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Does experience exert impact on a public-private partnership performance? The case of Poland

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Keywords: *survival analysis; public-private partnership (PPP); organizational learning; investment decisions*

Abstract

Research background: Researchers traditionally assume that learning is a product of experience. In general, it means that learning can only take place through the attempt to solve a problem and therefore only takes place during activity. On the ground of organizational theory, it has two implications. First, we can agree that repeated activity requires less effort. Second, we can argue that firms undertake activities, with which they have been the most successful in the past and that they expect to be the most successful in the future.

Purpose of the article: The aim of the research is twofold. Firstly, this article aims to investigate if we can identify a relationship between the experience in PPP projects and the performance of initiatives of this kind. Secondly, the article aims to provide an interpretation of the relationship between experience and PPP performance.

Methods: This research investigates factors influencing the survival of PPP projects in Poland over the period 2009–2015. Cox proportional hazard model is utilized to distinguish between PPPs that succeeded to the operation phase and those that were canceled on the procurement stage.

Findings & Value added: The research confirms the existence of a positive relationship between experience in PPP and the outcome of a PPP development.

Introduction

The problem of understanding how organizations develop competence has been widely discussed on the ground of organizational (Cyert & March, 1963; Levitt & March, 1988; Argyris & Schon, 1978; Argote, 2001) and strategic management literature (Zollo & Winter, 2002). In Poland, the problem was raised, for example, by Mikuła (2006) and Olejniczak (2012).

One of the areas that have been receiving increasing attention from scholars is the study of experience — performance relationship (Anand, Mulotte & Ren, 2016). This relationship is generally described as the association between the number of times a firm has conducted the particular activity and the resulting performance and is interpreted consistently with the long-standing idea that learning is the product of experience (Arrow, 1962). The role of experience in increasing productivity was first observed by aeronautical engineers, particularly by T.P. Wright (1936). He measured that the number of labor-hours expended in the production of a particular part of a plane is a decreasing function of the total number of the same parts previously produced. Other scholars took up the idea and have shown the existence of the same type of “learning curve” in a wide range of operational processes.

More recently, the study on experiential learning processes has been expanded to numerous corporate development activities, including new product introduction, international expansion, alliances, and acquisitions (Hayward, 2002; Zollo & Reuer, 2002). These studies generally confirm the existence of a learning effect. Yet, some scholars argue that the learning through corporate development activities differs from learning through operational processes (Anand *et al.*, 2016). Consistent with this reasoning, the experience accumulation in corporate development activities is more complex and depends not only on the experiential learning, but also on the willingness to repeat this types of activities that are associated with the highest past performance.

According to the above mentioned, the primary aim of this study is to apply the concept of experiential learning to investigate projects developed by public organizations. We will focus in particular on public-private partnership (PPP) projects initiated in the 2009–2015 year.

This paper intends (i) to investigate if we can indicate the relation between the experience in PPP projects and the performance of this kind of undertakings and (ii) to provide an interpretation of the relationship between experience and PPP performance.

The composition of the article is as follows. The next section discusses PPP as a subject of the research, then followed by institutional details on

PPP in Poland. Methodology part of the study explains the reasons for applying Cox regression model, data uses, sample design and variable selection procedure. The next part displays the result of the model resulting in discussion part and conclusion of the presented study.

PPP as a subject of the research

Most commonly PPP is perceived as a tool for providing infrastructure investments. Typically, this types of arrangement are organized around a design, finance, build, own, operate, transfer model and involves private sector financing and private sector project management capabilities.

We can identify a range of economic, social and political reasons and motives for the growth of PPPs. For example, there is a growing body of evidence-based literature attempting to explain why in some cases public authorities are more willing to choose this organizational form of delivering infrastructure services (Hammami *et al.*, 2006; Galilea & Medda, 2010; Buso *et al.*, 2017; Moszoro *et al.*, 2014).

Investigating the factors that exert an impact on the development of PPP some scholars emphasize the importance of choice that must be undertaken by potential providers of public services (McQuaid & Scherrer, 2009). These decisions can be affected by poor contractual design and arrangements and inappropriate risk-sharing (based partly on limited expertise, experience and capacity, especially at a local level), as well as accountability (Pollock *et al.*, 2007). Recently Klijn and Koppenjan (2016) investigated what kind of contract characteristics influence PPP performance.

According to Hart (2003), one of the main property of a PPP is to bundle facility construction and service provision. These two phases can be considered as the most important in PPP contracts. However to obtain a wider research perspective on the process that supports implementing PPPs we should get back to the date of announcement of a PPP tender. In this case, we can assume that the willingness to cooperate under PPP is revealed firstly by the public party. This can be described as the date 0. The tender continues to the date 1 when the private partner is selected and the contract is specified. The facilities are delivered at date 2 and the services are provided between date 2 and date 3 when the contract finally comes to a close. Identified milestones allow us to distinguish three phases in a PPP project (Węgrzyn *et al.*, 2018).

In this context, we can utilize the market data to find out what features of the PPP contract and its main actors help to move PPP project from one phase to the next. Adopted research approach would help to assess the im-

portance of experience among other factors contributing to the PPP performance.

PPP in Poland

In Poland, the process of implementing PPPs began as late as 2009, when the new PPP law came into force (Tasan-Kok & Zaleczna, 2010; Wojewnik-Filipkowska & Trojanowski, 2013; Śmiechowicz, 2014).

During the 2009–2015 period the total number of announced PPP procedures reached 425. However, only in 119 cases, private partners were selected. More than 70% of all PPP procedures was announced by municipalities. The average contract value reached approximately 13 million Euro while half of the contracts did not exceed the amount of 1.7 million Euro. We may notice therefore that the characteristic of Polish PPP market can be reduced to two its main features: local nature and the fact that the market is still in a development phase (Hajdys, 2016).

Research method and data

The research employed survival analysis to uncover a causal relationship between PPP characteristics and its performance. In general, survival analysis is a statistical framework for studying the duration of an event. This type of analysis is well established in several fields of knowledge. This method has been extensively used in medical and engineering research for studying the survival time of patients or the reliability of devices (Sokołowski, 2010).

Recently, the use of survival analysis is increasingly widespread across different disciplines of social science. Several authors have employed duration models to analyze the determinants of length of stay in tourist accommodation (De Menezes *et al.*, 2009) or the survival of ski lift operators (Falk, 2013). Such methods have been also used for the duration analysis of software projects (Sentas *et al.*, 2008).

Considering PPP literature Buso *et al.* (2017) utilized this method to examine under what conditions public authorities are more likely to use a PPP rather than traditional procurement methods. However, to the Author's best knowledge, there is no prior application of such models to the analysis of PPPs duration.

This study focused on the first phase of a PPP project, namely procurement stage. The necessity to limit the study to this stage resulted from three

main reasons. First of all, the duration of the procurement stage is closely related to its cost — especially the cost that has been already incurred by all participants and cannot be recovered. The next reason is associated with the specific feature of PPP market in Poland — a prevailing number of PPP initiatives that did not reach the next phase described as a service provision. The final argument is the data availability. Statistics on PPP in Poland covers information on two dates — the date of a tender announcement (t_0) and the date of private partner selection (t_1). Information of these two relevant dates can be obtained only for projects that succeeded to the next phase. Information on the duration of the initiatives that did not succeed is — in practice — unavailable.

The reasons stated above determined the choice of the survival analysis as a tool to study the project duration. The benefit of using the survival analysis is the fact that we can construct probabilistic models for the durations utilizing the data not only from projects, for which we know both dates but also from projects that we don't have information on a termination date. In this specific case, projects having the private partner selected were defined as completed observations (coded as 1). Projects that were not completed in the way that allowed them to move to the next phase were defined as uncompleted observations (codes as 0). The duration of uncompleted observations (right censored) is defined as the time from the start date until the date when the data collecting was stopped. A graphical distribution of duration of PPPs — procurement stage — is presented in Figure 1.

The data set covers 423 PPP projects. The data used in the model were obtained individually for each project from the official websites dedicated to public procurement: Teds Electronic Daily (TED) and Public Procurement Bulletin (BZP). The number of PPPs that proceeded to the next phase (completed observations) was 118 while the unsuccessful (uncompleted observations) procedure reached 305. The mean durations were as follows: 5,66 months for completed observations and 51,57 months for uncompleted observations.

The duration of a PPP procurement may be affected by a range of factors characterizing the project, PPP partners or the market. Data obtained from tender announcements enabled to prepare the following set of factors describing PPP projects:

- type of public partner: local governments – type1 (rural, semi urban, urban), local governments – type 2 (big cities), middle level of government, central government,
- construction phase: required/not required,

- type of private partner engagement: building of facilities is not required, new facilities are required, modernization/renovations is required,
- legal form of PPP procedure: concession for construction works, concession for services, PPP under concession law, PPP under public procurement law,
- number of procedures for the same project: procedure conducted only one time, procedure repeated for the same project,
- experience in PPP procedure: public entity has no experience in conducting PPP procedures, public entity has experience in conduction PPP procedures,
- experience in PPP cooperation: public entity has already been engaged in cooperation under PPP, public entity is not engaged in cooperation under PPP,
- year of starting the PPP procedure: project started between 2009–2010, 2011–2012, 2013–2014, 2015.

The mean durations of PPP projects divided according to the enumerated categories are presented in table 1.

Results of the research

To report the results, we present the Kaplan-Meier estimation of the duration curves and construct a Cox regression model describing the relation between the duration and different groups of PPP projects. The Kaplan-Meier survival estimates help to identify what kind of PPP project are more likely to reach next phase (in our case it means that are less likely to survive). These estimates are shown in Figure 2.

In general, the types of PPPs that are most likely to proceed to the next phase are the following: initiated by central government and its representatives, PPPs for which private partners are not engaged in building facilities and/or conducted under concession for services procedure.

Concerning public-private experience, we could say that either previous experience in initiating PPPs or undertaken cooperation increase the likeliness for a new projects success. However, the chance to proceed the contract is decreasing with the next announcement of the same project. The last figure doesn't suggest that the likelihood to survive depends on the period in which PPP procedure was initiated.

To get a further idea of the magnitude of these relations there is a need for statistical testing. There are various statistical tests in the literature. In the study, two test were chosen: *log-rank test* and *Gehan-Wilcoxon test*. Considering the results of these two tests, we cannot reject the null hypoth-

esis on the lack of differences between Kaplan-Meier distributions in two cases: *public partner type* and *year of starting procedure*.

Finally, *Cox's proportional hazard* model was used to estimate the influence of explanatory variables on the hazard of private partner selection. One of the key assumptions in the model is that of proportional hazards. According to this condition, the survival distributions should have hazard functions that are proportional over time. *Schoenfeld residuals test* indicated that the proportional hazard condition was not validated for factors: (1) *legal form of procedure* and (2) *number of procedures for the same project*. That is why these two factors were excluded from further analysis. Additionally, correlation test was conducted for the remaining variables and these tests did not reveal any significant relations between factors. Table 2 shows the results of the *Cox proportional hazard* models.

We were interested in exploring the link between PPP performance and public entities experience in PPPs. The relationship is described in the models by hazard ratio, which exhibits the ratio of the probability of an event (going to the next PPP phase) in one group to the probability in the reference group. A hazard ratio higher than 1 indicates a higher probability of ending procedure with a success while lower than 1 respectively lower probability.

The first two models investigate experience — PPP procurement (*Exo_p*) and experience — PPP cooperation (*Exp_c*) separately. We found that experience obtained from PPP cooperation (*Exp_c*) has less impact on PPP procedure than experience obtained during conducting previous PPP procedures. Due to this fact, in the next two models we used *Exp_p* indicator. The difference between Model 3 and Model 4 lies in the way of disaggregating private partner engagement. In the Model 3 PPP projects were divided into those for which construction phase was required or not. In the Model 4 we included an additional factor, the type of engagement in a construction phase. This resulted in a dividing PPP projects on three groups: (1) PPP for which private partner is not required to invest in any facilities (2) is required to build new facilities and (3) is required to modernize existing facilities. We found that Model 4 explains the survival of a PPPs in a more complete manner.

The presented results are quite intuitive — expected private partner engagement is the most powerful predictor of the survival of PPP projects. If a private partner is not required to build facilities, there are more than two times as likely to find a private partner as for the other cases (Model 3). However previous experience in PPP also influences PPP procedure. The hazard ratio is 0.668 indicating that lack of experience in PPP procedure

leads to a 33 percent lower probability to proceed the project to the next phase.

Conclusions

The applied methods of survival analysis allowed to assess the intensity of reaching the operational phase by PPP projects in Poland. According to the provided models, the outcome of a procurement phase depends mostly on the type of a private partner engagement that could require building new facilities, modernization/renovation or simply providing infrastructure services. We also found that the experience gained in conducting procurement procedure influence the duration of a PPP project. In general, it means that if a public entity has experience in conducting PPP procedures, it is more likely that the next PPP announcement will be positively verified by the market. However, we cannot apply this conclusion to all types of PPP projects. Public entities are rewarded only for those projects which involve searching for new opportunities for public-private cooperation, contrary to those activities that try to modify previous unsuccessful projects.

As Anand *et al.* (2016) explain, investment decisions are characterized by high levels of causal and outcome ambiguity and low levels of frequency and similarity (Anand *et al.*, 2016). That is why repetitive projects were not likely to perform better, as it is observed in the case of repetitive operations process.

This could lead to some main implications for the practice. We can say that the chance for a success decreases with making further attempts to repeat the same PPP project. This could guide decision makers to allocate the resources, e.g. time and experience of city office workers, in a more effective way.

In this context, it is interesting to investigate how the positive or negative experience gained in implementing PPP affects the decisions of neighbor municipalities, especially to search for the effects of mimicking or yardstick competition (Małkowska *et al.*, 2018). One more direction for the future research is to expand the duration analysis of PPP projects. One suggestion is to treat the repeated PPP procedures as recurrent survival episodes and compare them to the results obtained for an individual episode (Bieszk-Stolorz, 2018).

Unfortunately, the major limitation of the study is related to the nature of the data. A lack of reliable, publicly accessible database on PPPs limits the possible directions of the analysis of PPP in Poland.

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Annex

Table 1. Mean duration for the levels of each factor

Factor	Description	Levels	Mean duration (months)
Public partner type (Pub_type)	local governments – type1 (rural, semi urban, urban)	1	41.8
	local governments – type 2 (big cities)	2	48.5
	middle level of government	3	23.4
	central government	4	27.6
Construction phase (Cons_phase)	construction phase not required	1	22.1
	construction phase required	2	44.7
Type of private partner engagement (Type_eng)	building of facilities is not required	1	22.1
	new facilities required	2	49.4
	modernization/renovations is required	3	31.5
Legal form of procedure (Leg_form)	concession for construction works	1	22.3
	concession for services	2	60.9
	PPP under concession law	3	51.3
	PPP under public procurement law	4	27.3
No. of procedures for the same project (No_proj)	procedure conducted only one time	1	32.1
	procedure repeated for the same project	2	42.6
Experience – PPP procedure (Exp_p)	public entity has no experience in PPP procedures	1	47.5
	public entity has experience in PPP procedures	2	40.3
Experience – PPP cooperation (Exp_c)	public entity engaged in cooperation under PPP	1	33.5
	public entity not engaged in cooperation under PPP	2	43.3
Year of starting procedure (Year)	project started between 2009-2010	4	80.1
	2011-2012	3	61.0
	2013-2014	2	39.7
	2015	1	17.7

Table 2. Results for Cox proportional hazard models, $\alpha=0,05$

Factor	Model 1		Model 2		Model 3		Model 4	
	HR	p	HR	p	HR	p	HR	p
Cons_pase_1/2					2.120	0.000		
Typ_eng_1/3							1.400	0.000
Typ_eng_2/3							0.490	0.000
Exp_p_1/2	0.609	0.008			0.645	0.018	0.668	0.030
Exp_c_1/2			0.674	0.085				
AIC	1381.77		1386.22		1366.75		1361.05	
SBC	1384.54		1388.99		1372.29		1369.36	
R2	0.059		0.023		0.186		0.237	
No. of. c. obs.	118		118		118		118	
No of obs.	423		423		423		423	

Figure 1. Distribution of the duration of completed and uncompleted observations

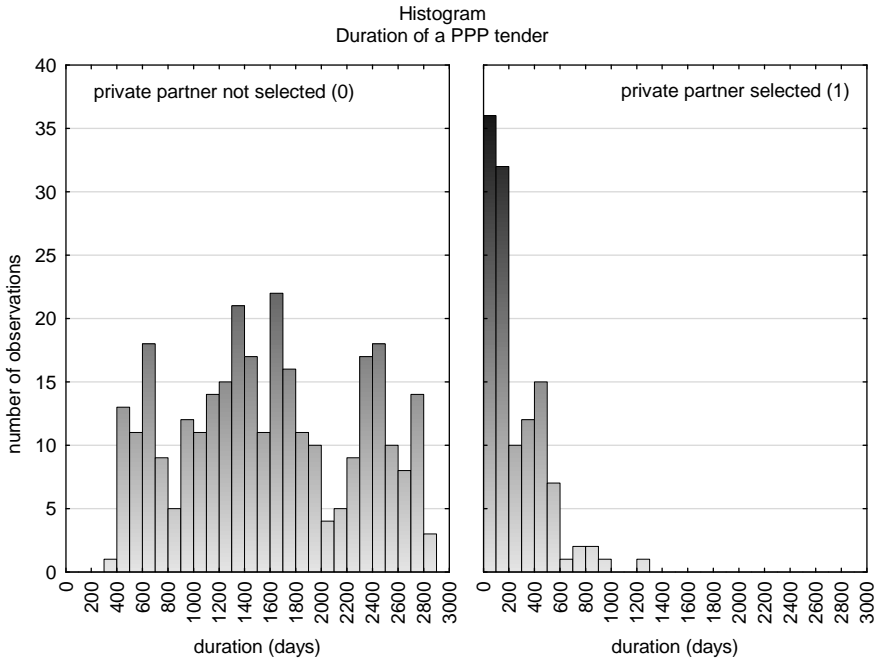


Figure 2. Survival function of completed observations

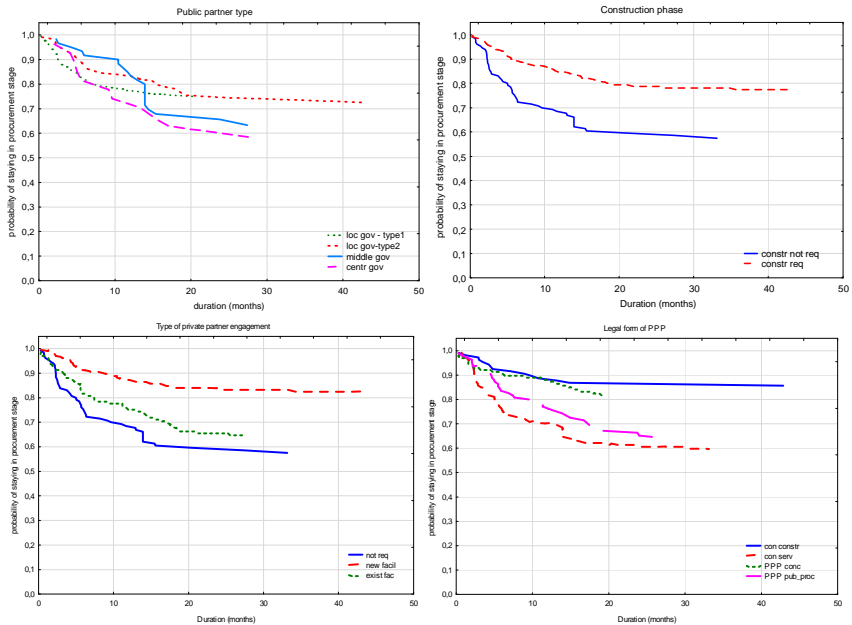


Figure 2. Continued

