INTELECTUAL PROPERTY AS THE ELEMENT OF THE STEEL INDUSTRY INNOVATIVE POTENTIAL

SZMAL Arkadiusz

Silesian University of Technology, Zabrze, Poland, EU, arkadiusz.szmal@polsl.pl

Abstract

The Steel industry companies operate in difficult and changing environment of significant competitive pressure. Trying to strengthen their market position, continuous search for competitive advantages must be carried out. This is done in both strategic and operation fields, however steel industry companies do not undertake courageous strategic decisions concerning investment projects. So far, cost optimization was the predominating strategy, enabling maintenance of the competitive position on the market, nevertheless this strategy has to drain someday. Steel industry faced new development challenges. Innovations are among the methods, enabling increase of the efficiency of resources management. Can we, however, observe the supply of the protected innovations? At which stages of the value chain creation process can they be observed? Article provides analysis of the availability of innovations in that field, with emphasis on European patents. Therefore, development of the methodology for seraching protected innovations and their statistical analysis in the context of steel industry value chain, became the main goal of this article.

Keywords: Steel industry innovations, innovations supply, R&D in steel industry

1. INTRODUCTION

1.62 billion tons of steel were produced last year. At the same time unused production capacity is up to 720 billion tons. The decline in demand, 30% of excess production capacity, a slowdown in China and the EU climate policy are the critical challenges for the steel industry in the world. Many researchers indicate trends that are to shape the development of metallurgical enterprises. These include energy saving, product quality, compact plan solutions, operational flexibility, productivity increasing, safety [1]. Many studies indicate the tools perfecting the strategy and its implementation as a key element in dealing with contemporary challenges [2]. Much attention in the research is paid to studies on use of new fuels [3], [4], [5]. Tightening of environmental regulations threatens steel industry with undermining of its market position and loss of profitability. Hence, there are many papers focusing on environmental solutions and technological eco-innovations dedicated to steel industry [6]. Competitive advantages are searched for in the area of logistics [7] but business models using innovation should be identified as the most important for the development of metallurgical enterprises [8]. Hence such business models that are able to generate and diffuse innovation are becoming increasingly important. It is of great importance whether companies can start innovative activity proper for their needs [9], [10]. Innovative activity is concentrated among others on the search for new technological solutions. Building competitive advantage is increasingly possible thanks to the ability and effectiveness of the company to introduce various types of innovations, both ones that are their own solutions as well as innovations applied due to their transfer. The growing importance of technological leadership requires access to genuinely new and valuable solutions. However, is there a sufficient supply of these solutions? Analysis of the amount and structure of the intellectual property present in patent data bases in the context of the steel industry value chain has been carried out in the article in order to assess availability of these solutions for enterprises. Such approach enabled achievement of the main goal of this article, i.e. to investigate whether intellectual property is the real element of the steel industry innovative potential.

2. INTELECTUAL PROPERTY IN VALUE CHAIN OF METALLURGICAL INDUSTRY

The aim of the study and analysis of patent database results was a quantitative assessment in terms of selected international patent classes - their structure, origin, date of publication. The analysis was carried out

in terms of global and local trends based on the example of Poland. As the source of the data the European patent databases were used i.e. search systems of the European Patent Office PATSTAT Autumn Online and espacenet.com and the base of the Polish Patent Office. The process of data collection and processing was performed with the use of software and available tools of the applied data bases (PATSTAT Autumn Online). The scenario of data preparation for analysis was consistent with the **Figure 1**.

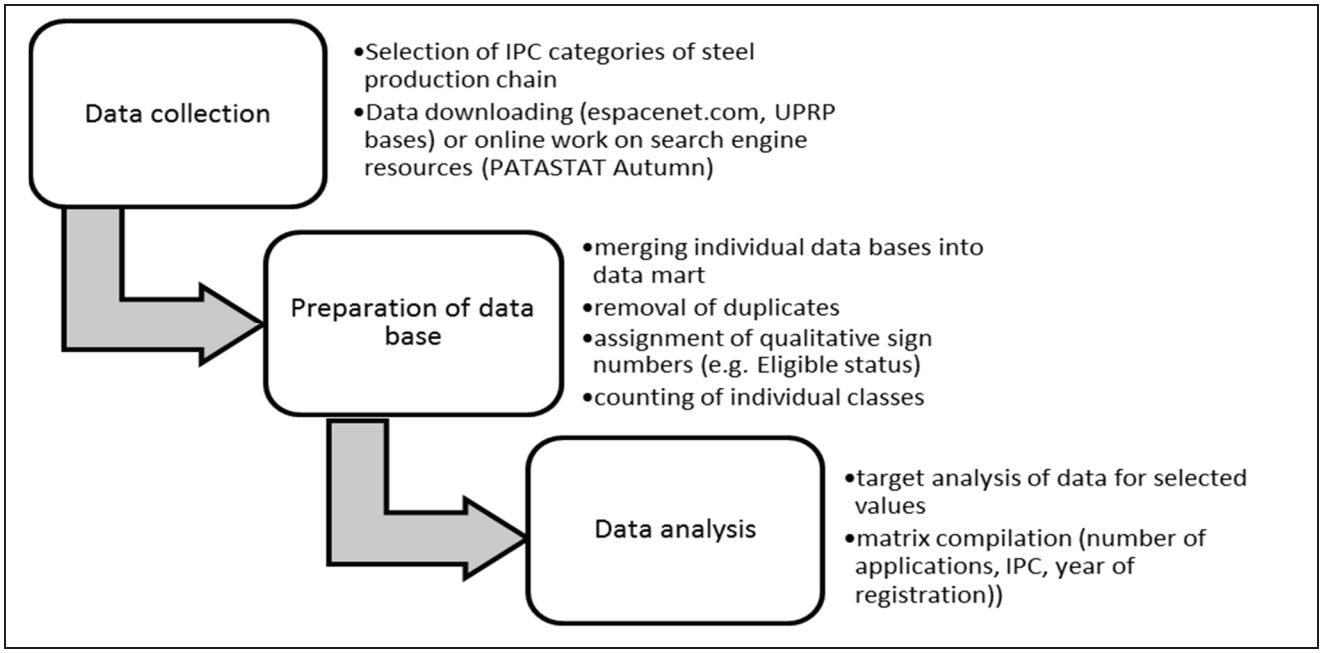

Figure 1 Diagram of the selection and analysis of international patent classes. [11] Materials of Center of Innovation and Technology Transfer of Silesian University of Technology.

Table 1 Allocation of International Patent Classification (IPC) categories along the value chain, Innovation trends steel 2015, PWC Report [12]

Level of value chain	IPC-Category IPC = International Patent Classification	Description
Metallurgy	C21B	Extraction of iron or steel
	C21C	Processing of pig-iron, e.g. producing steel
	C22C	Alloys
	C22B	Pretreatment of raw materials
Hot & cold forming	C21D	• Change in the physical structure of ferrous metals; • General devices for heat treatment of ferrous or non-ferrous metals or alloys; • Making metal malleable by using decarburization, tempering or other treatment methods
Finishing	C25,C,D	Electrolytic or electrophoretic processes
Processing	B21, B, C, D, F, H, J, K, L	Rolling metal, production of forged or pressed products etc.
	C23, C, D, F, G	Coating metallicmaterial

The following international patent classes (IPC) contained in **Table 1** were adopted for the purposes of identification of category of technology in the steel industry production chain. The model of division is consistent with the one proposed by PWC Strategy& in the"Innovation trends in steel in 2015 - Analysis of patent publications in steel and its implications"conference paper.

Analysis of patent applications for patent classes assigned in such a way to level of value chain was done in the European Patent Office (**Figure 2**) and the Polish Patent Office (**Figure 3**). Analysis of the structure of patent applications in the steel industry includes **Figure 4**.

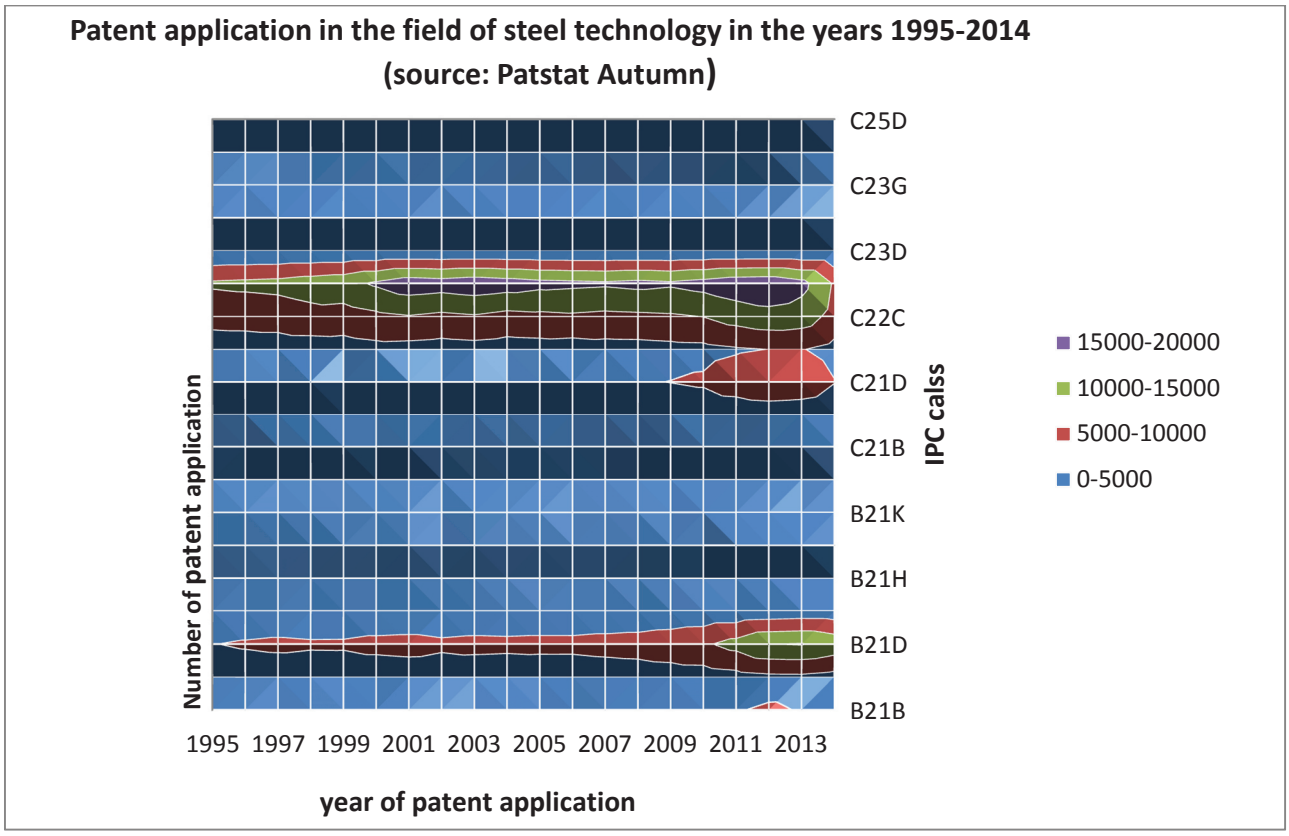

Figure 2 Patent application in the field of steel technology in the years 1995-2015. Source: Patstat Autumn.

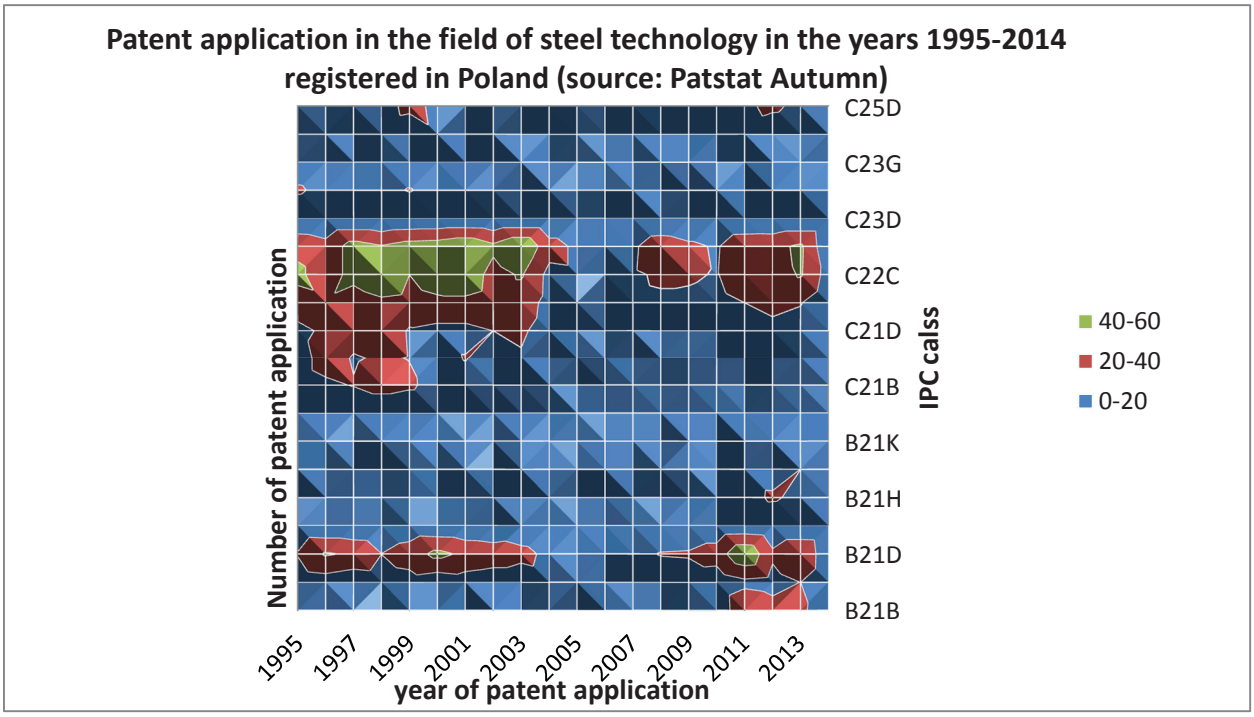

Figure 3 Patent application in the field of steel technology in the years 1995-2015 registered in Poland Source: Patstat Autumn. EPO

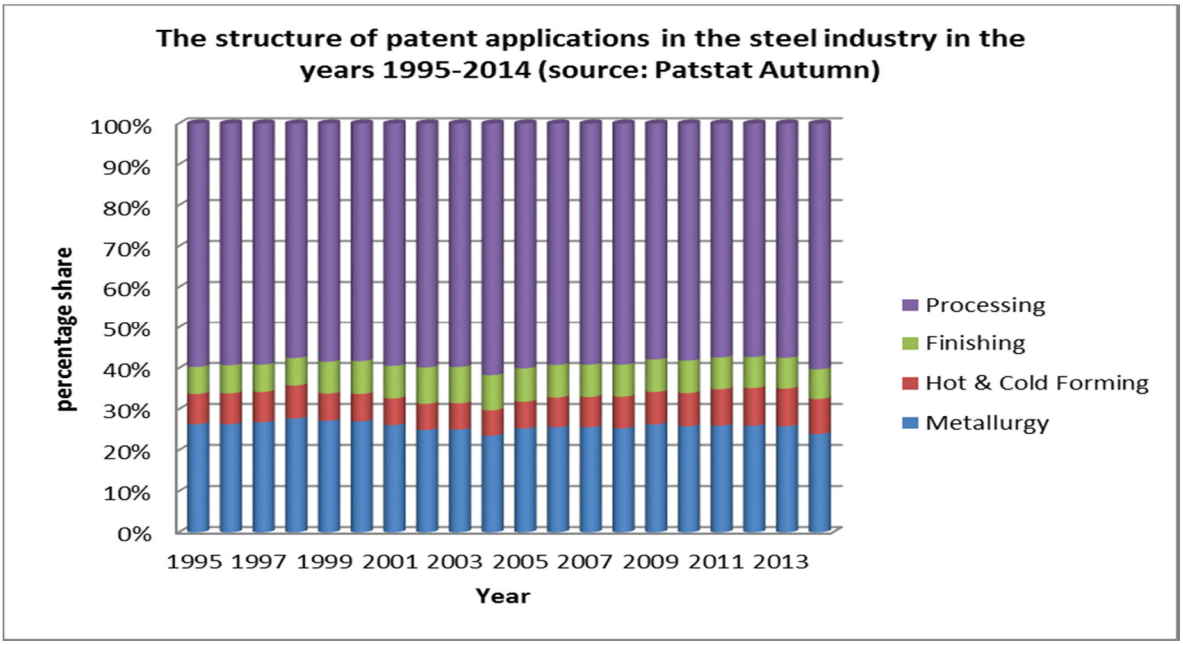

Figure 4 The structure of patent aplications in the steel industry in the years 1995-2014
Source: Patstat Autumn.

The largest number of the world's patents occurs in IPC-Category C23C group in the field of Processing Level of value chain. The second place with regard to the number of patents is in Category-IPC B21D also in the Processing field. Equally numerical representations are in the IPC-Category C22C in the field of Metallurgy. The following places are occupied by the IPC-Category C21D in the field of Hot & cold forming and B21C in the Processing field. The other IPC-Categories are significantly less numerically represented. A picture emerges from this review showing which parts of the value chain are protected by the largest number of patents according to the International Patent Classification (IPC). It is worth remembering that the Intellectual Property forming market monopoly zones improves the competitive position of companies that have access to it. Analyzing what place in the analyzed European patent structure have applications from Poland, one can see a few dependencies. Most applications coming from Poland concern IPC-Category C22C in the field of Alloys and C23C Coating metallic material. A significant share of patents can be also observed in IPC-Category B21D and B21B. Therefore it can be concluded that the activity of Polish innovators corresponds with the trends of the European Patent Office statistics.

3. PERSPECTIVE OF CREATING INNOVATIONS IN POLISH STEEL INDUSTRY

Many valuable solutions can arise if expectations of industry and proposals of R & D centers are confronted in one place. However, it is a difficult task as it is essential to use the entire range of the latest technologies during creation of specialized products. These are expensive projects and carrying great layers of risk. Taking into consideration the state of Polish steel industry it may not meet the challenge of formulating accurate research agenda and founding its implementation only by itself. By the end of 2006 Polish steel sector has completed the restructuring process resulting in the disposal of obsolete and inefficient production capacity and non-organic production processes. This is an important step but clearly insufficient to gain a global competitive advantage. In order to provide the Polish sector with real possibilities of competition with industry from countries with greater innovation (Western Europe), or from countries with significantly lower labor costs and much less stringent environmental requirements (Asian countries), it is necessary to begin R & D activities. For this purpose it is necessary to ensure adequate support for the activity of research and development sector, including inter alia actions leading to the development of new, innovative steel products and production technologies, new and improved input materials and alloys for metallurgical production, recovery and recycling

of raw materials from metallurgical wastes and scrap, energy use optimization, feedstock, reducing harmful emission into the environment, innovative solutions modernizing and supporting the metallurgical production technology processes. Polish government recognizing the enormity of the challenges launched an INNOSTAL program. The aim of the program is to support the Polish steel industry in the field of production of innovative products tailored to the needs of the market in Poland and abroad. The main objective of the INNOSTAL program is to increase competitiveness and innovativeness of Polish economy in the area of the steel industry and sectors related to it [13]. The indicated main objective results primarily from the need to counter the main threat to the steel sector in Poland, i.e. the loss of competitiveness due to the low level of expenditure on R&D activity and lack of new technologies. Achievement of the objective of the program will be monitored by means of the number of new implementations documented within 5 years from the completion of the project implementation. It is assumed that as a result of the program at least 30 new products / technologies will have been implemented until the end of 2028. Being aware of the great challenges facing the industry the initiatives to build a network of cooperation for effective development are taken [14]. Challenges and factors of competitiveness in the steel sector are examined which gives grounds for formulating effective innovation activities [15]. Implementation of the research program with such objectives is also a huge challenge for the research partners involved in the implementation of the program. However, there are many reputable centers, including ones in Poland, which should meet the intellectual and organizational requirements.

4. CONCLUSIONS

Challenges concerning increase of the productivity, quality requirements and reduction of the energy consumption will dominate directions of the steel works development. Innovations focusing on new products and fulfilling requirements of the final clients will be essential in the nearest years. Methodology used in this article proved to be efficient because it enabled identification of the amount and structure, according to the patent classes, of the innovative solutions in the steel industry. Identified protected inventions were assigned to the elements of the steel industry value chain and their intensity at each element of the value chain was presented. This shown how strong monopolies, resulting from the patent availability, can be observed at numerous elements of the value chain. This impacts directly possibility of participation in the value chain.

Shortening innovation cycles and new application requirements require integrated R&D programs. Analysis of the new patent applications in steel industry indicates that the supply of the innovation solutions is insufficient. Intellectual property does not improve competiveness of the steel industry sufficiently.

Activeness of the Polish steel companies in creating innovations is insufficient. This results from the shortage of the R&D financing and poor cooperation between science and business. In June, 2016 INNOSTAL program shall be started which is extremely expected. The aim of this program is to support Polish steel industry in introducing to the Polish and foreign market innovative products of high quality. It is worth emphasizing that analysis of the patent applications carried out for both world and Polish trends, shown some similarities, however intellectual property in Poland is still much more potential than real element of the Polish steel industry innovations

REFERENCES

[1] TSCHIRKY, H. *Bringing Technology and Innovation into the Boardroom. Strategy, Innovation and Competences for Business Value*, European Institute for Technology and Innovation Management, PALGRAVE MACMILLAN, 2004, p.27.

[2] BLACHA, L., BRZÓSKA, J. The use of the balanced scorecard in evaluating the results of the innovations implemented in metallurgical companies. *Metalurgija*, 2016, vol. 55, issue 4, pp. 790-792.

[3] SZMAL, A., JODKOWSKI, M. Technical-economic perspective of using composite alternative fuels in metallurgical production, *METAL 2015, 24th International Conference on Metallurgy and Materials*, TANGER, Ostrava 2015.

[4] ŁABAJ, J., JODKOWSKI, M., SZEJA, W., HEHLMANN, J., KOZIOŁ, M. Alternative binder for copper concentrate briquetting, *Metalurgija,* 2015, vol. 54, issue 4, pp. 646-648.

[5] HEHLMANN, J., SZEJA, W., JODKOWSKI, M., BEK, P. *Method for producing composite molded fuel from slurries of coal and coke, involves forming plastic homogeneous mixture by evaporating residual moisture at low temperature in moldings*, Patent Number: PL393363-A1.

[6] RYSZKO, A. *Proactive environmental strategy, technological eco-innovation and firm performance* - case of Poland, Sustainability, Vol. 8, Issue 2, 2016:156.

[7] MATUSEK, M. Supplier selection process supporting sustainable development - using analytic hierarchy process to determine priority factors. *In CLC 2015: Carpathian Logistics Congress.* Ostrava: TANGER, 2016, pp. 404-411

[8] BRZÓSKA, J. *Innowacje jako czynnik dynamizujący modele biznesowe*. Wydawnictwo Politechniki Śląskiej 2014.

[9] SZMAL, A. Condition and prospects of innovative activity in the steel industry in Poland, *METAL 2013: 22nd International Conference on Metallurgy and Materials, Conference Proceedings,* TANGER, Ostrava 2013, p. 2036-2042.

[10] SZMAL, A. The role of innovative initiatives in innovative activities in the enterprise, *2nd International Multidisciplinary Scientific Conference on Social Sciences and Arts. SGEM 2015*, Albena, Bulgaria. Conference proceedings. Book 2, Political sciences, law, finance, economics and tourism. Vol. 3, Economics and tourism. Sofia: STEF92 Technology, 2015, pp. 915-922.

[11] SZMAL, A., ZIEMSKI, P. Materials of Center of Innovation and Technology Transfer of Silesian University of Technology, 2016.

[12] PWC Report „Innovation trends in steel 2015 -Analysis of patent publications in steel and its implications http://www.stahl-online.de/wp-content/uploads/2013/09/20150616_Innovation_trends_steel_2015_EN.pdf

[13] http://www.ncbir.pl/

[14] KNOP, L., ODLANICKA-POCZOBUTT, M. Antecedencje i konsekwencje trwałości sieci - podstawowe założenia badawcze. Organizacja inteligentna. Perspektywa zasobów ludzkich. Red. Cezary Suszyński, Grażyna Leśniak-Łebkowska. Warszawa: Szkoła Główna Handlowa - Oficyna Wydawnicza, 2016, pp. 415-430

[15] SZMAL, A. The competitive challenges for the Polish steel industry, *METAL 2014: 23rd International Conference on Metallurgy and Materials, Conference Proceedings*, TANGER, Ostrava, 2014, pp. 1914-1919.