

Measuring Public Procurement for Innovation at Country Level and the Role of ICT Support

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Abstract

In recent years, the use of public procurement as a tool for promoting innovation has captured the interest of many researchers. However, their research mostly focuses on the impact of public procurement on companies' innovativeness. This article discusses the findings of available literature on this topic and proposes a model of transferring the concept from a company level to the level of the whole country. One of the major problems is the unavailability of appropriate measures for this phenomenon, so the authors of this paper suggest that the concept of public procurement for innovation can be approximated by applying the most economically advantageous tender (MEAT) criterion. The implementation of this criterion in choosing the best offer can be supported and facilitated by the use of ICT, which can improve the efficiency of procurement process and enable more innovations.

Keywords: public procurement, innovation, most economically advantageous tender (MEAT), information and communication technology

1. Introduction

Today every country aims to create such conditions that support an adequate level of economic growth, which in turn ensures an adequate standard of living for their citizens. Growth is a characteristic of competitive countries, so numerous studies deal with the issue of competitiveness. One of the most famous is a survey performed by the World Economic Forum – the Global Competitiveness Report – which has been going on for more than 30 years. In the period from 2014 to 2015 the report covered 144 countries [41]. WEF uses a complex system of assessing competitiveness, based on the twelve pillars of competitiveness. The eleventh pillar stands for business sophistication and the twelfth for technological innovation, and in the long run they are the most important ones of all the twelve pillars for achieving a higher standard of living [41]. This system is based on Porter's *Competitive Advantage of Nations*, written in 1990 [34], but numerous studies, reviewed by Weresa [42], offer new and practical evidence that the innovativeness of a company, a region or a country improves their competitiveness.

Recent years have brought a rising interest in using public procurement as a tool for promoting innovative solutions, either by creating innovations or by diffusing them and increasing their usage (e.g., [1], [13], [14], [21]). From the scientific point of view, it seems very interesting to see the effects of such trends, and to explore if directing public funds into public procurement could induce more innovation, compared with the usual instruments of

innovation policy (such as research and development (R&D) subsidies, regulations, and cooperation in creating innovations).

Since most of the research in the field of **public procurement for innovation (PPI)** was done in the form of case studies, and mainly at company level [2], [7], [13], [15], [20], [26], [27], [31], [32], our intention is to perform it at a higher level of a whole country's economy and to create the grounds for researching the effect of PPI on the country's level of innovativeness. All the reviewed studies indicate that PPI raises the level of innovativeness, but there is a problem with measuring such a concept because of the lack of appropriate country-level data on PPI. This is why the paper starts with a presentation of the conceptual model of how PPI influences a country's innovativeness.

Next, we suggest that the use of the most economically advantageous tender (MEAT) criterion [10] for choosing the best offer in the process of public procurement might be a good indicator that such public procurement would result in an innovative solution. Namely, many procurers nowadays widely use the criterion of the lowest price (LP), which is very straightforward and simple to use, but it cannot really evaluate the quality and innovativeness of an offer. The implementation of the MEAT criterion requires following strict procedures in the public procurement process and it can be enabled and facilitated by information and communication technology (ICT).

PPI emerged as a prospective research field a decade ago. The number of studies that explore this phenomenon continues to rise, but the body of evidence they provide grows mainly in the sphere of presenting and analyzing various individual cases in which public procurement induces the formation of innovation. There are some studies that managed to create a model and measure the effect of public procurement on certain measures of innovation [3], [22], but only at the level of company (micro-level). Since the studies show that a certain form of public procurement can indeed induce innovation on the micro-level, we propose the following hypothesis:

Public procurement for innovation raises a country's level of innovativeness

Every government has a budget at its disposal and channels the public money into different activities in order to achieve its objectives. One of these objectives is to support innovative activities and this should be done by finding the channels with greater effect on their policy objectives. Therefore, researchers try to explore the ways of assessing the impact of such policy measures. The results of their research can then be used as an argument for evidence-based innovation policies.

2. Trends in Research on PPI and Its Proposed Model

As already mentioned, most of the research in the domain of PPI relies on the analysis and comparisons of case studies. Yet one of them [3] widened scientific horizons by creating an econometric model for examining how PPI affects innovativeness at the company level. The authors connected the innovative outputs of a company with the applied measures of its innovation policy. Innovative outputs were measured according to the revenues made from a company's innovative products and services. The explored innovation policy channels were:

- cooperation in creating innovative products and services (COOP)
- regulations (regulatory quality - RQ)
- research and development subsidies (R&DSUB)
- public procurement for innovation (PPI).

Beside these policies, the researchers also included certain other factors into the model to control for their impact on a company's level of innovation (size, location, etc.) [17]. If these policies can affect companies' innovative activity, then it is important for the government to be aware of how they direct public finances to achieve such an important goal of the national economy. An increase of innovative activities in companies ultimately raises a country's

competitiveness and the standard of living [41]. But, transferring the model from micro- to macro-level poses certain problems, mostly connected with finding the appropriate measures for the researched phenomena.

Based on the micro-model, we propose the following concept of how innovation policies create positive effects on a country's economy in the form of a function:

$$\text{Innovativeness} = f(\text{COOP, RQ, R\&DSUB, PPI, environment}) \quad (1)$$

Furthermore, this concept is presented in the form of the logic model in Figure 1, with more elaborated ideas of the processes within this context. The model consists of the Reasons for using innovation policy measures, the Inputs into the economy (policy measures), Assumptions, the Environment in which the system works, the Outputs (results of the policy measures), and the Outcomes resulting from resolving great challenges by using innovations. The rest of the paper focuses on showing how the phenomenon of public procurement for innovation could be measured, seen in the growth of a country's innovativeness level, which ultimately increases the competitiveness of said country.

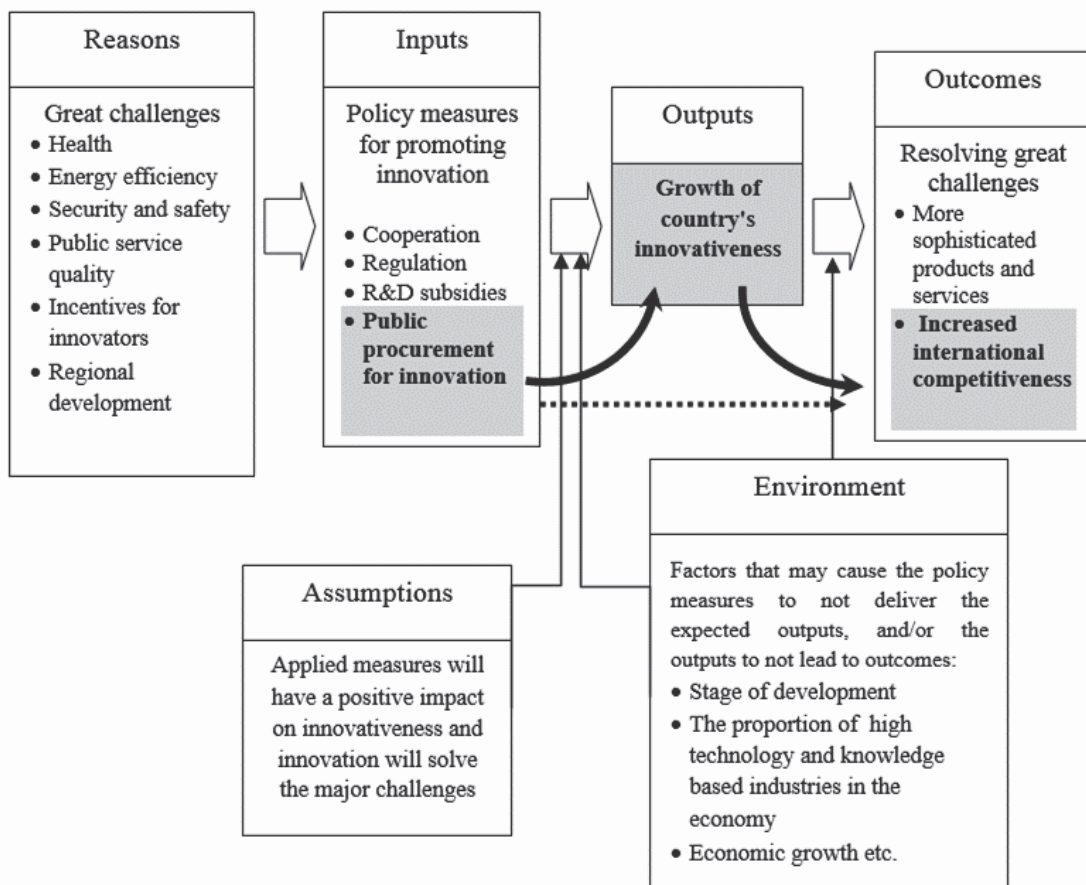


Figure 1: The logic model of possible channels for promoting innovation, adapted from [8]

2.1. Proposal for Measures of Model Elements

For testing the model on real-life data, we can choose different measures that would represent the described elements of our model. Due to the continuous long-term efforts of harmonizing available data for all the member countries on one hand, and a certain spread of those countries on the development scale on the other hand, the European Union could be a good example and source of empirical data for the analysis. If, for instance, the OECD countries would be taken into consideration as a test sample, the results could not really be generalized, because the OECD members are the most developed countries in the world. On the other

hand, the EU comprises developed and transition countries, which offers greater variety and a wider base for conclusions. Yet, there is another shortcoming of this approach – there are only 28 subjects in this sample. That shortcoming can surely be overcome by applying the panel analysis which combines cross-section time series dimensions [38].

In our model, the dependent variable is the **level of country's innovativeness**. Former measures of innovation used approximations, such as the number of patents or the R&D investments, which are most likely related to radical innovation (e.g., [29]), but neglect the diffusion of these innovations into economic practice, which can also improve competitiveness. As of recently, some researchers advocate an approach which supports the broadening of the scope of innovation policies to include the field of entrepreneurial activity and diffusion of radical innovations, while at the same time they promote "small" innovations and incremental improvements, since these represent the majority of today's innovation activities [19]. Therefore, it is important to use an indicator that includes both sides of the "innovation coin". Business sophistication and Innovation (**BSI**) is an indicator of the eleventh and twelfth pillar in the WEF research on world competitiveness [41]. It distinguishes two kinds of innovations: technological and non-technological knowledge. In the long run, they enable economic growth and sustainable positive impact on the standard of living. Non-technological innovations include knowledge, skills and working conditions embedded in organizations representing business sophistication, while the twelfth column comprises only technological innovations [35]. Although the WEF survey has been going on for more than twenty years, the current way of measuring business sophistication and innovation has been available only since the year 2004. Also, since the year 2013, the data has been available through the data platform [40].

Cooperation with others in the process of creating an innovation (COOP) on a micro-level is a simple dummy variable based on the answer to the question of whether companies cooperated with others in the process of creating their innovations [3]. For the macro-level, Eurostat data is available [18], based on the Community Innovation Survey (CIS) questionnaire. The indicator COOP represents the percentage of enterprises in the country which create their innovations in cooperation with others. These cooperation partners can be customers, suppliers, competitors, consultants, private or public research laboratories and institutes, universities, or other institutions of higher education.

The **impact of regulatory conditions** can be one of the six Worldwide governance indicators (WGI) [43]. Regulatory Quality (**RQ**) shows the perception of government's ability to create and implement good policies and regulations which support the development of the private sector. This is a proxy measure for the regulatory environment because it reflects changes in economic conditions that are affected by changes in the regulatory framework.

Public subsidies in business sector R&D (R&DSUB) can be measured by Eurostat's technology indicators [18]. An indicator can be calculated as a share of the publicly financed part of total Business Enterprise Research and Development Expenditure (BERD).

The most appropriate indicator for monitoring the focus variable – **Public procurement for innovation (PPI)** – has no appropriate measures in currently available statistics. In the published literature, it has not been possible to trace relevant indicators, except for an estimation of the total amount of public procurement in the EU over the past few years and the share of public procurement in GDP, published by the European Commission [12]. But the data on total public procurement is not suitable for the research on PPI because it lacks details about the innovativeness of such public purchases.

2.2. Public Procurement Process and Its Suitability for PPI

The EU prescribes legal thresholds above which the state, local authorities and (in some countries) public companies have to implement a mandatory procurement process [17]. But, there are big differences between the member states even when collecting the data about procurements above the threshold, and let alone when reporting procurements below the threshold. Also, the total figures on procurement do not distinguish between traditional and innovative procurement, which would be a lot more appropriate. For instance, in the public

procurement system in the USA, there are indicators that show if it was a regular or innovative procurement, which were used in Slavtchev and Wiederhold's study [36]. On the contrary, some studies from the EU show that most of its member states report on open tenders and awarded contracts extremely differently [25]. About half of them require mandatory reporting to one public body or agency, some countries require reporting on multiple bodies or agencies, depending on the type of goods (services or works) procured, while some allow for voluntary reporting. Some countries prescribe mandatory reporting for public authorities, but not for public companies. Therefore, it is very difficult to harmonize gathered information. Also, Kapff [25] noted that in almost two-thirds of these countries there were data available for procurements above the threshold for mandatory implementation of the procurement process, which sometimes leaves out smaller contracts. This can be a problem since there are some examples from transition countries when public procurers split the value of the contract into smaller parts to avoid the obligation to stick to the strict procurement rules [8]. Recent changes in the EU directives and the resulting laws (e.g., [30]) bring the obligation for public procurers to publish tender notices in electronic form [39], [16], as well as to receive offers electronically. This will increase ICT usage in public procurement processes (*e-Procurement*), which will then enable the collection of more detailed procurement data and the harmonization of the available data across Europe. Therefore, in the future there is a possibility that ICT would make the data on PPI available.

Generally, the process of public procurement can be divided into two major sub-processes or two phases: the first occurring before the contract is awarded and the second after the contract is awarded. Figure 2 shows a two-level *Pre-award public procurement process*, developed in accordance with the EU directives [17], CEN Workshop on Business Interoperability Interfaces for public procurement in Europe - CEN WS/BI [5] and CEN Workshops agreements on e-Tendering [6]. The first level comprises six sub-processes. The second and fifth sub-processes are further developed as the 'level 2' processes.

All the procedures prescribed in the European directives [17] and the methods of executing a procurement process are presented in the left 'level 2' process, *Call for tender preparation*. Possible procedures are: open procedure, restricted procedure, negotiated procedure or competitive dialogue. Presented in the right 'level 2' process, *Awarding*, there are two criteria for evaluation of collected offers.

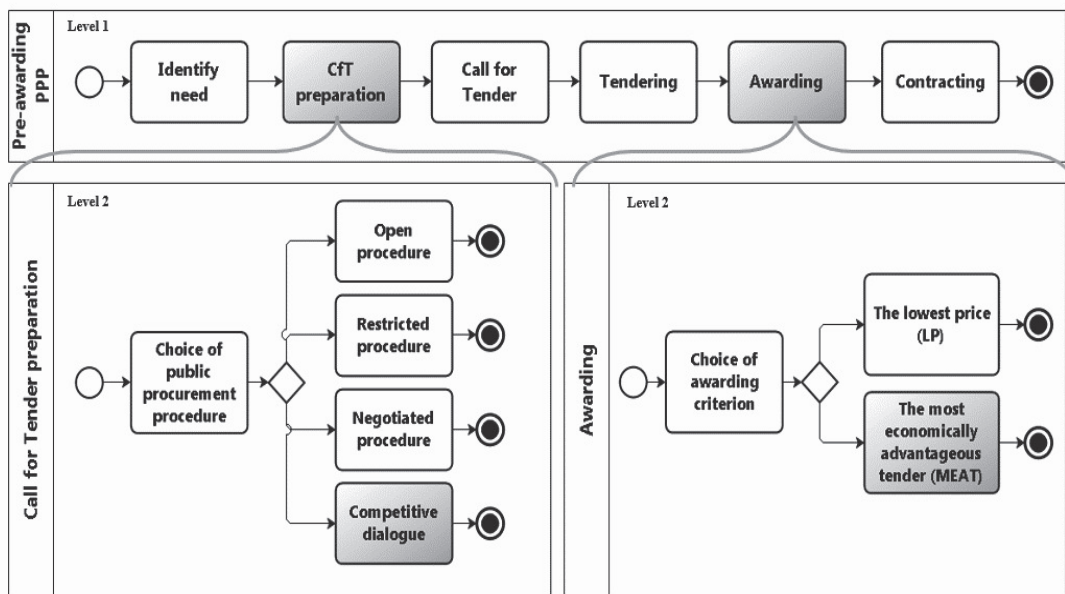


Figure 2. Pre-awarding public procurement process with key sub-processes

In the EU legislation there are four available procedures that can be used for public procurement [17] in left 'level 2' process, but not all of them are appropriate for the process of innovation procurement.

- In the **open procedure** any organization can send their offer;
- In the **restricted procedure** any organization can ask to participate, but only preselected ones are invited to send their offer;
- In the **negotiated procedure** the procurer directly approaches wanted tenderers and negotiates the terms of the contract with them
- In the **competitive dialogue** the procurer discusses the possibilities with greater number of potential suppliers and in several steps narrows the choice and then selects between the tenders on the basis of predefined criteria.

Open and restricted procedures are more suitable to be used in regular procurement (ordinary goods and services) due to their characteristics. The negotiated procedure can only be used in certain cases (e.g., supplies intended exclusively for research or testing purposes), which means it could be appropriate for PPI. Sometimes it can also be chosen after an unsuccessful open or restricted procedure or when the demanded goods or works can only be supplied by a single supplier. The most suitable procedure is, however, the procedure of competitive dialogue, which is often used in complex situations and projects. It allows a public entity which knows the desired outcome of awarding a public contract, but is not sure how to best achieve this outcome, to get to know its options through dialogues with capable suppliers [4]. The most prominent feature of this procedure is the need to define functionalities and not the exact specifications of the procured goods, services or works in the beginning, which opens up space for innovative solutions. Even when the procurer has a good idea about the key features from the start and knows the strengths and the weaknesses of potential solutions, often certain practical and procedural barriers emerge in the development or improvement of those solutions. At least three potential suppliers are required in this procedure and the tenders are submitted after a dialogue with each of them [17].

Another part of the problem with PPI is that this kind of public procurement requires more complicated criteria in deciding who will be chosen in public tenders. There are two award criteria possible for public contracts [17]:

- the **lowest price** (LP) and
- the **most economically advantageous tender** (MEAT)

The MEAT criterion looks at both qualitative and quantitative aspects of the tender. The criterion of the lowest price does not take qualitative aspects of the offer into account, which is especially unfortunate for those offers that include high levels of innovativeness, usually connected with higher costs and, therefore, higher prices. But the awarding of contracts based on the MEAT criterion uses significantly more resources due to its complexity and the requirements for more specific knowledge in its implementation [37]. This affects the procurer, as well as increases the effort required from tenderers.

2.3. Public Procurement Procedures and Award Criteria in EU

An interesting overview of public procurement practices is available in the report to the European Commission (EC) [37] which includes the data on public procurement in 27 EU members and 3 EEA countries (Norway, Iceland and Lichtenstein) in the period 2006-2010. Additional data for Croatia is based on the reports of Croatian Ministry of Economy for the period 2008-2012 [28].

It is obvious that the most widespread procedure is open procedure, which makes about three-quarters of the total number of tender notices and about half of the contract award notices. On the other hand, competitive dialogue is rarely used (in only 0.5% of all tender notices), with significantly higher average of 4% of total awarded value in the whole observed period. Thus, we can conclude that the more valuable the contracts are, the usage of competitive dialogue is more frequent, and there is more chance to have sufficient funds for

innovation. Croatian case [8], which was not included into this EC report due to the country's EU candidate status in the observed period, shows somewhat different trends. In the period 2008-2012, open procedure grows both in terms of the number of contracts and in their value (reaching almost 90%), while the competitive dialogue is represented extremely poorly (below 0.1%), even dropping to zero in some years. In the European context, the competitive dialogue criterion is mostly used in services (60%) and the number of contracts is small, although they have high average contract values [37]. It is mostly used in the ICT industry and knowledge-intensive services (IT systems development, engineering, architecture and management consulting), but it can also be found in construction. All these industries extensively use modern technologies and support their activities by using ICT.

Description	
Use of open procedure (EU)	cca. 50%
Use of open procedure (Croatia)	cca. 90%
Use of competitive dialogue (EU) - value	cca. 4.0%
Use of competitive dialogue (Croatia) - value	cca. 0.1%
Use of MEAT criterion (EU) - value (most cases in research from FR, DE, ES, PL & UK)	cca. 80%
Use of MEAT criterion (Croatia) - value	1.45→0.45%

Table 1. Selected indicators of public procurement in the EU (2006-2010) and Croatia

When discussing the two criteria for choosing the best supplier, we have already said that, considering the objectives of PPI, the most economically advantageous tender (MEAT) is more appropriate. Moreover, the European Commission insists on the MEAT criterion in case of the competitive dialogue [10]. The criteria for the identification of the most economically advantageous tender must be announced in advance (e. g., in the descriptive document, in the contract notice, or in the invitation to participate in the dialogue). The relative weight of the criteria should be established according to their importance and the award criteria (and their order) may not be changed during the award procedure. All the potential suppliers should receive equal treatment, so any changes of the award criteria are not allowed and could be characterized as favoring one supplier over another. This is also supported by certain research examples which show that, in the practice of public procurement, there are numerous formal methods, decision-criteria, decision makers and interested parties with different perspectives. It all complicates decision-making, so there exists a substantial need for more openness and transparency in all award phases [24]. This is mutually advantageous for both contracting authorities and suppliers, as well as for the other interested parties. The use of the MEAT criterion also increases the chance of choosing an offer with a better value/price ratio [9]. The implementation of e-procurement and broader ICT usage in the procurement processes could enable an equal treatment of suppliers and make the whole procurement process more transparent and efficient.

Another interesting finding [37] is that the contracts awarded based on the MEAT are more expensive for both businesses and authorities. Nevertheless, they receive more offers than those who award contracts based on the lowest price criterion. This is a potentially interesting result and might be explained by the notion that some companies, with more complex solutions, cannot compete with the lowest price, so they do not even bother to submit a tender when the award criterion of lowest price is used.

The MEAT criterion is used in the EU in 70% of awarded contracts, whose value amounts to 80% [37], but it is important to note here that France, Germany, Spain, Poland and the UK constitute nearly 70% of all procurement notices in the report. This means that their results affect the mean percentage by creating an upward bias, whereas in other (mostly smaller) countries the usage of this criterion is not so high. Since these are large countries and they are often mentioned in PPI case studies [8], we can conclude that the usage of the MEAT criterion in choosing the best tenderer could be an indicator that the public procurement is

more oriented towards innovative solutions. By contrast, in Croatia MEAT is used only in a small number of all reported contracts (falling from 1.45% to only 0.45%) [8]. It is the same in other small countries in the EU report (e. g., Malta, Cyprus...) that, similarly to Croatia, almost exclusively use the open procedure in public procurement [37], which implies the prevalence of the lowest price criterion.

As it was pointed out earlier, there is no statistic that shows the proportion of innovative public procurement in total public procurement, which would be needed to empirically test the proposed model. Since all the other proposed measures are available for the period from 2004 onwards, we suggest that the data on the usage of MEAT criterion can be taken as a proxy that represents the innovation-oriented public procurement. The combination of PPI and the MEAT criterion offers another interesting idea, namely that the promotion of using the MEAT criterion could open up significant space for more innovative solutions in the process of public procurement. In the following paragraph, this idea is therefore further developed by observing that the complexity of implementing the MEAT criterion can be mitigated by including the ICT support in the public procurement process.

3. Role of ICT in Enabling Implementation of MEAT in PPI

Despite the arguments in favor of using the MEAT criterion that have been presented so far, admittedly, the application of this mechanism is not widespread [37]. This is due to existing perception that it is more complicated than the traditional lowest-price award mechanism. One can argue that the MEAT criterion is more complex, but its benefits for the buyer and the public sector could be far greater than the time spent on evaluating offers [37]. It is easy to choose between tenders for everyday products (e. g., toilet paper or office water), which are known to the smallest specification detail. But it is a lot more complex to choose among services or products that create a new value, unknown up to that moment, which are not only needed, but will also help the procurer organization to do its job better or accomplish its purpose more effectively.

The main barrier for the implementation of MEAT is the lack of information on how to formulate suitable MEAT award mechanisms to achieve maximum transparency. There is some evidence from Croatia that the public procurers avoid setting the MEAT criterion in the Call for Tender because they know that the lowest price tenderer will file a complaint for not being chosen, in spite of the clearly set MEAT criterion [8] which makes the complaint unjustified. Naturally, this then prolongs the procurement process, which causes additional costs. The introduction of ICT into the decision-making and contract-awarding phase would improve this process and its transparency. Ho et al. [23] dealt with this issue in their extensive paper on multi-criteria decision making approaches to supplier evaluation and the selection of best offers.

The authors listed the following methods, appropriate for multi-criteria evaluations of complex offers with known specifications, ranges, or maximum/minimum values for all tendering criteria [23]:

- analytic hierarchy process (AHP),
- analytic network process (ANP),
- case-based reasoning (CBR),
- data envelopment analysis (DEA),
- fuzzy set theory,
- genetic algorithm (GA),
- mathematical programming,
- simple multi-attribute rating technique (SMART)

The proposed methods need fine tuning and human interaction, but if supported with contemporary ICT solutions, they could provide fast and precise evaluation mechanisms for assessing a large number of complex offers.

In order to speed up the procurement process, to raise its efficiency [37] and to open tenders for national or global markets, the EU has implemented projects such as PEPPOL [33]

and developed public procurement portals such as e-Prior [11] or Tenders Electronic Daily [39]. National portals were also developed (e.g., Croatian Electronic Public Procurement Portal [16]), which helps in making public procurement transparent and open to all suppliers nation-wide. Electronic business and public procurements show a trend of supporting more complex procedures in public procurement. Also, e-Procurement is the main tool that will provide the conditions for more extensive usage of the MEAT evaluation criterion in future public procurements.

4. Concluding Remarks

Public procurement for innovation is an emerging concept, whose current application in the field of innovation policy shows great potential and efficiency. Given the trend of increasing usage of modern ICT systems and the integration of procurement processes through e-Procurement systems, we can expect that the implementation of complex public procurement procedures (e. g., competitive dialogue) will become easier and more common. This particularly refers to the application of the most economically advantageous tender (MEAT) criterion in evaluating all types of tenders.

This paper presents the concept of PPI based on numerous studies performed at the micro-level, which confirm the positive effect of PPI on the level of innovativeness of individual companies. Applying this to the country level implies that PPI increases the level of innovation of suppliers in public procurement, and indirectly the level of innovativeness of the country in which they operate.

The strength of this study is a model founded on an extensive review of recent and relevant literature, rooted both in theory and practice. The analyzed trends show that growing usage of modern ICT systems and e-businesses open new opportunities for the application of complex procedures and criteria in public procurement. Hereby, ICT significantly affects the acceleration and increase in the efficiency and transparency of the public procurement process, and thus enables greater efficiency in public spending, which all speaks in favor of evidence-based policies. Smaller and less developed countries (and especially countries in transition) could learn from the best practices of the countries that are more experienced in PPI and therefore improve their innovativeness and competitiveness.

One significant limitation of this study is certainly the lack of appropriate and relevant data for measuring PPI, which is the main concept of our model. Notwithstanding the lack of data to measure the actual presence of PPI, complex procurement procedures and the most economically advantageous tender criterion might serve as proxy measures for PPI. Collecting the empirical data and testing the proposed model would represent further development of the PPI theory. That way it would be possible to empirically verify or reject the hypothesis that the application of PPI, or its increase in total public procurement, results in the growth of countries' innovativeness and, consequently, their competitiveness.

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