ZESZYTY NAUKOWE POLITECHNIKI ŚLĄSKIEJ 2017
Seria: ORGANIZACJA I ZARZĄDZANIE z. 114 Nr kol. 1993

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KNOWLEDGE TRANSFER METHODS APPLIED ON POLISH ENERGY INNOVATION AND EFFICIENCY PLATFORMS

Abstract. Web platforms are designed for supporting learning and sharing processes and offer one of the most promising way for the promotion of new ideas and solutions. They provide powerful search capabilities to get accurate information and offer the opportunity to connect different stakeholders to support research and development. The paper presents brief description of such a platforms taking into account different perspectives. The concept of Responsible Research and Innovation (RRI) platform for Energy Community of Knowledge is presented and based on its idea a results of knowledge transfer on polish energy efficiency platform are discussed.

Keywords: knowledge transfer, energy efficiency, energy clusters

TRANSFER WIEDZY NA POLSKICH PLATFORMACH NA RZECZ INNOWACYJNYCH ROZWIĄZAŃ DLA ROZWOJU EFEKTYWNOŚCI ENERGETYCZNEJ

Streszczenie. Jednym z możliwych sposobów promowania nowych rozwiązań, wymiany doświadczeń oraz dzielenia się wiedzą jest tworzenie wirtualnych platform. Pozwalają one nie tylko na możliwość znalezienia odpowiedniej informacji, ale też na łączenie zainteresowanych stron oraz budowanie skutecznych narzędzi wspierających strategię badań i rozwoju w dziedzinie, której dotyczy. W artykule dokonano charakterystyki tego typu platform, przedstawiono jedną z koncepcji platformy dla wspierania działań na rzecz innowacyjnych rozwiązań dla rozwoju efektywności energetycznej oraz omówiono wyniki badania metod transferu wiedzy na polskich platformach.

Słowa kluczowe: transfer wiedzy, efektywność energetyczna, klastry energetyczne

1. Introduction

The sustainable development linking the economic growth with the relation to the technology, innovation and environment set trends for organizations in XXI century. This may be indicated by the number of publications considering ideas of eco – innovations, which is growing fast, although different meanings of this term and communities associated with them can be observed [7].

The energy sector so far based mainly on fossil fuels is under a strong pressure to change the processes of energy generation and distribution. The power grid is moving towards a system where a physical and computational cyber infrastructure cooperates to deliver power in an efficient and reliable way, while, at the same time, changing the role of energy consumers. Moreover, the smart grid evolution must be technologically up to date, changing customers into smart energy users. It is a big technological challenge, and yet, it is a possibility to change the social dynamics of energy systems. Both challenges require immense work in the area of technical solutions, as well as designing the processes and platforms for communication, and knowledge sharing between energy market stakeholders.

IT evolution and advancements of the Internet tied the growth of Knowledge Management (KM) closely to communication technology. The application of IT that supports KM influences the results of knowledge collaboration [16]. Most of the basic learning collaborative platforms are based on the Semantic Web model, and are designed with the optimal usage of Web 2.0 technologies, making it easier to create a social network. Such models combine individual learning and social processes. Organizing memory content through the form of ontologies, and linking formal and informal forms of learning in the same collaborative web platform can foster knowledge sharing [1]. Knowledge sharing can be achieved through different activities in a range of ways.

Innovation increasingly demands an active search involving several organizations to discover new sources of knowledge and apply them into the market [9]. Theoretical foundations of responsible research and innovation belong to several areas considered by different scientist [11] innovation systems and innovations policy, corporate social responsibility or technology road mapping. Four dimensions of RRI are considered: anticipation, reflexivity, inclusion and responsiveness [15]. A theoretical model of RRI construct is also developed for considering those four dimensions as dependent variables and mediating variables while RRI sensitivity and project success are described as independent variables. Responsible research and innovation models are developed to generate guidelines and roadmaps for organizations that drive substantial and radical innovations [11].

The smart grid (SG) is a relatively new idea for both business and customers and became an area where a lot of research and innovation is and will be created in the nearest future. Knowledge management solutions are necessary in many areas, and there is a strong need to

design, create and make useful technological, market, and educational platforms. In order to realize the new activities, energy stakeholders need a shared space focused on knowledge, know-how and models about how to apply RRI concept in R&D and how to implement it in a collaborative works. These platforms will play a crucial role by integrating energy consumers, providers, and other stakeholders. As massive stakeholders' engagement is a crucial part of SG, these solutions must be designed taking into account differing requirements and users .

2. The Energy cluster perspective

A cluster concept as a solution for generating value for small specific groups of stakeholders like SMEs, universities, funding bodies and local inhabitants was widely described at the literature [8]. The implementation and development of clusters with local socio-technical and socio-political factors can help to share expertise and create a value in inter–organizational supply chain networks and generate a wealth for whole region [8].

Different points of views on the cluster are considered by various disciplines. The economists put strong emphasis on competitive business models seeing nature of competition, speed of innovation, knowledge management strategies as a potential benefits. However some barriers mainly related to communication and collaboration as well as lack of SMEs support were identified by some scholars [8]. The cluster model as a community based demands a strong interactive collaboration. In its early stage, the smart grid is a challenge not only for big utilities. Other stakeholders who would like to benefit from the new power network paradigm, such as SME, have limited or lack of knowledge. Involving them in SG deployment requires knowledge sharing and the implementation of a solution for creating new business opportunities.

Business clusters are defined as combination of interconnected organizations of different type and profile (supplier, service providers, universities or research bodies) that leads to shared advantages due to aggregation of certain resources [12]. The firms gathered in the cluster have more chances for performance advantages, due to economic of scale, and access to the local information and networks [5]. The other benefits are the culture of innovation and new venture development based of mobility of resources. Clusters are focused on new industries, like biotechnology, nanotechnology and recently more clusters on "green" industries are created. The important part of the cluster of innovation is the entrepreneurial mechanism for continuous and rapid innovation, technology commercialization and new market development [5]. The knowledge of the entrepreneurial processes, their reputation and the access to critical resources seems to be the main factors of changing the business clusteres into clusters of innovation [5].

Looking for new ways to reduce energy consumption and CO2 emission and trying to find a place on the changing energy market "green" clusters are established, to produce new equipment, to create a new infrastructure for energy and services supply to neighboring companies and residential areas. Most processes of producing and installing new renewable energy resources (RES) and offering new innovative solutions to energy customers require different types of expertise, information and services provided by various units and organizations. Good communication and collaboration is a prerequisite for not only the value of green energy produced but added value for the regional growth achieved as well.

3. Collaborative knowledge management

Knowledge is the most important organization resource that can decide of organization success on the market. Several technics and tools were developed to capture, store, transfer and retrieve explicit knowledge in forms of procedure manuals, document management systems, database systems or collaborative platforms. Web 2.0 with ease of use and informal characteristics has changed the way people share knowledge and exchange ideas. The Collaborative knowledge management based on ICT is a promising solution for tacit knowledge sharing [3]. Knowledge transfer plays the significant role in the knowledge management (KM). The first generation of KM systems focused on people sharing ideas using offering document management systems, content management systems, intranet and information portals. The second generation are devoted to people creating together new knowledge that leads to innovative and sustainable ideas and implementations. This demands not only IT solutions but access to some experts or expert knowledge system and to be iterative and improvisational [3]. The most important collaboration technologies features are: share ideas in real time, ability for social interaction and discussion, post rich content, search within described solutions, anytime anywhere availability, access to archive information. Knowledge sharing platforms are closely tied to intellectual property. The concept of RRI underlines a very dynamic process of elaboration and discussion and it is not commonly agreed. Experts refer that RRI seeks to make issues related to research and innovation accessible, to anticipate the consequences of research and innovation, to involve society in discussions on how science and technology can help the creation of such a kind of world and a kind of society we want for generations to come. It allows all societal actors (researchers, citizens, policy makers, businesses, third sector organizations etc.) to work together during the whole research and innovation process in order to better align both process and its outcomes with the values, needs and expectations of the society. Even if RRI it is not focused on computing or ICT a number of aspects and components of RRI are directly related to the ethics of research and technology development. Some authors suggest that adopting RRI

means that information systems solutions will need to look beyond its traditional boundaries and be more mindful of broader societal needs and ethics [14].

4. Platforms focused on sustainable development

A widely accepted definition defines a Platform as a 'decision-making body (voluntary or statutory) comprising different stakeholders who perceive the same resource management problem, realize their interdependence for solving it, and come together to agree on action strategies for solving the problem' [4], [13]. It is like a Roundtable, where stakeholders are gathered with very different perspectives. Supporting appropriate knowledge transfer policies is crucial issue for innovation systems marketing and knowledge transfer occurs trough different channels and mechanisms [6].

Web platforms designed for supporting organizational learning and sharing processes offer different functionalities, such as: social networks, content management, forums, but mostly without links between those tools, so users do not have a global view of the whole aspect of problem solutions or discussions. Some innovative platforms are being developed and proposed based on semantic models [2].

Many virtual Platforms are focused on sustainable development, climate change and job skills improvement, but in most cases they address policy-makers. It is out of the scope of this paper to present all of them, but some good examples are as follow:

- The European web-based knowledge Platform for energy efficiency in buildings, building-related technologies, and appliances;
- The Green Growth Knowledge Platform – the global network that addresses major knowledge gaps in green growth theory and practice (http://www.greengrowthknowledge.org/learning);
- INCLUDE - the knowledge Platform offering insight into policy matters and research issues related to inclusive development (http://includeplatform.net);
- The Singapore-based Knowledge Platform - one of Asia-Pacific's leading 'next-generation' learning solutions companies (http://www.knowledgeplatform.com);
- The Web Platform for energy efficiency - a user-friendly online collaboration Platform for Vietnamese building stakeholders (http://www.reeep.org/projects/web-platform-and-films-energy-efficient-building-construction-vietnam) and other – subject to further investigations and analysis during the project.

Several types of knowledge sharing platforms regarding energy efficiency (EE), smart energy communities and other energy related issues are provided by many organizations, most of them combine basic areas of the smart grid with other smart city areas such as smart transport, smart buildings, smart jobs, and consumers. Portals and platforms concerning

ecological issues have become a source of knowledge and a place to start business contacts in the area of SG [11].

5. Energy innovation clusters for Community of Knowledge

The European Union has recognized the crucial importance of science, technology and innovation for its prosperity. Over the last few decades many experiments have been done, which aimed at decreasing the distance between science and society. These efforts have led to the European-wide approach in Horizon 2020 called "Responsible Research and Innovation". The general European Commission's (EC) concept frames in regards of RRI follow six key components: engagement; gender equality; science & education; open access; ethics; governance. Nowadays, Europe faces a shortfall in science-knowledgeable people at all levels of society and the economy. Therefore, science has to inform citizens and politicians in a more trustworthy and accessible way in order to provide valuable information on future markets and innovative industries in Europe. This starting point for RRI has been evident in from a re-framing of 'Science in Society' to 'Science for Society, with Society' at the EC [10], and the directing of science and innovation towards societal 'grand challenges' Europe is facing now, and could face in the future.

In order to shift the focus of RRI to a proactive approach, to develop, share and spread new knowledge; key competences; major technological breakthroughs and innovations in the hyper-connected society, different projects were proposed to exploit the ICT power by developing a high virtual Platforms as a knowledge-sharing and collaborative tool. One of them proposed a model that to divide the platform into 2 main parts and 5 sub-areas as follows[1]:

- Information & Learning area with the 3 sub-areas: "Repository", "Learning", "Laboratory",
- Networking & Crowdfunding area composed of 2 sub-areas: "Networking" & "Crowdfunding".

In principle, the role of the Knowledge Platform is to transfer knowledge, to create a place for stimulating research and innovation solutions, as well as to create agenda for actions to be supported by both private and public funding. It mobilizes stakeholders to deliver on agreed priorities and share information and know-how.

The Informative & Learning area part cover following sub-areas:

- A "Repository" containing RRI best practices, cases, standards, recommendations, analytical reports, new financial instruments etc.

[1] Based on the project proposal developed by 12 partners leaded by Marco Olivotto (Polo Tecnologico di Pordenone, Italy) and Irina Terzyiska (European Labour institute — ELI, Bulgaria).

- A "Learning" area for business companies on one side and citizens and public administration on the other with e-learning modules. Selected and appropriated with co-create e-learning curricula for energy science and innovation education for different stakeholders.
- A "Laboratory" functioning as a tool for sharing intelligence and best practices among clusters and developing new ideas and solutions in the energy sector. It enhanced the holistic and far-sighted approach and was expected:

- to provide a much needed tool to bridge knowledge gap,
- to collaborate, create and exchange information on successful EE measures and RE solutions through collaborative R&I,
- to manage knowledge, and yielding innovative ideas and solutions on energy-related problems.

The second part of the platform dedicated to Networking & Crowdfunding area cover 2 sub-areas:

- A "Crowdfunding" area addressing the scientific and non-scientific stakeholders with a crowdfunding space for funding RES projects (with direct links to already existing crowdfunding platforms in the area of RES, EE, and RRI).
- A "Networking" area, developed as a social platform, following the requirements of the most common social network such as the possibility to share contents, create discussions and groups.

In order to provide a high-quality and productive dialogue among stakeholders, the Platform should offer the opportunity for e-training of selected groups of stakeholders offering e-learning programs and a huge data base of good practices, business models, investment's sources as well as the professional support of the national energy RRI clusters.

6. Knowledge transfer in Polish Energy Clusters platforms

Energy clusters play a vital role in creating a new value and promoting ecological an energy efficiency issues, so their portals and platforms have become a source of knowledge for different groups of stakeholders. In order to get a broader picture of the knowledge transfer in Polish energy clusters the study was conducted to investigate the methods applied for knowledge sharing. The research question was pointed as "How the knowledge sharing areas defined in the model of virtual Knowledge Platform (chapter 5.) are implemented on the websites of Polish Energy Clusters?"

Based on the register of clusters published by the Polish Agency for Enterprise Development (PARP) the list of clusters for the further study was created. From 134 clusters those with "energy" or "efficiency" in the name or business description were selected. As the

result a group of 14 clusters was identified. As the register published by PARP was dated on September 2015 additional research was conducted using google engine considering the same keywords. A list of several clusters was found, but in some cases only the information about intention letter with no web page nor portal was found. As the result a total number of 19 clusters were identified for further study. The research was conducted in March 2017. The websites were examined based on the model described in chapter 5. The public repository, news and possibility to search through the database were assigned to the Repository, training materials and e-learning courses were assigned to the Learning part and forums or discussion groups were assigned as part of Laboratory. Links to Facebook, Twitter, YouTube and google+ were treated as Networking. Crowdfunding option was not found on any of the cluster site, only one cluster offered a bank account number for donation.

The results show that the Informative & Learning area is very limited and mostly outdated. Table 1 presents obtained results. Except one example, no e–learning courses were found. Training materials were limited to the structure or the info about the courses possible to join in traditional class-learning format. The repository references and news were outdated (in some cases dated on 2011, 2013) and covered a short list of references (less tan 20). A few links to other sites, mainly government bodies and other clusters were recognized. Only one example of advanced repository with the possibility of domain search and expert database was indicated. The Laboratory part was limited in almost all clusters to the possibility to contact.

Table 1

Knowledge-sharing and collaborative tools in polish energy clusters

Cluster	Repository			Learning		Laboratory	
	Public repository	**News**	**Search**	**e-learning**	**Training materials**	**Contact**	**Forums**
Klaster Centrum Technologii Energetycznych	X*	X			ON SHELF PROJECTS	X	X***
Wspólnota Wiedzy i Innowacji w Zakresie Generacji i Użytkowania Energii od Skali Mega do Nano	X*,**	NO DATA				X	
Lubelski Klaster Energetyczny	X	X				X	
Klaster Bioenergia dla Regionu	X +DOMAIN SEARCH	X	X +EXPERTS DATABASE		STRUCTURE WITH NO COURSES	X	
Małopolsko-Podkarpacki klaster czystej energii		X**				X	
Mazowiecki Klaster Efektywności Energetycznej i Odnawialnych Źródeł Energii		X			INO ABOUT PROJECTS (PAST)	X	
Podkarpacki Klaster Energii Odnawialnej	X	X		E-COURES -MOODLE		X	NO ACTIVE GROPUPS
Bałtycki Klaster Ekoenergetyczny		NO DATA	GOOGLE				
Klaster Budownictwa Pasywnego i Energooszczędnego	GENERAL EKONEWS	X*				X	

Klaster Innowacyjne Strategie	X	X				X	
Klaster na rzecz rozwoju rynku prosumenskiego w Polsce		X				X	
Klaster Technologii Energooszczędnych "Euro-Centrum"		X**				X	
Polski Klaster techniczno-technologiczny POWEARTH	X	X				X	
Świętokrzysko-Podkarpacki Klaster Energetyczny	X	X				X	
Centrum Innowacji Fotowoltaicznych (Dolina Fotowoltaiki)	X						
Klaster Kotlarski		X**					
Dolnośląski Klaster Energii Odnawialnej	X	X				X	NO ACCESS
Klaster Energetyczny ESCO		X**				x	
Wielkopolski Klaster Energii Odnawialnej		X				X	
* limited less than 20 references ** outdated *** on-line chats +tel. conversation. with experts							

Source: Based on the survey results.

The Networking activity was observed only in case of three clusters offering Facebook and Twitter communication. One cluster offered also google+, and YouTube channel.

It is worth to notice that some clusters offered additional options for members, but those were not examined as required a process of formal registration.

The research showed limitations in knowledge exchange and interactive methods of stakeholder's discussion. The clusters platforms focus more on presenting offers or organizing events than knowledge sharing. Additionally it was possible to observe that those that were founded based on EU founds are not active after the projects (that was confirmed by the other researches).

Conclusion

The Knowledge Platform role is to stimulate research and innovation as well as mobilize stakeholders to share information and know-how. Such a platform helps to simultaneously operate and draw from the networking of relevant projects, service contracts and actors. The idea of such a platform was presented in the paper. The survey result presented limited knowledge sharing options offered by Polish Energy clusters. The outdated reference list showed that the knowledge is creating and sharing during the project phase, when stakeholders (scientists and business) are more engaged in common ideas.

The number of energy clusters in Poland is increasing rapidly since the changes in the Polish support system for renewable energy sources were published in the Autumn 2016 and

the concept of the Energy Clusters Operation' study by the Ministry of Energy was released in March 2017. The role of energy cluster is defined more as distribution operator than knowledge sharing broker, but achieving common engagement in the community needs more focus on the interactions between individuals and requires different internal and external sources of knowledge as well as methods of sharing it.

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