Public Private Partnerships: Social Acceptability and Impacts on Employment

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Abstract
The development of infrastructure in country can boost its economic growth and contribute in job creation targets. Although infrastructure has been financed with public funds, governments with financial shortages have preferred private funding using the alternative method of Public-Private Partnerships (PPPs). In consideration of the social benefits that infrastructure development provides in one hand and the current economic crisis on labour markets across the EU on the other, local PPP initiative is expected to provide employment and increase economic activity. With a focus in the new stream of PPPs introduced in the Greek context over the last decade, the current study examines the dynamics of employment from the PPP development.
In order to understand the production system of PPPs and examine a strategic approach for their development we have employed the theory of System Dynamics (SD). SD methodology allows mapping the complexity of the system by integrating the factors that affect the implementation flow of PPP projects and employment. In particular, a quantitative SD model that incorporates elements that affect the flow of the projects in all PPP implementation phases, i.e. decision, procurement, construction and operation under several real-world assumptions has been developed. The model integrates behavioral patterns of the actors in the system considering social acceptability, investment attractiveness as well as country's experience in PPPs.
Simulation runs of several dynamic scenarios regarding social acceptability patterns and development rates deliver the employment contribution from the PPP exercise. The model sheds light on PPP development policies that can be implemented to boost employment and allows further experimentation and extension for regional employment policy making.

Keywords: Public Private Partnerships, Employment, System Dynamics

Introduction

The provision of public infrastructure is one of the most important elements for social and economic development in a country. However, financial shortages have led governments to exercise alternative methods for the financing and development of infrastructure. Apart from concession contracts met mainly in the transportation sector, infrastructure demand in other sectors, such as healthcare and education, has been satisfied with the supply ofPublic Private Partnerships (PPPs)(COM(2009)615; Kappeler, 2010).According to the Commission's 2004 Green Paper on Public-Private Partnerships, PPPs are'forms of cooperation between the public and private sectors for

the funding, construction, renovation, management or maintenance of an infrastructure or the provision of a service'(COM(2004)327).The financial gap covered by private funding through PPPs is expected to boost employment in many European countries preventing the effects of the economic crisis on labour markets (Duchemin and Irving,2011).

In the Greek context infrastructure activity had been substantially contributive in regional growth and employment levels, forming the backbone of the Greek economy from the contractors' perspective. Traditionally, apart from concession contracts applied in road infrastructure, public infrastructure has been developed using mixtures of public funds and other European Structural Funds.However, adverse conditions of limited financial resources for public investments raised the need to attract private capital. As such, over the last decade the development of infrastructure projects in Greece, has been facilitated through PPPs(Kappeler, 2010).

The attractiveness of PPPs is not only based on the financial shortages, but alsoin allocation ofrisks between the partners. In PPPs the private sector becomes responsible for the financing, design, construction and operation of a project to design for a strategic horizon, while the public sector guarantees for the social acceptability of the project, improves the legal environment and keeps its supervisory role (Burger and Hawkesworth, 2011).

Positive outcome in construction employment rates can be achieved when projects in a pipeline flow with no delays in all project execution phases from procurement to operation. A precondition to this is the constant satisfaction of all the actors involved, ie the society, the public and the private partner regarding their demands. The long duration of PPP projects underline deep uncertainty for all parties andthe project itself. Usually, theprivate intervention for public services is often opposed from low income societies due to the unknown future increase of the debt that might be realized throughout the projects' lifecycle. In turn, and in order to limit these opposes, governmental bodies try to inform and convince the public opinion aboutthe long term benefits of PPPs, such as employment,and try toreduce the risk of political changes. Political stability during the life ofa PPP project is an important factor that explainsinvestors' attractiveness, since investors demand and need a stable legal framework to invest. As theinvestors' attractionis increased the more effective competitionsupon the procurement of projects can be accomplished. In turn, construction activity generates jobs and boosts employment in the labour market. In a region where the latter possesses a strong part of the total, construction employment should deliver social acceptance and demand for more PPPs.

The current paper deals with the employment contribution delivered from PPPs' development and is part of an ongoing research. The scope of the ongoing research is to understand the systems' behavior and analyse policies regarding employment. For the analysis we adopt the method of system dynamics. System Dynamic (SD) models allow decision makers to study and reveal strategies to meet specific goals. With the use of causal loop diagrams the impact of PPP development on construction employment and on social acceptability can be examined. The conceptual causal loop diagram (CLD) that integrates the main elements of the system under study is shown in Figure 1 below.

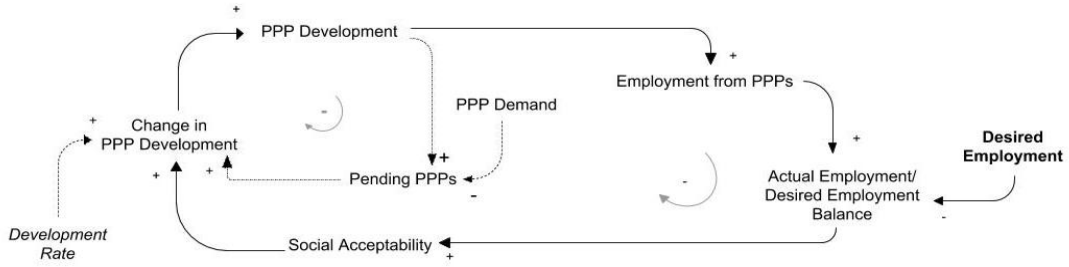

Figure 1: Generic concept of relationships in PPPs Development and Employment under research

The construction of infrastructure from PPPs, i.e.'PPP Development', has a positive effect in 'Employment from PPPs'. Assuming a constant 'Desired Employment' target level, located on the right edge of Fig.1, actual 'Employment from PPPs' delivers the dimensionless discrepancy ratio 'Actual Employment/Desired Employment Balance' that explains employment contribution. The dynamics of the latter is assumed to drive 'Social Acceptability' of PPPs in a region. As employment balance grows the more positive social behavior regarding the acceptance of the PPP development system can be obtained. Decision makers in consideration of 'Social Acceptability'can then control'Change in PPP development' per year using the external parameter 'Development Rate'.

In the current paper however, 'Social Acceptability' is considered out the above systems' boundaries and is used as an external parameter. In particular, it is considered to wear a pessimistic, a normal and an optimistic scenario and is not explained from employment balance.

The rest of the paper is organised as follows. The next section delivers a literature review.In Section 3 we present the system under study, while in section 4 we present the causal loop diagram of the system dynamics model of the PPP production system. In section 5 numerical analyses reveal the employment contribution of PPP development adopting data from Greece. Finally, in Section 6 we present the conclusions and the drawbacks of our study.

Literature Review

To the best of our knowledge we have not met a supply chain model of the PPP production system and its impact on construction employment. System dynamics is a powerful methodology that has been helping policy makers to map elements of complex systems and explain causal relationships that change the state of a system. Approaches in infrastructure development have been providing useful public policy insights while recent studies keep on referring on J.W. Forrester, the founder of System Dynamics methodology, who developed the *Urban Dynamics Model* to study interactions between the housing, business, and population sectors of an urban system(1971).

Therefore, the current review is divided in two main parts; the first reviews the theory that has been developed using SD methodology in PPPs and the second one reviews literature on the factors that affect PPPs as integrated for the creation of the SD model.

System Dynamic Approaches in PPPs

From the PPPs' perspective, that has been raising the academic interest over the last decade, literature using system dynamic approaches has been limited on a variety of other issues than employment.The dynamic models developed so far regard the critical factors during pre-contract negotiations, processes used to implement PPP projects, 'bankability', and pricing models.

A system dynamics based concession pricing model for PPP highway projects was introduced from Xu,et al.(2011) who developed a reliable, objective, and systematic model for determining a rational concession price for PPP highway projects based on pro forma financial statements developed during the feasibility study period. One of the most important variables that has to be determined during the negotiation period is the concession price; the methods available for calculating the value of this variable are limited while it is an essential element of the financial viability of highway projects.The effectiveness of the proposed SD-based concession pricing model was verified by a real toll tunnel project located in China and results showed that the proposed model is reliable, accurate, and suitable for the application by practitioners for concession price determination. It is believed that a rational and practical concession pricing model can create a 'win–win' situation for both the private investor and the host government.

Another systemic PPP model for planning and implementation in PPP projects in South Africa has been constructed fromNyagwachi and Smallwood (2008). The scope of the model is to illustrate the systemic processes used to implement PPP projects, clarify the complexity of the causal interrelationships within the PPP system and provide direction for the current and future researchers into new discoveries. The PPP systemic model was tested for appropriateness by administering a two-page questionnaire to sixty PPP and non-PPP participants; the results from the survey scoped to validate the interrelations of the variables incorporated in the model.

Chaim et al. (2010) argued the use of the system dynamics as a main approach to a new research area named Territorial Engineering for the development of a model aiming to measure the 'bankability' of infrastructure projects. The study has also examined the possibility of using agent-based modeling in the form of a hybrid model to study bankability.

Another study regarding road procurement strategies proposes SD modeling in combination with Role-Playing Games(Altamirano, 2006). In the study a SD model integrating four contractive trends in road management procurement strategies has been developed and different scenarios were built corresponding to four new policies; indirect financed projects, combined contracts, outcome/final quality criteria and long-term contracts.The study indicates the limitation of system dynamics to explain 'soft variables' relevant to the behavior of the parties involved resulting from the choices of diverse economic agents and structural changes resulting from new policies and proposes the combination of SD models with Role-Playing Games.

PPP issues and factors

Employment contribution depends on the implementation rate of the PPPs, but the latter isstrongly affected by factors representing risks. Risk management in PPPs has captured a possessive part in PPP literature. For example, the effect of financial risks in Built-Operate-Transfer projects on different phases of procurement was investigated in a survey by Lam and Chow(1999). Results suggested that "interest rate fluctuation" was the most significant financial risk in the pre-investment phase, while 'currency exchange restrictions' was moderately significant in the operational phase.

Additional studies, using questionnaires to collect data, have identified that the key risk areas in BOT projects are political risks, financial risks, revenue risks, market risks, promoting risks, procurement risks, development risks, construction completion risks, and operating risks (Akintoye, 1998; Li, 2003; Li, 2005). Merna and Smith (1996) have classified risks in two broad categories: elemental and global risks, where elemental risks are those that can be controlled from the partnered parties and include project risks, completion risks, operation and maintenance risks, risks on inputs and outputs, financial risks, political risks, credit risks and sovereign risks, while global risks refer to phenomena that cannot be controlled, such as natural disasters, civil disturbance or war.

Other studies have focused on successfulness and performance factors that affect the individual project stages (Yuan et al. 2009; Abdel 2007).Recognized obstacles in PPP implementation were found to be lengthy delays in negotiation;lack of experience and appropriate skills and lengthy delays due to political debate(Chan et al. 2010). Additionally, opaque and inadequate legal system, complex approval system, regulatory constraints on market entry and low market prices for infrastructure products and services have been significant impeding factors for BOT projects(Dima, 2004).

From the above literature review we notice a growing concern of literature to study the impact of risks in PPPs and reveal the appropriateness of system dynamics modeling for policy making. The contribution of the theory in the field of PPPs has not been comprehensive especially from the perspective of growth and employment in a region. However, in consideration of economic growth and development of a country, many system dynamic approaches have provided useful insights for policy making. Since there is a lack of well proven approaches in evaluating the PPP dynamics, we have developed a SD model to study development strategies.

The system under study

The structure of the production process of projects running under the PPP scheme does not differ from the traditional procurement methods. The figure below shows the operations incorporated in a PPP system from perception until implementation. Public bodies submit their infrastructure needs to the government forming a list of number of projects pending for approval from government policy makers. Then the government – Ministry of Finance (Inter-ministerial Committee for PPPs) decides with which of these Project Proposals may proceed with procurement. Upon approval, procurement procedures from public bodies take place.

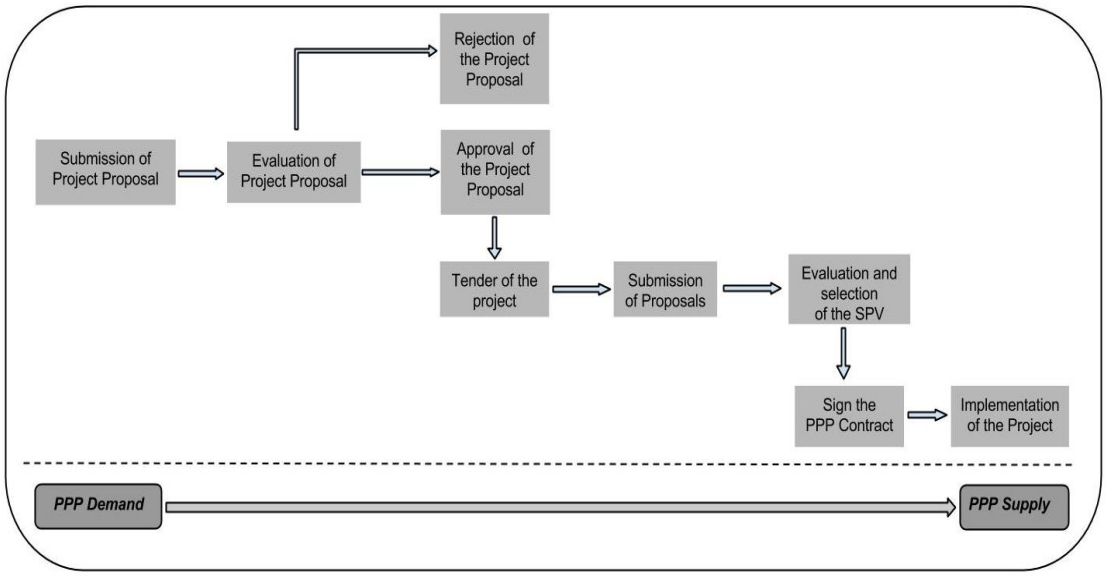

Figure 2: The Structure of PPP production supply

In reality, however, the process described above integrates long delays due to a mixture of interactions of the actors in the system. In order to deliver a realistic approach on the flow of projects we have adopted the method of system dynamics to capture the factors that explain real phenomena.

The next paragraph presents the developed causal loop diagram of the above process.

Model Structure

The structure of the PPP production system is captured by causal loop diagrams.The causal loop diagram developed is presented in Figure 3. First, we describe the physical structure of the system and then we explain the feedback loops and the factors that affect the rate of physical flows.

The arrows among variables are used to describe relative influences. The'+' or '-' symbols on the direction of each arrow indicate the increasing or decreasing effect caused from one variable to the other.

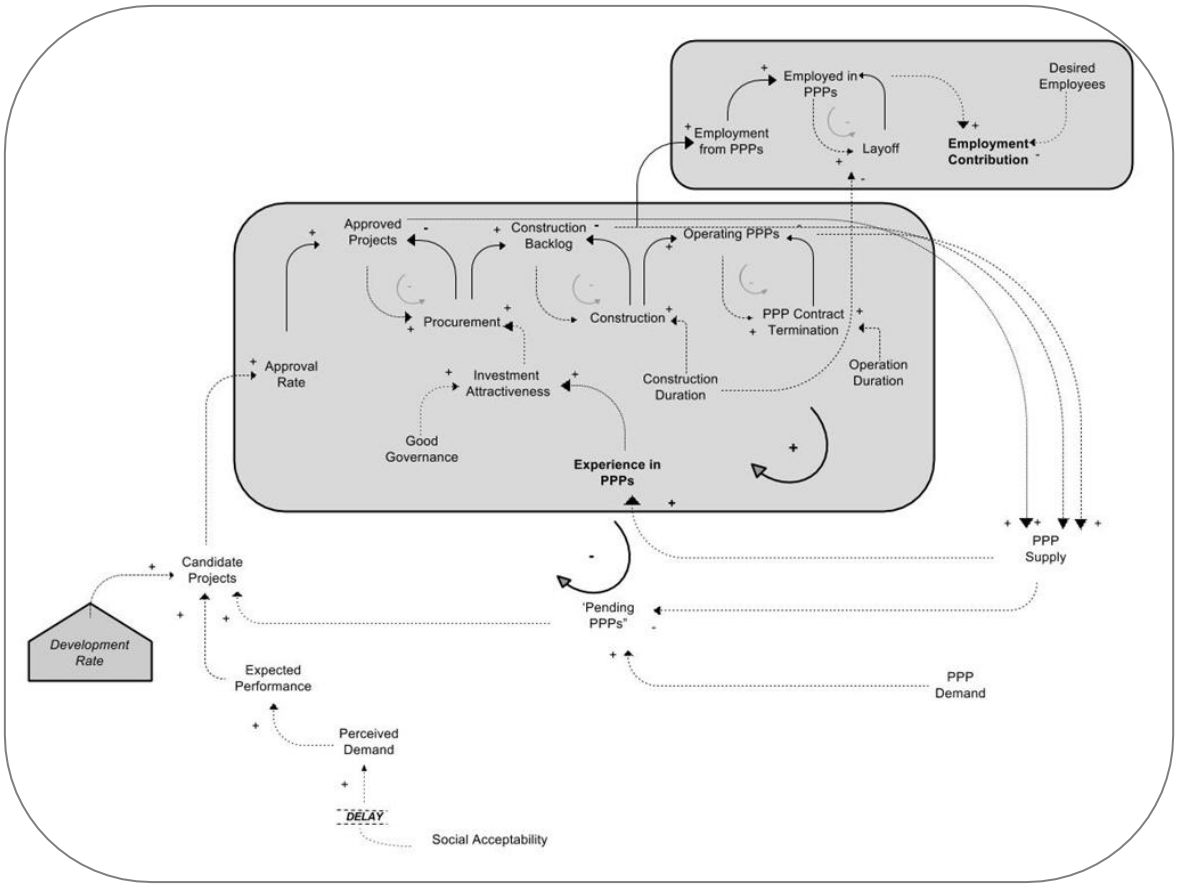

Figure 3: Causal Loop Diagram of PPP Development

The physical structure of the system

The 'Approval Rate' of projects increases the level of 'Approved Projects', which is decreased by the 'Procurement' rate. In turn the 'Procurement' rate creates the level of 'Construction Backlog', which reflects the remaining amount of work that has to be executed by the contractors in the years ahead. 'Construction' rate delivers the 'Operating PPPs' that terminate after the duration of the contract.

'Construction' boosts 'Employment' delivering the number of 'Employed in PPP' construction workers. The level is naturally decreased with a 'Layoff' rate that changes in relation to 'Construction Duration'. In consideration of the desired employment level, 'Employment Contribution' from PPP projects' is determined as a fraction of 'Employed in PPPs' to 'Desired Employees'.

Important feedback loops and Relationships

In order to examine the impact of decisions on development rates we present the following balancing loop: The sum of 'Approved Projects', 'Construction Backlog' and 'Operating PPPs' delivers the total of 'PPP Supply'in the construction industry. Discrepancy between 'PPP Demand' and 'PPP Supply' delivers'Pending PPPs'.

Information delivered from 'Social Acceptability' impacts the magnitude of 'Candidate Projects'. Final Candidate Projects are controlled from the parameter 'Development Rate'.

'Social Acceptability' and the 'Perceived Demand' describe 'Expected Performance' which describes the expected financial viability and successfulness. So, as 'Perceived Demand' about the use of PPP services grows, so does their 'Expected Performance' as shown in the diagram below. The relationship is non-linear and captures a realistic practitioner's view. Project consultants reveal the demand of a proposed project, i.e. use of the services provided by the project and examine Social Acceptability. So, the parameter of 'Social Acceptability' explains the population volume that will use and have the capacity to pay for the project. Capacity to pay is of course related to unemployment, as hypothetically shown in Fig.1, but the study currently lacks observational data to integrate this relationship.

Therefore, in order to test policy making for employment growth from PPPs 'Social Acceptability' is an external variable and wears a pessimistic, optimistic and normal behavior.

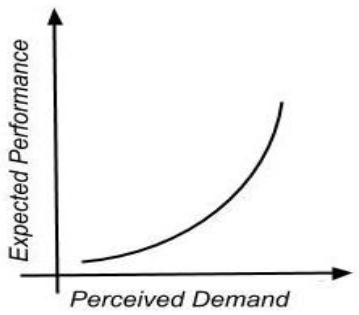

Figure 4: Relationship of 'Perceived Demand' and 'Expected Performance'

Policy-makers adjust to 'PPP Demand' with a development rate and form 'Candidate Projects'. Governments then proceed with 'Approval' for procurement of 'Candidate Projects' It must be noted that 'Information about the behavior of 'Social Acceptability' cannot be immediately revealed in real world, so we link it to the variable of 'Perceived Demand' using a '*DELAY*' to represent the time-delay incurred. A similar delay is realized from 'Candidate Projects' to 'Approval Rate'.

A reinforcing information loop exists at procurement stage. In order for successful procurement strong interest and participation from private investors has to exist. Parameters considered to affect investor's attractiveness in a region are the country's good governance indicators and the experience of the hosting country in PPP implementation (Galilea and Medda, 2010). We therefore input 'Investment Attractiveness' on the 'Procurement' rate variable, tomirror the behavior ofthe investors on procurement stages. We consider that the factors 'Experience in PPPs' and the country's 'Good Governance' can describe an attractive environment for private investments. 'Experience from PPPs' is positively affected from the total 'PPP Supply' creating a positive loop. Good governance is combined with the country's' past experience in PPP agreements,since

the latter boosts rule stability and minimizes political risks building greater confidence and trust for private investments.

Simulation Results

In this section we present a numerical example of the simulation runsexecuted regarding the impact of PPP development rate on employment using data from the PPP market in Greece.

For the development of the SD model the Powersim 2.5c simulation software package was used. The model's validity was checked by conducting tests suggested by the SD literature (Oliva,2003; Sterman,2000). First, the model's dimensional consistency was checked. Then extreme condition tests were conducted, checking whether the model behaves realistically even under extreme situations. For example, it was checked that when social acceptability is low, investment attractiveness is weak, or if there is no PPP demand, development ceases. Integration error tests were subsequently conducted. The model employs the Euler integration method with integrating time-step equal to 1 year. The results of the tests indicated no integrating errors.

We assume that the total demand for PPP projects represented by the variable 'PPP Demand' is 50 million euro, equal to the total budget estimated from the summation of the pending projects waiting for implementation delivered from the PPP Unit.Regarding 'Desired Employment', while in 2005 the number of construction workers was 299,207 in 2012 this number had dropped to 112,444. We therefore assume a constant total labour capacity of 100.000 for simulation.

In Tables 1 and 2 below we reveal the simulation results of 'Employment Contribution' in equilibrium states when Pessimistic and Normal scenarios are considered for 'Social Acceptability'. The results refer to three alternative inputs of the 'Development Rate', i.e. 5%/yr, 10%/yr and 20%/yr.

Table 1: Employment Contribution under Pessimistic Scenario of Social Acceptability

Development Rate	**5%**	**10%**	**20%**
Employment Contribution	10%	15%	20%

Results reveal expected phenomena. Firsthand, we notice that as 'Development rate' increases so does 'Employment contribution'. The latter however, performs weaker in the case of Pessimistic Scenario of Social Acceptability than in the Normal Scenario shown below in Table 2.

Table 2: Employment Contribution under Normal Scenario of Social Acceptability

Development Rate	**5%**	**10%**	**20%**

Employment Contribution	18%	22%	25%

The dynamic behaviour of 'Employment Contribution' for the two dynamic scenarios of 'Social Acceptability' is shown in Figures 5 and 6 below. In particular, Figure 5 presents the case of Pessimistic Social Acceptability and Figure 6 the case of the Normal one. In both diagrams the three numbers indicated on the graphs, i.e. 1,2 and 3 represent the behavior performed under the three 'Development rates' of 5%, 10% and 20% respectively.

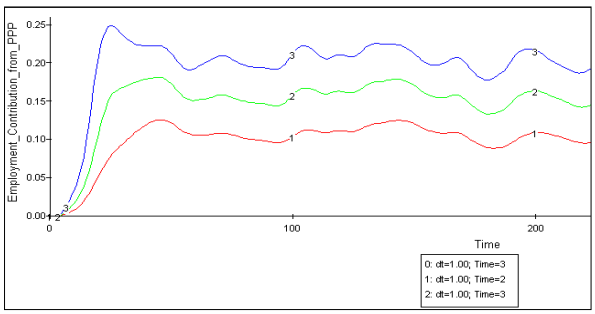

Figure 5: Achievable Employment Contribution/Pessimistic Scenario of Social Acceptability

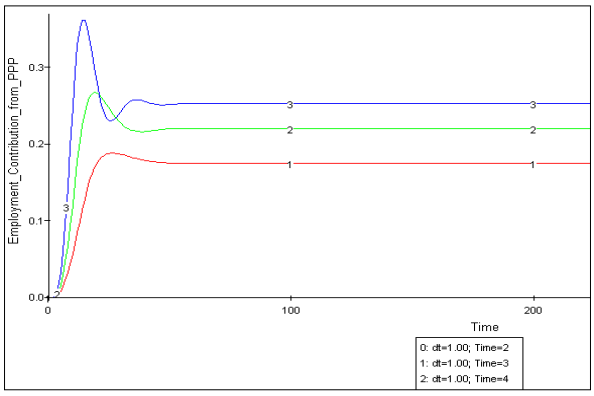

Figure 6: Achievable Employment Contribution/Normal Scenario of Social Acceptability

The dynamic behaviors from the above diagrams deliver the transition periods for 'employment contribution' to enter quasi-equilibrium states. In particular, in the pessimistic scenario we observe that a 50% decrease in the development rate delays equilibrium states in employment by approximately 50%. Similar 50%-50% attitude resulted in the case of normal social acceptability.

From the above diagrams we also observe that in the case of Pessimistic Scenario of Social Acceptability the employment contribution has a fluctuating behaviour around the mean equilibrium values performed. On the contrary, dynamic behavior in the normal scenario remains stable on equilibrium states.

Conclusions & Expectations

The current study sheds light on the first results of an ongoing research that aims to propose development strategies of PPPs that contribute in regional employment. Based on the theory of system dynamics a simulation model has been developed to capture in a holistic way the operational environment of the PPP production system.

The dynamic behavior of employment is examined under alternative PPP development decision strategies. The model is adjusted to data from the Greek context and considers alternative patterns of 'social acceptability' of PPPs. Simulation runs present deliver the transition periods for 'employment contribution' to enter quasi-equilibrium states; low social acceptability environment delays the transition period to equilibrium states of employment in comparison to a normal one. All results describe increased employment dynamics from the PPP development.

Considering that PPPs can be a promising resource to boost employment and growth in a regional context, the current model allows further testing of several development rates, being a helpful tool for policy making. As it is assumed that the more the employment rates the more the social acceptability for the development of more PPP projects, the current study will be extended to address the impact of the employment contribution on social acceptability of private initiatives for infrastructure development.

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