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## Does Experience Exert Impact on a PPP Performance?

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**Does Experience Exert Impact on a PPP Performance?**

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## Does Experience Exert Impact on a PPP Performance?

**JEL Classification:** *C41, D01, H54, L32, O22*

**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 (Arrow, 1962). 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.

**Methodology/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 cancelled 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 organisational (Cyert & March, 1963; Levitt & March, 1988; Argyris & Schon, 1978; Argote, 1999, 2001) and strategic management literature (Zollo & Winter, 2002). In Poland, the problem was raised by B. Mikuła (2006) and K. Olejniczak (2012).

One of areas that has 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 particular activity and the resulting performance and is interpreted consistent 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 has 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). This 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, Mulotte & Ren 2015). 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.

There appears to be an interesting inconsistency to explain the learning across organizational activities and open area for potential contribution. We will focus in particular on the public-private partnership (PPP) project development activities.

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.

## **PPP as a Subject of the Research**

We can identify a range of economic, social and political reasons and motives for the growth of PPPs. For example there is a growing number 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, Ruhashyankiko, & Yehoue, 2006), (Galilea & Medda, 2010), (Buso, Marty, & Tra, 2014), (Moszoro, Araya, Ruiz-Nuñez, & Schwartz, 2014).

Investigating the factors that exert impact on the development of PPP some scholars emphasise the importance of choice that must be undertaken by potential provider of public services (McQuaid & Scherrer, 2009). This 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 E. Klijn and J.Koppenjan (2016) investigated what kind of contracts characteristic influence PPP performance.

According to Huxman and Hubbert (2009) the performance of a PPP project has several dimensions. One of this dimensions can be described as reaching the emerging milestones by the project.

That is why it was assumed that a basic characteristic of PPP projects can be reduced to its main property. This property is to bundle facility construction and service provision (Hart, 2003). This 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 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 the date 2 and the services are provided between the 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.

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 to the next phase. Adopted research approach would help to assess the importance of experience among other factors contributing to the PPP performance.

## **Method of the Research**

To uncover causal relationship between PPP characteristics and its performance the research employed survival analysis. 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 methods 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 analyse the determinants of length of stay in tourist accommodation (De Menezes, Vieira, & Moniz, 2009) or the survival of ski lift

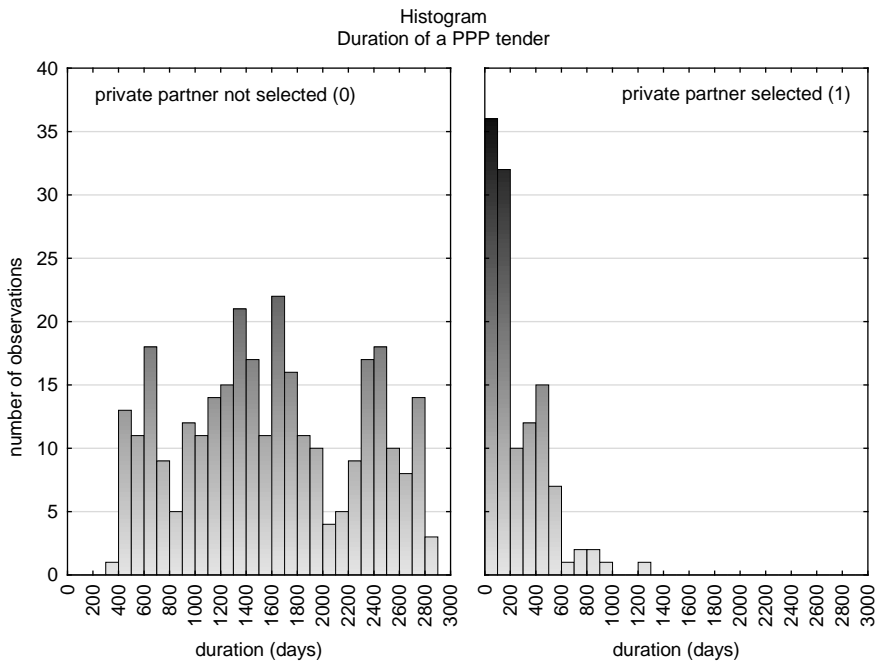
operators (Falk, 2013). Such methods have been also used for the duration analysis of software projects (Sentas, Angelis, & Stamelos, 2008).

Considering PPP literature Buso, Marty and Tran (2014) utilised 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 can't be recovered. Next reason is associated with the specific feature of PPP market in Poland - a prevailing number of PPP initiatives that did not reached 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 are – 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 distributions of duration of PPPs – procurement stage – is presented on the Figure 1.

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



Source: own calculations.

The set covers data on 423 PPP projects. The number of PPPs that proceeded to the next phase (completed observations) was 118 while the unsuccessful (uncompleted observations) procedure reached 305. The median durations were as follow: 5,66 months for completed observations and 51,57 months for uncompleted observations.

Duration of a PPP procurement may be affected by a range of factors characterizing the project, PPP partners or the market. The data used in the model were obtained individually for each project. Information on PPP projects is available on official websites dedicated to public procurement: Teds Electronic Daily (TED) and Public Procurement Bulletin (BZP). Data obtained from 423 tender announcements enabled to prepare a following set of factors describing PPP projects (Table1).

## Results of the Research

To report the results we present the Kaplan-Meier estimation of the duration curves, and we construct a Cox regression models describing the relationship 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 on Figure 2.

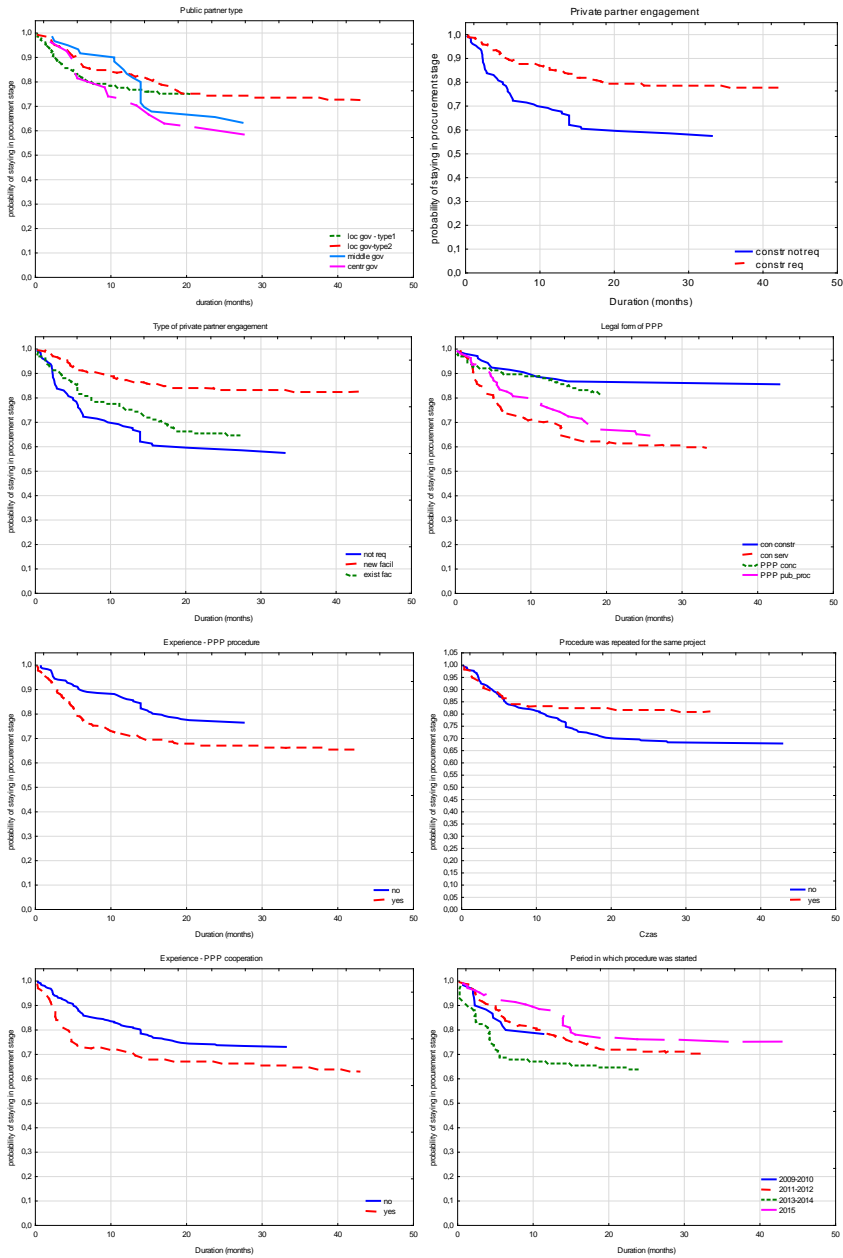
**Table 1.** Median duration for the levels of each factor

<b>Factor</b>	<b>Description</b>	<b>Levels</b>	<b>Median duration (months)</b>
Public partner	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
Private partner engagement	building of facilities is not required	1	22,1
	required	2	44,7
Type of engagement	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	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	project was initiated only one time	1	32,1
	procedure was repeated for the same project	2	42,6
Experience – PPP procedure	public entity has no experience in PPP procedures	1	47,5
	public entity has experience in PPP procedures	2	40,3
Experience – PPP cooperation	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	project started between 2009-2010	4	80,1
	2011-2012	3	61,0
	2013-2014	2	39,7
	2015	1	17,7

Source: own calculations.



**Figure 2.** Survival function of completed observations



Source: own calculations.

In general, the types of PPPs that are most likely to proceed to the next phase are following: initiated by central government and its representatives, PPPs for which private partners is 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 likelihood for 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 likeness 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 can't reject the null hypothesis 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 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 this two factors were excluded from further analysis. Additionally correlation test were conducted for the remaining variables and these tests didn't reveal any significant relations between factors. Table 2 shows the results of the *Cox proportional hazard* models.

**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
Priv_eng_1/2					2,120	,000		
Typ_eng_1/3							1,400	,000
Typ_eng_2/3							,490	,000
Exp_p_1/2	,609	,008			,645	,018	,668	,030
Exp_c_1/2			,674	,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.		118		118		118		118
obs.								
No of obs.		423		423		423		423

Source: own calculations.

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 *Exo\_p* and *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 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 terms of a type of building facilities or its lack. We found that Model 4 explains survival of a PPPs in more complete manner.

Presented results are quite intuitive – expected private partner engagement is the most powerful predictor of the survival of PPP projects. If private partner is not required to build facilities, there is more than two times as likely to find a private partner as for the other cases (Model 3). However previous experience in PPP also influence 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

This study delivered a detailed examination of the determinants of performance of PPP projects under procurement stage over the period 2009-2015. Our objective was to offer an interpretation of the relationship between experience and PPP performance in the context of investment decisions. The overall conclusion is that if a public entity has an experience in conducting PPP procedures it is more likely that PPP initiative it offers will be positively verified by the market. If we compare this outcomes to the results obtained from PPP projects for which the procedure was conducted more than once, we can say that public entities are rewarded for those activities which involve the search for new opportunities for public - private cooperation contrary to these activities that try to modify previous unsuccessful projects. 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.

The major limitation of the study is related to the nature of the data. A lack of reliable, publically accessible database on PPPs limits more detailed examination of PPP in Poland. Another field for future work is to include additional variables into the survival model. One suggestion is to include time-varying factors to obtain information on possible trends that may occur if we consider a longer period of the analysis.

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