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Understanding Public Sector Capacity Planning Using a Dynamic Performance Management Approach

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Abstract

Capacity planning is a fundamental activity that regulatory agencies in the public sector are called to carry out in order to improve the quality of services. Thus, there is an increasing need to understand how the capacity planning used under public sector would support activities of operational management from a dynamic perspective. In this article, System Dynamics (SD) modelling has been used for strategic capacity planning and policy analysis, supported by a dynamic performance management (DPM) approach. This model-based planning methodology, which has long been the main way of approaching planning in the public/private sector is supported by a novel performance management framework. The results show that institutions in the public sector should change from traditional planning to strategy development taking into account the response capacity in the services promised. The main contribution of this article is assessed the strategy resources for the public sector, with a regulatory agency of Colombia taken as a case study.

Keywords
Capacity Planning, Performance Management, System Dynamics, Public Sector, Modelling.

1. Introduction

The key performance indicators (KPIs) help in assessing the quality of supplied service in the private/public institutions (Asif et al., 2012). In recent years, research on KPIs management has grown significantly, giving rise to assess the capacity of the resources (Asif et al., 2012; Barney, 1991; Warren, 2005). Although this performance measures a few times taken into account the sustainability in the long-term, modelling the sustainability of organizational implies the understanding of a more complex system than simplistic conditions used for the allocation of resources (Bianchi, 2016; Bianchi et al., 2015; Cosenz, 2017).

In the study case, the allocation of resources (i.e. capacity) influence on two aspects of the dynamic system. First, the quality of services depends on the available resources. Second, the used time on service influences on the completion rate of service. Thus, the delivery time of service has a high effect on the perceived quality of service (Herrera et al., 2018). These aspects could be comprising through modelling of performance indicators in order to damp delays service caused by insufficient resources capacity in the long-term (Bianchi, 2010; Bianchi et al., 2015).

The public sector faces challenges related to resources planning (Bianchi, 2010; Bouckaert et al., 2010; Hannon et al., 2015). These challenges comprise allocation of human and financial resources (Becerra et al., 2016). This paper analyses one public institution of Colombia dedicates to regulate the environmental policy. Currently, this institution faces drawbacks associated with available resources because of lack of capacity planning, which affects the quality of service. This issue can be an impediment to both the institutional reputation and the public financial resources.

Considering the above situation, it is natural that there has been a rapid growth of the research dedicated to the analysis of performance through indicators (i.e. KPIs) for capacity planning; however, these studies have not taken into account the dynamic of systems (Cosenz and Noto, 2017; Crespo et al., 2004). The delivery time plays a role important in the capacity planning of the public sector because of its influence on making the decision of allocation of resources

(Becerra Fernández and Herrera, 2018; Purdy, 2012). Thus, the main questions of this paper are: How to influence the delivery time of services for the capacity planning of resources in the public sector? What're the effects of delays on the perception of service quality? This paper makes two contributions from modeling in this issue. First, the service capacity is modeled through system dynamics modeling. Second, a dynamic performance management approach is used to analyze the public sector capacity. The results from the model contribute to identifying the resources, drivers and end-results employed for the management of the public sector.

The remainder of this article is organized as follow. Section 2 reviews relevant literature on blending system dynamics and DPM approach applied to capacity planning in the public sector. Section 3 describes the structure of the simulation model and the mathematical model. A framework based on a DPM approach for the public sector is presented in Section 4. Section 5 concludes by summarizing the most significant findings.

2. Background: system dynamics and DPM approach

Although there is abundant literature about capacity planning models from an optimization modeling approach, there is a deficiency profound from a dynamic modeling perspective that represents the delays in response capacity of service operations in the long run. Complexity and delays between causes and effects provide major obstacles to capacity planning (Becerra et al., 2016; Bianchi, 2016). SD modeling has been an appropriate approach to design strategies for overcoming such limitations. In particular, SD is adapted to map system behavior over time (Forrester, 1961; Sterman, 2000), while DPM approach is aimed at supporting decision-making from performance management and strategy design of system structure (Cosenz and Noto, 2017). This section reviews relevant literature on blending between system dynamics and DPM approach and they are applied for capacity planning.

2.1 System Dynamics

One of the most explored issues of SD application to strategic management is related to capacity planning (Cosenz and Noto, 2016; Torres et al., 2017). Capacity planning is broadly defined as the process by which an organization improves its performance through the efficient allocation of resources. Although there are several ways of trying to classify which type of planning approach is appropriate for each situation, SD has been useful to assess alternatives of strategic planning in the long term (Dyner and Larsen, 2001; Torres et al., 2017). In addition, SD has the ability to explain feedback loops and learn through the planning process as a result of strategic decisions (Cosenz and Noto, 2017; Gary et al., 2008; Torres et al., 2017). By learning through SD simulations, decision-makers can enhance their analyses and draw ways to improve performance.

SD models are appropriate to assess policy scenarios that contribute to the understanding of perceptions of reality as well as a good communication tool to advocate actions towards better management strategies (Bala et al., 2017). Previous studies show SD applications into the public sector focused on understanding the structure and behavior of systems, including the perception of service (Bianchi, 2016, 2010; Cosenz, 2014; Wheat, 2010). Models that analyze services and impacts on quality to determine service management policies are approached through SD using empirical tests that determine service quality (i.e. intangibles) (Ghosh et al., 2014; Pal and Hui, 2013). Given that the citizens' perception influences the image of the public institution, the SD is a useful tool to model the service quality over time.

2.2 Dynamic Performance Management

A service is defined as a set of activities that satisfy a particular need and that is characterized by a high level of intangibility that requires management before and after in order to achieve complete satisfaction with the service (Becerra Fernández and Herrera, 2018). How the perception delays have an impact on citizens in the long term, which affect the organizational performance, DPM becomes a suitable approach to understand how a change of perceived quality (end-results) can be affected by service capacity (performance drivers). DPM is an approach to enhance organizational development through a synthetic picture of the key performance factors (Bianchi, 2016). This approach is also conducted from quality mapping based on DPM chart, including in this paper.

Some research reported how DPM has been using for resources capacity planning (Bianchi, 2016; Cosenz, 2014; Cosenz and Noto, 2017; Crespo et al., 2004). The change of policy in public universities is evaluated from a DPM approach by Cosenz (2014). The study analyzed how a lack of coordination among different departments involved in

the delivery of services may considerably limit the ability of an organization to generate value. In this way, others studies highlighted the importance of the public sector performance due to the impact on the quality of life of citizens and may constitute either an acceleration factor or a constraint for the economic growth (Bianchi, 2010).

Consequently, DPM chart may guide the strategic planning of resources (i.e. capacity) and service offerings to facilitate citizens value creation. While SD could help in the process of prediction and prospective becoming a tool to improve the perceptions and probably other aspects related to citizens' satisfaction.

3. Modeling Approach

This paper provides a model-based framework for analyzing intangible resources and offers guidance for capacity planning in the public sector. The structure of a simulation model is represented by a stock-and-flow diagram based on feedback structure and time-delays. This structure represents the interaction between used capacity resources, perceived service quality and citizens. Figure 1 presents the stock and flow diagram using for capacity planning in the public sector. The service capacity is determined by the adjustment between current capacity resources and desired capacity. However, the time to adjust capacity influences on the changes of capacity resources.

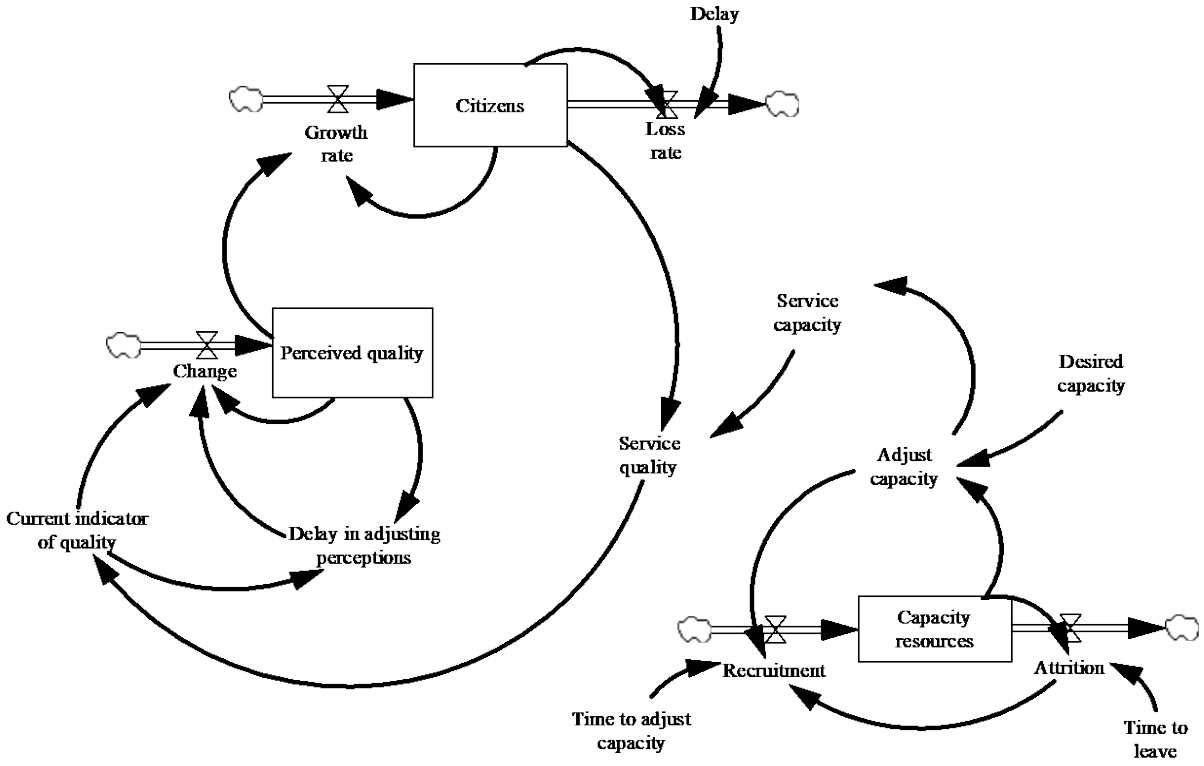

Figure 1. Stock-and-flow diagram for capacity planning, including perceived quality service and citizens.

A public institution of Colombia is taken as a case study. Currently, the operations at the Department of Financial and Business of this public institution faces delays, which affect the availability of services. The delays reach around 78% of the available time of operation. Thus, the perception of service quality could impact the long run the current indicator of quality. This proposal gives some elements in order to measure the effect of adjusting capacity on service quality within the simulation model as follows:

$$Adjust\ capacity = Capacity\ resources - Desired\ capacity \quad (1)$$

$$Service\ quality = \frac{Citizens}{Service\ capacity} \quad (2)$$

4. Results: Framing the Performance of Capacity Planning in the Public Sector

In this section, a framework for the performance management of capacity planning in the public sector is developed. This framework obtained from stock and flow diagram represents the interaction between strategic resources, performance drivers and end-results of the public institution. This model is based on studies of Bianchi (2016) and Herrera et al. (2018).

Figure 2 presents a DPM chart for capacity planning in the public sector. On the one hand, the adjust capacity to influence on recruitment of human resources. The recruitment depends on time to adjust capacity (hiring). On the other hand, perceived service quality affects the growth rate of citizens because of the delays in adjusting perception that influences on change of quality.

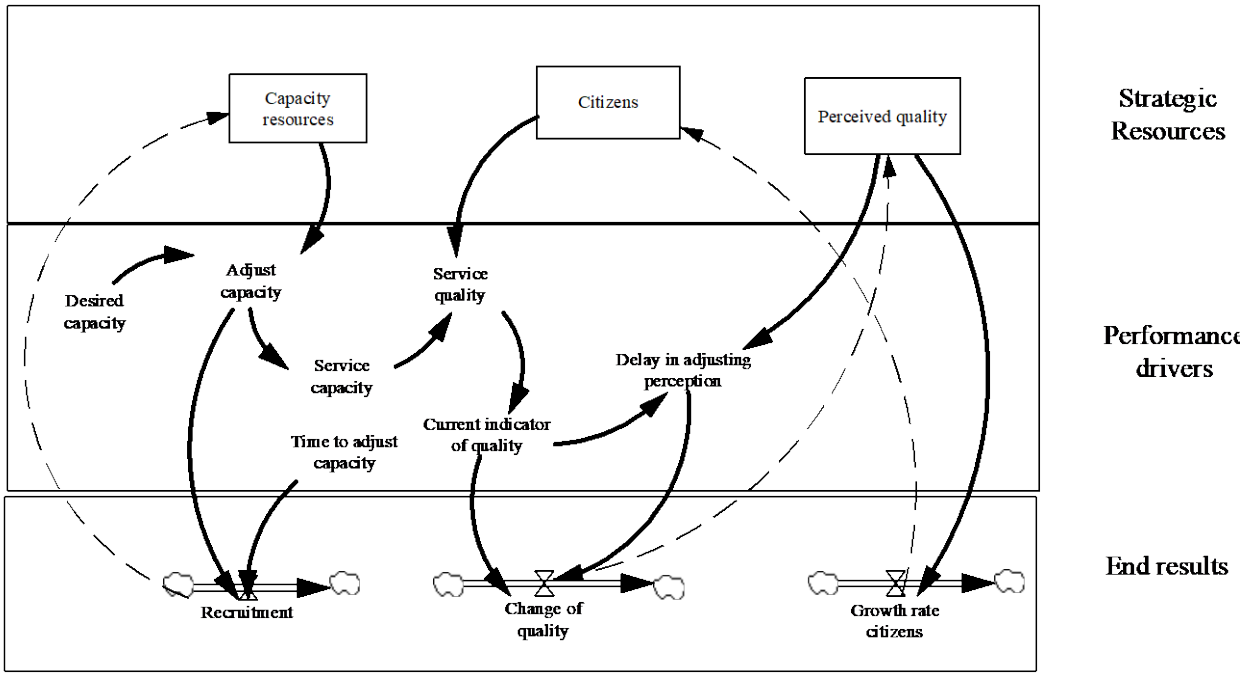

Figure 2. DPM chart for capacity planning.

5. Conclusions

This paper developed a framework to represent through SD and DPM the benefits of strategic capacity planning in the public sector. This framework contributes to identifying strategic resources, performance drivers and end-results as well as their interactions.

Although this paper does not present the effects of capacity service on the growth rate of citizens, the simulation model could be supported by this analysis. Also, a similar strategy could be used to analyse the private sector, using the simulation approach proposed here.

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