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The Green Jobs and the Industry 4.0

Grzegorz Michalski[1], Małgorzata Rutkowska[2], Adam Sulich[2], Robert Rohe[2]

[1] Faculty of Engineering Economy
Wrocław University of Economics, Poland
[2] Department of Infrastructure of Management,
Wrocław University of Science and Technology, Poland

WORMS is a joint initiative of the Management Science departments
of the Wrocław University of Science and Technology,
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

Grzegorz Michalski
Wydział Ekonomiczno-Inżynieryjny
Wrocław University of Economics

Małgorzata Rutkowska, Adam Sulich, Robert Rothe
Department of Management Infrastructure
Faculty of Computer Science and Management
Wroclaw University of Science and Technology

THE GREEN JOBS AND THE INDUSTRY 4.0

Abstract

This paper presents and discusses The Industry 4.0 and the "green jobs" definitions and their mutual relations. The Industry 4.0 is a synonym for a new age of technological jump based on digitization and extended Internet connection between devices. Next to this progress also important are a sustainable development and its measurable implementation in labour market – green jobs. Green jobs are decent jobs, either in traditional sectors or in the new green ones, which contribute to preserving or restoring a sustainable environment. This combination of innovation and progress approach can be interesting solution not only for business but also for non-profit organisations which are the subject of the research in this paper. Furthermore, the role of non-profit organizations is examined and described in aspect of changes in green economy and The Industry 4.0 with special emphasis on the maintenance of their capital structure.

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1. Introduction

The non-profit organizations are the organizations which have been formed by a group of people in order to pursue, a common not related with income, goal. A non-profit organization is often dedicated to furthering a particular social cause or advocating for a particular point of view. These type organizations are also members of market; moreover, they are more vulnerable in case of any economic instability. Related to the latest economic crisis and growing in this period unemployment rate, especially among young people, in European Union, there is a need for a new approach according to the shape of the future jobs also in non-organizations sector. Once occurred the crisis can repeat, therefore solution how to avoid its effects is very important. On the other hand the expectation of a nowadays society has been changed significantly. In the past the market was driven by producers. Today this trend from the past is totally inverted and is driven not only by the customers, but also non-profit organizations. The customers' choicesare a source of variance in products and services, what induces a direction of progress. Producers and service providers have recognized it and rearranged their factories for high variability of products to aim in better manner the

customers' expectation which is nowadays more pro-ecological oriented.This paper proposes an answer for this market challenges as a solution which is an effect of combination of two ideas, namely The Industry 4.0 and the green jobs. These two concepts are combined by technologies related directly with the usage of renewable energy resources and environment protection.

The aim of this paper is to analyse of green jobs creation in the aspect of The Industry 4.0 idea. Second goal of the article is to promote the social development based on sustainability and ongoing progress represented by a green jobs idea. These two goals are based on the research of the non-profit organizations performed in Poland, which are interested in The Industry 4.0 and green jobs or at least one of them.

The methodology used in research is based on a review of available national and foreign literature and research among non-government organizations. Then an analysis of documents related to this program is performed and linked with green jobs. In the near future the jobs can become more challenging for employees, especially in manner of their flexibility in case of time, space or content[1]. Candidates not only should be prepared for their future tasks, equipped with competencies which allow them matching with offered position and ensure them employability.Future work places should be well addressed to future employees. One of the main solutions to face these challenges on this level can be combination of the Industry 4.0 and green jobs, which are nowadays often discussed topic in the various circles – professional and scientific.

2. The genesis and definition of the Industry 4.0

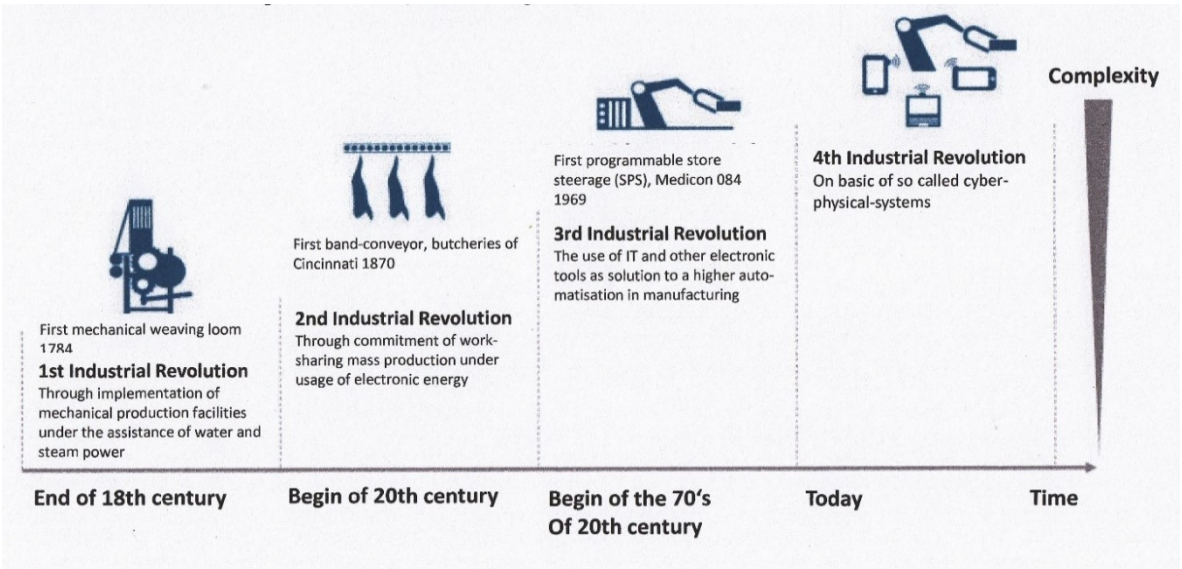
The Fourth Industrial Revolution, represented by the digitization and progress in the working conditions is one of the greatest challengesof present time. The digitization is going to be more and more reality through the development in area of Information and Communication Technology (ICT). These elements of The Industry 4.0 can have significant impact in art and way of acting in the economic environment, in working and last but not least in private life.The influence of The Industry 4.0 is so high, that it is proper to call it even The Digital Revolution. At the beginning of this development there wasa phase of computerisation, when popularity of computers rose. In this period of time the Internet was in the building up process. After that started the period of microchips and different sensors,

[1]Spath D., *Industrie 4.0; die vierteindustrielle Revolution*, Arbeit und Arbeitsrecht: AuA: Personal, Praxis, Recht; Huss-Medien GmbH, Berlin 2013,p. 385.

which through the years of course have been cheaper and performance of its improved[2]. These were the foundation stones that made first possible the forming of digitized world in shape of The Industry 4.0.

The Industry 4.0 changes qualitatively the whole organisation and management, not only in context of the shop floor management, but entire value creation chains. From idea of to-produce-product, over development and assembly, till to the distribution to the customers, recycling of products and after sale management, everything will be digitized. This manner is also common with the customers' expectations for individual custom desires and wishes[3]. The term The Industry 4.0 suggests that it is already a fourth development stage of the industry related to a timeline. The idea of constant progress is presented on the Picture 1. The sources of progress are mostly discoveries and improvements or small changes which brings better effectiveness and efficiency. All steps of progress need a time to be developed or to understand their impact to the future. The biggest impact of The Industry 4.0 is expected in the productive area like for instance at the machine and plant equipment makers or car manufacturer industry and its whole value chain.

Picture 1: The development stages of industry from 18th century.



Source: Kempf D., Bauer W., *VolkswirtschaftlichePotenziale von Industrie 4.0; Präsentation*, p. 2.

[2]Franken S., *Führen in der Arbeitswelt der Zukunft; Instrumente, Techniken und Best-Practice-Beispiele*; Springer Gabler; Springer Fachmedien, Wiesbaden 2016, p. 4.
[3]PlattformIndustrie 4.0, *UmsetzungsstrategieIndustrie 4.0. Ergebnisbericht der PlattformIndustrie 4.0*. http://www.its-owl.de/fileadmin/PDF/Industrie_4.0/2015-04-10_Umsetzungsstrategie_Industrie_4.0_Plattform_Industrie_4.0.pdf, p. 9, (accessed: 13.07.2017).

Indeed, in the past there were three more industrial subsequent periods defined nowadays by numbers as industry 1.0, 2.0 and 3.0 respectively. The beginning of these forms is datedin the end of the 18th century and the last one is present. The picture 1 shows the development from simple first stage with increasing complexity with time 1.0 to the Industry 4.0 (outlined shortly above) have been presented.

In the end of the 18th century (during the existence of Industry 1.0) started the very first art of the mechanisms construction - in this case through the usage of water and steam power. In the past was existing only manual labour, which had been to that time partially mechanised through „new work mate" – the machines but still based on human or animal's force – so it was pre-industrial time. However before the 18th century there was also a new development trend of discoveries related to renewable energy sources and machine construction such as: wind-powered machines (i.e.: windmills, vessels and pumps) and water-powered constructions.

During The Second Industrial Revolution the single work processes came to the centre of the interest. Thus the work processes had been optimised through the input of machine tools as the first form of the automation till there[4]. In this period of time the electric energy was in use as a main source of machine power. Besides the first band-conveyor was invented and with this work-shared mass production was able at that time. At the beginning of the 20th century Germany reached already the leadership in several sectors of the economy, such us: chemistry, electro technology, mechanical engineering or optical industry[5].

The next form of the Industry was Industry 3.0 which lasted from 1969 to 2014[6]. In thattime the several IT solutions and electronic tools came into operation. First programmable store steerage was invented, just like the first numerical controlled machine tool or the internet[7].Finally The Industry 4.0 phase, that is now, on the basic of so called cyber physical-systems is the main aim is to optimize or to digitize the whole value added chain (from the design of a product till its after-sales period of time)[8]. All these shall be happen through the networking of digital tools among each other. This circumstance is also summarized as

[4]Schäfer S., *Industrie 4.0 – die smarteFabrik*, https://www.ihk-berlin.de/blob/bihk24/produktmarken/branchen/industrie/downloads/2272472/5cdaac4e374ea55713a7ed4e3065ebf3/Vortrag_Prof_Dr_Schaefer-data.pdf, p. 6(accessed:13.07.2017).
[5]BundesministeriumfürBildung und Forschung (BMBF). Zukunftsbild „Industrie 4.0". Hightech-Strategie. Bonn Referat IT-Systeme; 2012, p. 10.
[6]Schäfer S., *op.cit*. p. 7.
[7]BundesministeriumfürBildung und Forschung (BMBF). *op.cit*. p. 10.
[8]Schäfer S., *op.cit*. p. 9.

Internet of Things (IoT)[9]. There is no universal definition of the term – The Industry 4.0, which is valid for each field of the industry and is more an idea or approach of description of continuous development of the technology presented on the Picture 1. There are numerous definitions, inin this chapter presents. The main idea of The Industry 4.0 is „*the intelligent networking of objects with embedded steering*"[10]. With this software ability will be possible the management of a shop floor nearly without human interaction. In this case is imaginable, that a factory, after incoming new order, is able to realise fully autonomous a custom wish.

Because of the installed communication systems (software and hardware) inside any object it is possible to manage better all processes ongoing in a factory. An example can be here the company, which is using this modern system to be able to response for any issue occurred in the process bottleneck to use better its resources. The maintaining operations, if needed, in this case will last likely shorter, cause the maintenance department would earlier get the information about defects at a specific facility.

IfoSchnelldienst defines The Industry 4.0 as: „*The Industry 4.0 in a strict sense can be considered as synonymous for the Internet of Things. Physical objects are clear identifiable over its IP addresses and communicate to each other via internet (so called cyber-physical systems). These systems of information are connected with other systems and applications"*[11].

Another definition proposed by the „PlattformIndustrie 4.0" understand under the term – The Industry 4.0 as the *„fourth Industrial Revolution, the one of the new stage of organisation and controlling of the whole value-added chain over the lifecycle of products."* Further we read *"The basic is the availability of all relevant information in real time through the network of all participated instances along the added value and the ability, from these data at any time deduce the optimal value-added flow. Through the bonding of humans, objects and systems there are created dynamic, real time optimal and self-organized the company comprehensive value-added networks, which can be optimized regarding to different criteria, as spending, availability or consumption of resources"*[12].

Finally Bauer et al. put in the middle of the Industry 4.0 the intelligent „*networking of humans, machines, objects information and communication systems to dynamic controlling of complex systems, which shall enable independent information exchange between intelligent*

[9]Schäfer S., *op.cit*. p. 11.
[10]Spath D., *Industrie 4.0; die vierteindustrielle Revolution, Arbeit und Arbeitsrecht*: AuA: Personal, Praxis, Recht; Huss-Medien GmbH, Berlin 2013, p. 385.
[11]*Industrie 4.0 digitaleWirtschaft; Herausforderung und Chance fürUnternehmenundArbeitswelt*; IfoSchnelldienst 10/2015; 68. Jahrgang; 28. Mai 2015.
[12]PlattformIndustrie 4.0; *Was Industrie 4.0 (füruns) ist*? www.plattform-i40.de/was-industrie-40-für-uns-ist, (accessed: 13.07.2017).

products, machines and factory equipment, initiating operations and be able to autonomous real-time steering"[13].

Swetlana Franken understands The Industry 4.0 as: "*the change of professional and private life owing to constant growing spread of the solutions in areas of Information and Communication Technologies*"[14].

Taking all above into consideration for purpose of this article the Industry 4.0 is represented by digital progress which is also represented by renewable energy sources management and related technology, which change sustainable development idea to practice. Therefore in a universal definition of the Industry 4.0 should not be missing the environmental part which include monitoring of: energy management, factory waste water and electricity usage.

3. Green Economy as a source of innovativeness

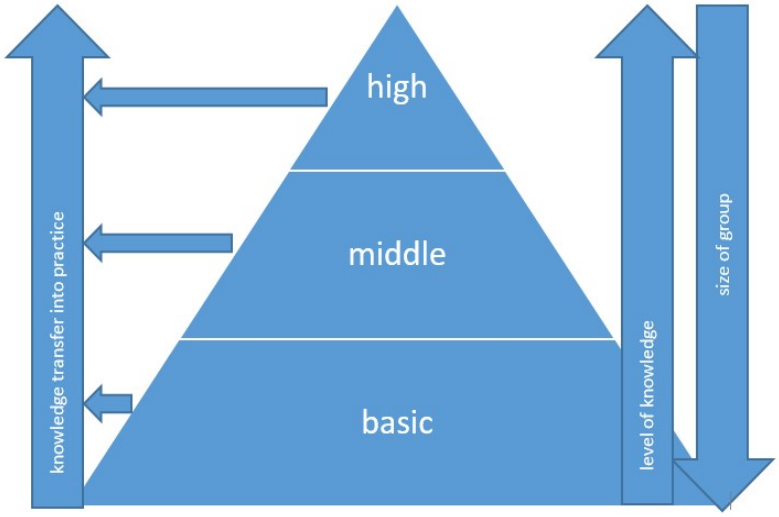
The Green Economy concept is widely discussed in many circles due to its qualitative and quantitative aspects; however innovativeness is represented by the blue economy concept which originated from the social economy. The blue economy is an idea introduced by Gunter Pauli in his book from 2010, in which author expresses the ultimate aim that blue economy business model will shift society from scarcity to abundance with resources locally available, by tackling issues that cause environmental and related problems in new ways[15]. Therefore it is able to consider the blue economy as a part of bigger idea of the green economy, because Gunter Pauli highlights potential benefits in connecting environmental problems with open-source scientific solutions to achieve sustainable development. This book suggests that human society can focus on the generation more value instead of blindly cutting costs; therefore there is a need to use simpler and cleaner technologies. Indeed, the innovation economy can be combined with green economy approach to create economic benefits and jobs.

This phenomenon was described by pyramidal model of knowledge transfer[16]. This model states that innovation comes from well-educated small group of society with ideas and knowledge how to "make their dreams come true" (Picture 2). On every higher level of pyramid the knowledge size of group is decreasing, but the degree of complexity of their

[13] Bauer W. et al., *Arbeitswelten 4.0 – Wiewir morgen leben und arbeiten*, Stuttgart 2012; p.8.
[14] Franken S., *Führen in der Arbeitswelt der Zukunft; Instrumente, Techniken und Best-Practice-Beispiele*; Springer Gabler; Springer Fachmedien Wiesbaden 2016, pp.1 etc.
[15] Pauli G., *The Blue Economy: 10 years – 100 innovations – 100 million jobs*.Paradigm Publications USA 2010, p.34.
[16]Wrzecioniarz P. [ed.],*Przedsiębiorczość Akademicka Dolnego Śląska*, Media Consulting AgenccyWrocław 2010, pp.9-10, 16-18.

innovation is also bigger. This model shows one huge limitation of the approach of the blue economy: that limited size group (high) has to way across longer distance, than bigger group of basic education. Explanation is that mostly in high knowledge group presents discoveries, whereas basic knowledge only small improvements.

Picture 2: The knowledge pyramid



Source: own elaboration based on Wrzecionarz (2010), p. 9-10.

The green economy is defined as an economy that aims at reducing environmental risks and ecological scarcities, and that aims for sustainable development without degrading the environment. It is closely related with ecological economics, but has a more politically applied focus mostly due to its social dimension in creating so called “green jobs”.

4. Green jobs

~~In~~ the literature of the subject contains many definitions of the term "green job". Without considering their deeper analysis, it was assumed that defining the concept of green jobs based on Eurostat methodology as Environmental Goods and Services Sector (EGSS) which is heterogeneous set of producers of technologies, goods and services that prevent or minimise pollution and minimise the use of natural resources[17]. Thus, environmental activities are divided into two broad segments: environmental protection and resource management. Only those technologies, goods and services are considered that have an environmental protection or resources management purpose as their prime production objective

[17]Eurostat:*Environmental goods and services sector*, 2015,http://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_goods_and_services_sector (available on 15.07.2017).

(i.e. 'environmental purpose'), hence excluding goods and services that are not provided mainly for environmental purposes[18]. Therefore than can be related with changes described above as The Industry 4.0. This definition is very wide, and includes green jobs and employment in protected areas. Mentioned above green jobs or environmental goods and is based at European level on the eco-innovation idea and sustainable development, which have been undertaken by: the European Commission, the OECD and Eurostat.

The European Commission defines green jobs also as 'a form of innovation aiming at significant and demonstrable progress towards achieving the objectives of development by reducing the impact on the environment or achieving a more efficient and responsible use of natural resources, including energy'[19]. Therefore the accepted in this paper definition of green jobs is based on the Eurostat and European commission is quantitative.

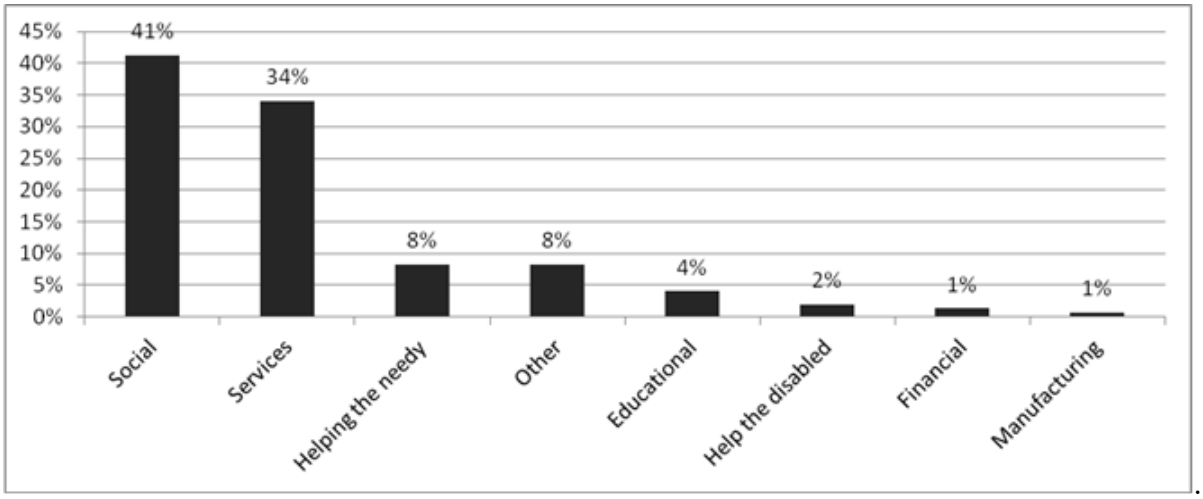
In Poland, the concept of green jobs is not defined by the Central Statistical Office (GUS) and was not able to indicate similar jobs to European EGSS until 2007 when the Polish Classification of Activities (PKD) was redefined[20]. Green jobs are defined as "decent jobs, either in traditional sectors or in the new green ones, which contribute to preserving or restoring a sustainable environment"[21].

5. Results of the research

The aim of the original research was to examine how non-profit organizations manage their cash levels regarding to new investments such as: implementing The Industry 4.0 and idea of green jobs, if applicable. From obtained data regarding 543 non-profit organizations in Poland from original research, only 300 were selected, because their profile which can be assigned to one specific group (Picture 3). Only participants which declared interest both in green jobs changes and The Industry 4.0 were selected. Factors of choice were also sustainable development declaration, registered activity and its transparency.

Picture 3: Non-profit organizations activity type.

[18] GUS, *Działalnośćinnowacyjnaprzedsiębiorstw 2006-2009*, Warszawa 2010, p. 48.
[19] European Parlament, *Competitiveness and Innovation Framework Programme2007 to 2013*, [Pol. Decyzjanr 1639/2006/WE ParlamentuEuropejskiego i Rady z 24 października 2006 r. (Dz. U. UE L z 2006, Nr 310, p. 15), preambuła] p.25.
[20] Polish Ministry of Development, *Polish Classification of Activities*,https://prod.ceidg.gov.pl/ceidg.cms.engine/?D;439165b7-9e89-4efb-8538-43878ad8ea94 (14.07.2017).
[21]Rutkowska-Podolowska et. al., *Green jobs* [in] Kovarova, E; Melecky, L; Stanickova, M. [editors] Proceedings of the 3rd International Conference on European Integration 2016 (ICEI 2016) pp. 822-829.



Source: survey results.

Large number of selected non-profit organizations is related to social issues of local society (41%), whereas 34% are involved to services for individuals or local community. Only small group of non-profit organizations are dedicated to financial sector or manufacturing – 1% in both categories. This results are related also to declaration by majority of non-profit organizations (242 answers), which stated that they classify their organization to social economy (Table 1).

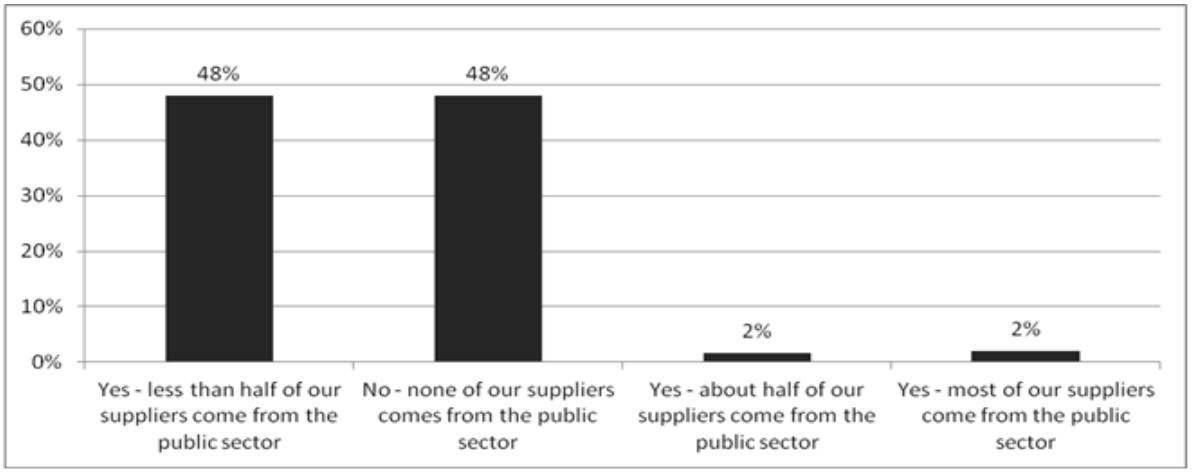
Table 1. Results for question: "Do you classify your organization to social economy"

Answer	Frequency	Percent
Positive	242	81
Negative	54	18
Neutral	4	1
Total	300	100%

Source: survey results

Selected non-profit organizations were analysed by their customersor suppliers affiliation to public sector. Moreover, majority (46%) of these organizations arenot connected with public sectors as their customers, but for 37% of answers it is true that less than a half of their customers come from public sector. Results for supplier's origin are presented on Picture 4.

Picture 4: Non-profit organizations' suppliers' relation to public sector



Source: own research results

The 97% of the respondents indicated that the institution was non-profit and the status was of a public benefit institution. They do not make money; they help others, and are social institutions.

For the surveyed respondents the most important sources of cash were public subsidies, monetary donations and tangible donations, private grants, 1% personal income tax deductions. Grants are non-refundable financial resources transferred to the organizations for the implementation of a particular project. Public subsidies are governed by the law: primarily the Public Finance Act and the Public Benefit and Volunteer Work Act. Subsidies are funds from the state budget, the budget of local self-government units and state-owned special purpose funds designated under the Public Finance Act, separate statutes or international agreements. Their purpose is to finance or co-finance public tasks or investments related to the implementation of these tasks.

Research revealed that non-profit organizations save significant amount of cash to run business as usual, whereas prefer bank loans and European Union programs to support investments related to infrastructure and renewable resource management.

6. Conclusions

In connection of The Industry 4.0 non-profit organizations in Poland are customers of solutions developed by producers. Their choice is to invest in pro-ecological solutions is the result of European Union law implementation and European funds or subsidiaries, but also new trend among all non-profit organizations. Although, only few selected non-profit organizations offered green jobs as defined by GUS or Eurostat, all of them influence the business environment to develop this type of decent work places, which helps reduce negative

impact on environment or protect it. This change brings attention to green jobs and eco-friendly clean production and renewable energy resources management more effective thanks to digitalization an IoT, two main parts of The Industry 4.0.

However only 4.0% of researched non-profit organizations indicated that their main field of activity is education, they play also important role of non-profit organization in popularization of some innovative solutions among society, what is with accordance with presented pyramid of knowledge. Non-profit organization are first to invest in digital management of their impact on natural environment and undertake pro-ecological actions. Therefore non-profit organizations focused on environmental protection can be recognized as places of implementation of green jobs and The Industry 4.0.

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