3/*, A23 P, C13 B, C13 F, C13 J, C13 K; A23L 2/*, C12 C, C12 F, C12 G, C12 H	67	16-22
12	A24 B, A24 D, A24 F	65.160*	01,03,06-08, 10,13,14,24
13,15	B65 D (5.88%), D04 D, D04 H, D06 C, D06 J, D06 M, D06 N, D06 P, D06 Q; A43 B, A43 C, B68 B, B68 C	59	50-60,63,65,41-43,64
14	A41 B, A41 C, A41 D, A41 F	61	61,62
16	B27 D, B27 H, B27 M, B27 N, B65 D (1.25%)	79	44,47
17	B42 F, B65 D (20.44%), D21 C, D21 H, D21 J	85	48
18	B41 M, B42 D, B44 F	37.100	84.43
19	C10 G, C10 L	75	27
20	A01 N, A01 P, A61K 8/*, A61 Q, A62 D, B01 J, B09 B, B09 C, B27 K, C01 B, C01 C, C01 D, C01 F, C01 G, C02 F, C05 B, C05 C, C05 D, C05 F, C05 G, C06 B, C06 C, C07 B, C07 C, C07 F, C07 G, C08 B, C08 F, C08 G, C08 H, C08 J, C08 K, C08 L, C09 B, C09 C, C09 D, C09 F, C09 G, C09 H, C09 J, C09 K, C10 B, C10 C, C10 H, C10 J, C10 K, C10 M, C10 N, C11 B, C11 C, C11 D, C12 S, C14 C, C23 F, C23 G, C25 B, C40 B, D01 C, D01 F, D06 L, F17 C, F17 D, F25 J, F42 B, F42 D, G21 F	71,87	28,29,31-38
21	A61 P, C07 D, C07 H, C07 J, C07 K, C12 N, C12 P, C12 Q, C12 R	11.120	30
22	B29 B, B29 C, B29 D, B60 C, B65 D (35.9%), B67 D, C08 C	83	39,40
23	B28 B, B32 B, B65 D (21.31%), C03 B, C03 C, C04 B, E03 D	81	70,69
24,25	B21 C, B22 D, C21 B, C21 C, C21 D, C22 B, C22 C, C22 F, C25 C, C25 F, G21 H; A01 L, A44 B, A47 H, B21 G, B22 F, B63 G, B65 D (15.17%), C23 D, C25 D, E05 B, E05 C, E05 D, E05 F, E06 B, F16 B, F16 T, F17 B, F22 B, F22 G, F24 J, F27 D, F41 A, F41 B, F41 C, F41 F, F41 G, F41 H, F41 J, F42 C, G21 B, G21 C, G21 D	77	72-76,78-83,93
26*,62	A61 N, B81 B, B82 B, B82 Y, C30 B, F15 C, G01 B, G01 C, G01 D, G01 F, G01 H, G01 J, G01 K, G01 L, G01 M, G01 N, G01 R, G01 S, G01 V, G01 W, G02 B, G02 C, G02 F, G03 B, G03 C, G03 H, G04 B, G04 C, G04 D, G04 F, G04 G, G05 B, G05 F, G06 C, G06 D, G06 E, G06 F, G06 G, G06 J, G06 N, G06 T, G08 B, G08 C, G08 F, G09 C, G11 C, G12 B, G21 K, H01 C, H01 F, H01 G, H01 J, H01 L, H01 Q, H01 S, H03 B, H03 C, H03 D, H03 F, H03 G, H03 H, H03 J, H03 K, H03 L, H03 M, H04 B, H04 H, H04 J, H04 K, H04 L, H04 M, H04 N, H04 Q, H04 R, H04 S, H04 W, H05 G, H05 H, H05 K; G06 Q	35	84.71

28,27	A01 B, A01 C, A01 D, A01 F, A01 G, A01 K, A01 M, A21 C, A22 B, A22 C, A23 N, A24 C, A41 H, A42 C, A43 D, A47 K, A62 C, B01 D, B01 F, B02 B, B02 C, B03 B, B03 C, B03 D, B04 C, B05 B, B05 C, B05 D, B06 B, B07 B, B07 C, B08 B, B21 B, B21 D, B21 F, B21 H, B21 J, B21 K, B21 L, B22 C, B23 B, B23 C, B23 D, B23 F, B23 G, B23 H, B23 K, B23 P, B23 Q, B24 B, B24 C, B24 D, B25 B, B25 C, B25 D, B25 F, B25 G, B25 H, B25 J, B26 B, B26 D, B26 F, B27 B, B27 C, B27 F, B27 G, B27 J, B27 L, B28 D, B30 B, B31 B, B31 C, B31 D, B31 F, B41 B, B41 C, B41 D, B41 F, B41 G, B41 J, B41 K, B41 L, B41 N, B42 B, B42 C, B43 M, B44 B, B44 C, B60 S, B61 B, B65 B, B65 C, B65F 1/*, B65F 5/*, B65F 7/*, B65F 9/*, B65 G, B65 H, B66 B, B66 C, B66 D, B66 F, B67 B, B67 C, B68 F, C10 F, C12 L, C13 C, C13 D, C13 G, C14 B, C23 C, D01 B, D01 D, D01 G, D01 H, D02 G, D02 H, D02 J, D03 C, D03 D, D03 J, D04 B, D04 C, D05 B, D05 C, D06 B, D06 G, D06 H, D21 B, D21 D, D21 F, D21 G, E01 C, E01 D, E01 F, E01 H, E02 C, E02 D, E02 F, E05 G, E21 B, E21 C, E21 D, E21 F, F01 B, F01 C, F01 D, F01 K, F01 M, F01 N, F01 P, F02 C, F02 G, F02 K, F03 B, F03 C, F03 D, F03 G, F04 B, F04 C, F04 D, F04 F, F15 B, F15 D, F16 C, F16 D, F16 F, F16 G, F16 H, F16 K, F16 M, F16 N, F16 P, F22 D, F23 B, F23 C, F23 D, F23 G, F23 H, F23 J, F23 K, F23 L, F23 M, F23 N, F23 R, F24 F, F24 H, F25 B, F26 B, F27 B, F28 B, F28 C, F28 D, F28 F, F28 G, G01 G, G03 G, G05 D, G05 G, G06 K, G06 M, G07 B, G07 C, G07 D, G07 F, G07 G, G09 D, G09 G, G10 L, G11 B, H05 F; A21 B, A45 D, A47 G, A47 J, A47 L, B01 B, B60 M, B61 L, D06 F, E06 C, F21 K, F21 L, F21 S, F21 V, F21 W, F21 Y, F24 B, F24 C, F24 D, F25 C, F25 D, G08 G, G10 K, H01 B, H01 H, H01 K, H01 M, H01 P, H01 R, H01 T, H02 B, H02 G, H02 H, H02 J, H02 K, H02 M, H02 N, H02 P, H05 B, H05 C;	21,23,53	84* (excl. 84.71 & 84.43),85,90* (excl. 90.180)
29	B60 B, B60 D, B60 G, B60 H, B60 J, B60 K, B60 L, B60 N, B60 P, B60 Q, B60 R, B60 T, B60 W, B62 D, F01 L, F02 B, F02 D, F02 F, F02 M, F02 N, F02 P, F16 J, G01 P	43	87
30	B60 F, B60 V, B61 C, B61 D, B61 F, B61 G, B61 H, B61 J, B61 K, B62 H, B62 J, B62 K, B62 L, B62 M, B63 B, B63 C, B63 H, B63 J, B64 B, B64 C, B64 D, B64 F, B64 G, B65F 3/*, E01 B, F03 H	45,47,49	86
31	A47 B, A47 C, A47 D, A47 F	97.140*	94
32	A41 G, A42 B, A44 C, A45 B, A45 C, A45 F, A46 B, A46 D, A61 B, A61 C, A61 D, A61 F, A61 G, A61 H, A61 J, A61 L, A61 M, A62 B, A63 B, A63 C, A63 D, A63 F, A63 G, A63 H, A63 J, B01 L, B04 B, B43 K, B43 L, B44 D, B62 B, B68 G, C12 M, D07 B, F16 L, F23 Q, G01 T, G03 D, G03 F, G09 B, G09 F, G10 B, G10 C, G10 D, G10 F, G10 G, G10 H, G21 G	97.200, 97.220, 11.040,39.060	92, 95.03, 95.06, 90.18,71
43,42	E02 B, E03 B, E03 C; E03 F, E04 B, E04 C, E04 D, E04 F, E04 G, E04 H	91,93	68

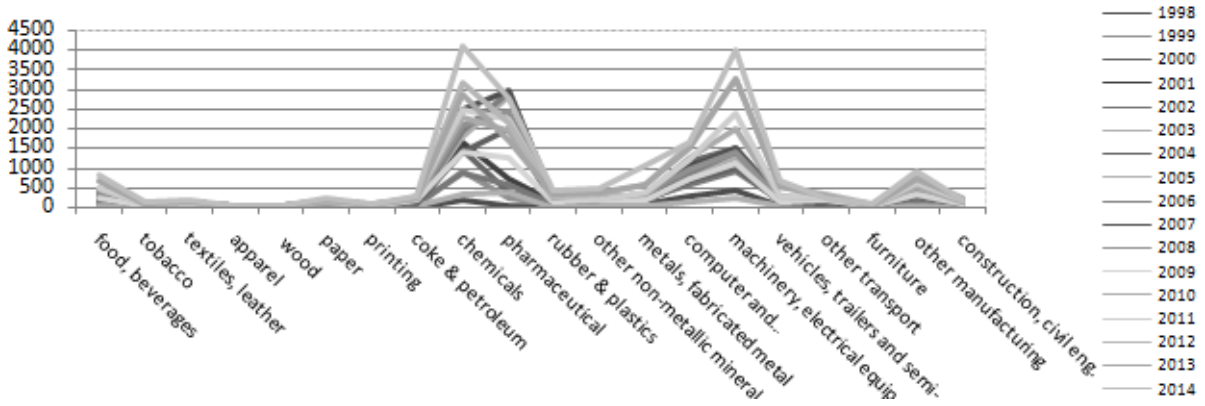
The symbol (*) applies only to some kinds of goods or products in a classification code.

This concordance is a result of the combination of IPC Concordance V8 - NACE Rev.2 (Eurostat, European Commission), Correspondence between ISIC Rev.4 and NACE Rev.2 (unstats.un.org), and concordance between ICS 6 Ed., ISIC Rev.4, and the HS 2012 in the previous paper (Tampubolon, 2016), with a slight improvement based on the concordance between patent and NACE. Concordance is not displayed all classification codes (IPC, NACE, ISIC or ICS), and is only limited to classification code of data that are available in Indonesia. This conversion will be used to analyse the correlation between the patents and the development of national standards. Another correlation is between patents and the development of the value of trade (exports and imports).

In this paper, the authors wanted to see if the effect of the development of innovation and standards on trade performance follow the same direction, go opposite, or are not correlated at all (Swann, 1996; Blind and Grupp, 2000; Blind et al., 2000; Blind, 2001; Blind and Jungmittag, 2001). We will see whether they take effect only on the value of exports or imports, or both. Therefore, it can be said that the development of technologies that form the basis of innovation and standards in the agricultural sector has restricted trade, especially imports. On the other hand, the adoption of these, increases the flow of goods from the developed countries to the developing countries, but not vice versa (Swann, 2000). In general, however, the effect of national standards on imports tends to be negative or positive, depending on each sector.

First of all, we will see the sector that has increased the number of patents in Indonesia. The following figure shows only 4 sectors that developed in the last 15 years; namely, the chemicals sector, machinery and electrical equipment sectors, the pharmaceutical sector, and the computer and programming sector. There is another sector that is less developed, but for more detailed analysis, we will take a look at the results and discussion. In the next section, we try to correlate the aspects of patent development with aspects of the development of standards and aspects of trade development or other aspects.

Figure 2: Patent Development in Indonesia by Industrial Sector



Theoretically, the development of a patent is not in line with the development of the standard. This is in accordance with the guidelines for the development of national standards PSN (National Standardization Guidelines, 03.1: 2007), which has been determined for the provisions to not accommodate patents in national standards or has the tendency of ignoring the patent. Hence, if in the process of developing national standards, a patent or part of the patents listed in the national standard which is composed is not identified, then there is no party (including BSN) which is responsible for the use of these patents and royalties. However, if there is a standard that has adopted a patent, or part of the patent, the next step would most likely be to revise the national standard and review the parts associated with a patent, or wherever possible, avoid the use of patents in the national standard (PSN 03.1).

Hypothesis

Based on some previous references, the determination of the research hypothesis is the innovation represented by the patent, and the development of standards give effect to the performance of trade in Indonesia (exports and imports). The author also will see the effect in each sector, based on the classification of ICS, for two independent variables and the dependent variable. We can establish an equation of linear regression functions related to the data above, as follows:

$\mathrm{Tr}_{\mathrm{it}} = \alpha_0 + \beta_1 \mathrm{Pt}_{\mathrm{i}} + \beta_2 \mathrm{St}_{\mathrm{i}} + \varepsilon \mathrm{t}$

where:

Tr = the trade value (export or import)

Pt = patent

St = standard

i = sector

εt = error

RESULTS AND DISCUSSION

Before further analysing the raw data of patents towards the development of national standards on the trade performance, a normality test and a homogeneity test were conducted. The Kolmogorov-Smirnov normality test is performed to determine whether the data in the two groups have a normal distribution or not. From the analysis results obtained, a significance value of 0.00 was obtained for both the dependent variables (the export value and import value), which is less than 0.05. This normality test result showed that the distribution of the free variables and the dependent variable is not normal, hence the data needs to be transformed / normalised, in order to become a normal distribution of data, in advance. In the software

program, the SPSS has provided an Automatic Recode tool, so that we get the new distribution. The normalisation test resulted in a normal distribution (the significant value of the performance of exports 0.095 and imports 0.190). An example of the data import performance can be seen in the following table.

Figure 3: Normality Test of Patent and Standard Data on the Import Value

One-Sample Kolmogorov-Smirnov Test (before)

		Unstandardized Residual
N		288
Normal Parameters[a,b]	Mean	.0000007
	Std. Deviation	7.24234444E9
Most Extreme Differences	Absolute	.261
	Positive	.261
	Negative	-.160
Kolmogorov-Smirnov Z		4.435
Asymp. Sig. (2-tailed)		.000

a. Test distribution is Normal.
b. Calculated from data.

One-Sample Kolmogorov-Smirnov Test (after)

		Unstandardized Residual
N		288
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	145.16918149
Most Extreme Differences	Absolute	.064
	Positive	.064
	Negative	-.043
Kolmogorov-Smirnov Z		1.085
Asymp. Sig. (2-tailed)		.190

a. Test distribution is Normal.
b. Calculated from data.

Homogeneity tests were conducted through the analysis using Compare Means to determine whether the variance of the independent variables and the dependent variable is the same or not. Based on the output of the homogeneity test results for all variables, it was determined that the significant value was only found in the export variable, whereas the patent as an independent variable had the same variant (0.055> 0.05). The rest of variables between independent variables and the dependent variable do not have the same variance.

Figure 4: Analysis of Variance among Groups of Independent Variables on the Import Value

Export

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.224E22	254	8.756E19	1.591	.055
Within Groups	1.816E21	33	5.502E19		
Total	2.405E22	287			

Using the SPSS software, we analysed the correlation between the patents and the standards (the independent variable), based on the bivariate correlation analysis, which quantifies the value of Pearson and Spearman's rho, provided that the two independent variables have little correlation value (Pearson = 0.401 and Spearman's rho = 0.446), and are very significant at the level of 0:01 (two-tailed), as shown in the following table.

Figure 5: Values of Correlation between the Two Independent Variables

Correlations			patent	standard
Pearson	patent	Correlation Coefficient	1.000	. 401**
		Sig. (2-tailed)	.	.000
		N	288	288
	standard	Correlation Coefficient	. 401**	1.000
		Sig. (2-tailed)	.000	.
		N	288	288
Spearman's rho	patent	Correlation Coefficient	1.000	.446**
		Sig. (2-tailed)	.	.000
		N	288	288
	standard	Correlation Coefficient	.446**	1.000
		Sig. (2-tailed)	.000	.
		N	288	288

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The author observed the relationship between each independent variable and the dependent variable, and it was found that the relationship between the development of national standards and performance of exports is relatively small but significant (Pearson = 0134 * or Spearman's rho = 0151 *). In addition, the relationship between growth in the number of patent and export performance is very small and insignificant. This shows only the development of standards that has an influence on export performance.

Correlation with the other independent variable (the performance of import value and growth in the number of patents or the development of national standards) is very significant, but with a small correlation coefficient (Pearson = 0.446** or 0.420 ** and Spearman's rho = 0.442** or 0.425 **). Based on the regression coefficients of independent variables, it can be avowed that the effect of the number of patents on import performance is greater than the standards' development.

The independent variables were tested to compare the effect on the dependent variable, where the value of the regression coefficient should be standardised. Standardised regression coefficients are indicated by the value of Beta. Based on Beta, value is obtained for the growth in the number of patents that have a positive influence (0,050), but are not significant to the performance of the export value, while the development of the number of national standards provides a negative influence (0.038), and no significant effect on export performance. Additionally, the effect of the development of the number of patents on the performance of imports, have a positive influence (0.512), and are significant, while the national standard did not have a significant influence but is still positive (0.037).

Figure 6: Beta Coefficient for the Growth of Patent on each the Dependent Variable

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.158E9	8.148E8		7.557	.000
	Patent	688008.660	853127.834	.050	.806	.421
	Standard	-1930477.334	3151079.720	-.038	-.613	.541

a. Dependent Variable: export

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.802E9	6.455E8		2.792	.006
	Patent	6589054.386	675855.802	.512	9.749	.000
	Standard	1757942.250	2496314.652	.037	.704	.482

a. Dependent Variable: import

When we observe the distribution of data among a group of independent variables (standard and patent development), which is quite large (standard deviation from the standard deviation of the sector, 228.19), we also need to find the best model that will affect trade performance. Method Enter is an analysis in which all independent variables are included as variables on the dependent variable; likewise, Method Remove is used to seek the dominant variables, and variables that have no effect, will be discarded. With SPSS program, the data are processed using both of these methods and the results obtained are as shown in the figure below.

Based on the Summary Model, and assuming that model 1 is the best model ($R^2 = 1.000$), and based on the value unstandardised Coefficients Beta that the independent variable patent offers positive contribution to the export performance, includes: wearing apparel sector, textiles sector, leather and related products sector, wood and products of wood, sectors of food products and beverages, tobacco products sector, construction sector activities and sectors of motor vehicles, trailers and semi-trailers, civil engineering. Other independent variables that are standard, and which make a positive contribution in this model, are the furniture sector, transport equipment sector, and construction activities and civil engineering sector. This model also has a patent, which had a negative impact on the export performance, namely rubber and plastics products sector, transport equipment sector, and furniture sectors. The standard which had a negative impact on this model includes the computer, electronic and optical products sector, tobacco products sector, and paper and paper products sector.

Figure 7: The Best Model is based on the Value of R Square for each Dependent Variable

Variables Entered/Removed[d,e]

Model	Variables Entered	Variables Removed	Method
1	St_T, St_N, Pa_R, Pa_D, Pa_E, Pa_C, St_R, Pa_B, Pa_P, Pa_Q, Pa_K, Pa_T, St_B, St_Q, St_F, Pa_A[a]	.	Enter
2	.[b]	Pa_A, St_F, St_T, Pa_T, St_B, Pa_K, Pa_Q, Pa_P, Pa_B, St_R, Pa_C, Pa_E, Pa_D, Pa_R, St_N, St_Q[c]	Remove

a. Tolerance = .000 limits reached.
b. All requested variables entered.
c. All requested variables removed.
d. Dependent Variable: export.
e. Linear Regression through the Origin.

Variables Entered/Removed[d]

Model	Variables Entered	Variables Removed	Method
1	St_T, Pa_D, Pa_M, Pa_C, Pa_R, Pa_E, St_P, St_N, Pa_N, St_R, St_B, Pa_F, Pa_B, St_Q, St_L[a]	.	Enter
2	.[b]	St_R, Pa_M, St_Q, St_B, Pa_F, St_L, Pa_B, St_T, Pa_N, Pa_E, St_P, Pa_R, Pa_C, Pa_D, St_N[c]	Remove

a. Tolerance = .000 limits reached.
b. All requested variables entered.
c. All requested variables removed.
d. Dependent Variable: import.

With careful examination, the author discovered four groups of the same sector between patents and standards that give effect to the performance of exports; 75% (or 3 sectors) contributed to influence a contrary or opposite direction, and there is only one sector (construction activities and civil engineering) which shows growth in the number of patents and national standards, and provides a positive effect on the value of exports. From the analysis, it was also found that the standard variable beta coefficient is very large in the furniture sector, and is very different from the other variable coefficients. This suggests that the standard of the furniture sector is the most positively contributing influence (about 14.45 times) among the other sectors on the performance of export value.

The best model for the performance of imports, the independent variable patents, that contributes towards the positive influence on the import value include the furniture sector, wearing apparel sector, textiles sector, leather and related products sector, paper and paper products sector, and basic metals, fabricated metal products sector. A positive effect on the variable standard include other non-metallic mineral products sector, other transport equipment sector, tobacco products sector, computer, electronic and optical products sector, motor vehicles, trailers and semi-trailers sector. A negative effect of the patents' variables to import

performance was noted in the tobacco products sector, wood and products of the wood sector, and computer, electronic and optical products sector. Additionally, the standard variable was found in the furniture sector, and construction activities, and the civil engineering sector.

When observed further, both the independent variables showed that there are three equal sectors seen between the standard and the patent influence on the performance of imports. It is surprising to note from these findings, that 100% of the sectors (furniture sector, tobacco products sector, and computer, electronic and optical products sector) contribute towards contrary or opposing influence. There are other observations on patent and the national standard for every sector which, contributing together, contained trade performance, obtained 66% of the standard and 33% of patents, providing a positive contribution. This means that the standard contributes more directly and positively than the growth of patents, to the performance of trade.

In a simple method, when we compare the charts from growth of patents, standard, and trade performance for each sector, a surprising result revealed that only the sectors of patent and import demonstrated a common high growth, and even then, that too only in two sectors; namely, sectors of chemicals and chemical products, and sectors of machinery and electrical equipment. The development of every sector that is high on the standard variable and exports greatly contrasts with the development of sectors in patent and import.

CONCLUSION

The data regression analysis, as a whole, the coefficient value shows a growing influence of the patent (Pearson = 0.446 **, or Spearman = 0.442 **) to be greater than the national standard development (Pearson = 0.420 **, or Spearman = 0.425 **), against the import performance in Indonesia. Based on the Standardised Coefficients, Beta found that patent growth (exports = 0.050, imports = 0.512) had more influence than the national standards development (exports = -0038, imports = 0.037) on the performance of the trade. Hence, in the overall variable data, the growth of patent is more impactful than the development of national standards on trade performance.

From the results obtained, it can be seen that the impact of the growth of standards and patents in several sectors, that have an effect on some influential sectors in best model, approximately 75% of the performance of export value and 100% of the performance of import, goes in the opposite direction, or is contradictory. In Indonesia's case, it can be interpreted that the effect of the national standards development is in contrast with the effect of growth in the number of patents on the trade performance of either exports or imports. This was in line with the policy guidelines for the development of national standards (PSN 03.1: 2007), to avoid the

use of a patent, or part of the patent, on standard products, and this is also found by Swann (2010). Therefore, it is reasonable if the development of the national standard goes against the growth in the number of patents to improve trade performance.

This paper also determined a sector with a growing number of patents, and the development of national standards makes a positive contribution to the total export value; these activities include the construction sector and civil engineering. It was concluded that both patent and standard, have small correlation or are relatively independent (with coefficient Pearson = 0.401 and Spearman's rho = 0.446), but significant (0.000, at the 0:01 level), and that both of them contribute to the export performance. The relationship between innovation and standards that occurred in this sector, are also found in the study by Blind (2006).

Based on the charts of sector growth on each variable, it has been found that the development direction based on patent, standard, and trade, are very different from each other. It is obvious from around the 20-sector based ICS classification, that only two sectors are the same between patent and import that have high growth; however, they are not related to one another. In addition, both these sectors are not included among the variables that influence in the best model. Hence, it can be concluded that even these sectors have no effect on the trade performance despite making rapid progress.

In this paper, we can see that the contribution of innovation and standard on trade performance is either contradictory or follows the same direction. For a more comprehensive result, we cannot ignore the many other factors that support the development of infrastructure on both. Future research needs to focus on the several factors of infrastructure on innovation and standards that have an influence on the value of trade.

ACKNOWLEDGEMENTS

As the author, I would like to convey my gratitude to the Directorate General of Intellectual Property, Jakarta for sharing the dataset of patent and trademark, and to colleagues at BSN and TU Berlin, for their comments and suggestions. I would also like to thank the Puslitbang BSN for their support in facilitating access to the publication of this paper.

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