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The impact of Lean adoption on organizational performance in a public service: The case of the Greek citizen's service centers

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Abstract

Purpose: The aim of this study is to determine the relationships between Lean adoption and organizational performance in a specific Greek public services sub-sector namely Citizen's Service Centers (CSCs).

Design/methodology/approach: An online structured questionnaire survey was distributed to all the Greek CSCs and six hundred and seventy-two employees responded and fully completed the questionnaire. Exploratory and Confirmatory Factor Analysis were applied to assess the measurement model reliability and validity. The relationships between the latent constructs were examined through Structural Equation Modelling.

Findings: The study revealed that Greek CSCs adopt at a medium to high extent the following principles: understanding customer needs, establishment of value streams, creating flows within the value streams and value perfection. The data also revealed a valid latent factor reflecting the Lean application namely, "Lean adoption", which according to the findings contributes to the organizational performance of Greek CSCs.

Research limitations/implications: The small percentage of the responding employees of the Greek CSCs, given their large population, and the subjective nature of the data collected constitute the main limitations of the present study.

Practical implications: The findings of this research will serve as a reference source for managers and decision makers of CSCs in order for them to set the foundations for successfully adopting the Lean principles and therefore improve their organizational performance in terms of operational performance and satisfaction employees and citizens.

Originality/value: Building on the public sector literature, this is the first study that evaluates the adoption of Lean principles in the Greek CSCs and defines the relationships between Lean adoption and organizational performance.

Key words: Lean principles, public sector, organizational performance, Citizen's Service Centers

Paper type: Research paper

Introduction

In recent years, the worldwide economic downturn and shrinking budgets (Costa *et al.,* 2020) combined with the ever-changing demands of citizens, in a rapidly evolving environment, highlight the need to reform public administration in order to be able to serve citizens better, with new tools and reduced cost. Public administration is an important part of the economy in every country in the world and regardless of its operation or service (Rodgers and Antony, 2019), provides social justice and influences citizen's quality of life (Costa *et al.,* 2020). However, to combine efficiency and economy in public organizations, it is necessary to reduce the administrative burden for governments (Caiado *et al.,* 2020). Thus, the need to adapt to the new environment is pushing public organizations to implement continuous improvement methodologies, which focus on quality improvement, eliminate waste, reduce cost and crack down on bureaucracy (Fletcher, 2018; Vadivel *et al.,* 2021). Such approaches are aligned with the Lean philosophy (Bakar *et al.,* 2017; Costa *et al.,* 2020; Rodgers *et al.,* 2021).

The literature review shows that in general there have been several initiatives that indicate that the awareness and adoption of Lean in various public sector organizations has increased quite sharply in recent years (Madsen *et al.,* 2017; 2019; Abdelmalek and Houfaidi, 2022). According to Osborne *et al.* (2013) Lean has successfully made the transition from the manufacturing setup to the service sector by incorporating coproduction to the creation of public service-dominant logic. Costa *et al.* (2020) state that Lean has been successfully applied in the armed forces while Lukrafka *et al.* (2020) point out the application of Lean by both central and local governments. Antony *et al.* (2019) and Rodgers *et al. (*2019a) report the successful implementation of Lean in the

police. In addition, Antony *et al.* (2017b) and Madsen *et al.* (2017) positively assess the future of Lean methodology in the public sector, agreeing that it is an effective tool for reducing waste and not a passing trend. In the same vein, Rodgers *et al.* (2021) and Psomas *et al.* (2022) emphasize that Lean is the most widely used methodology in many areas of the public sector.

These examples demonstrate not only the variety of the services which Lean has been applied to but also the sporadic and sparse nature of its application in public sector (Rodgers *et al.,* 2021). However, empirical studies that highlight the application of Lean methodology in the public sector are relatively few (Adacu *et al.,* 2018; Antony *et al.,* 2019; Fredriksson, 2020; Abdelmalek and Houfaidi, 2022). According to the published literature there is a growing body of research on leadership, readiness and success factors, strategic alignment and Lean as a system (Smith, 2016; Rodgers *et al.,* 2019b). However, these studies do not focus on the organizational performance of Lean management in specific public administration organizations (Monteiro *et al.,* 2015; De Almeida et al., 2017; Adaku *et al.,* 2018; Lukrafka *et al*., 2020; Caiado *et al.,* 2020). According to Bakar *et al.* (2017) there is a severe deficiency of bibliography regarding the investigation of the impact of Lean management on organizational performance in the public service sector and in particular in the context of local government. Moreover Gupta *et al.* (2016) found no available literature presenting the success measures of Lean development in service organizations (public or private). In other words, the issue of Lean adoption in the public sector remains largely under review (Juliani and de Oliveira, 2021; Fredriksson, 2020; Pollalis and Angelopoulos, 2021).

Thus, many future research suggestions have been made by several authors in terms of Lean adoption in the public sector. De Almeida *et al.* (2017), Antony *et al.* (2017a), Juliani and de Oliveira, (2021), Vadivel *et al.* (2021), Costa *et al.* (2020) and Psomas *et al.* (2022) indicate that studies are needed in various public services organizations and different sub-sectors such as, local governments. In addition, various research work such as those conducted by Hadid and Mansouri, (2014), Madsen *et al.* (2017), Antony *et al.* (2017b), Sony *et al.* (2020), Costa *et al.* (2020) and Rodgers *et al.* (2019a), also, highlighted the fact that there is a strong need for credible studies on the impact of Lean on the public sector. More specifically, Vadivel *et al.* (2021) studying public post offices suggest future research studies to investigate the impact of Lean on the organizational and financial performance of the organization while Sony *et al.* (2020) recommend further research of the impact of Lean on all dimensions of public services. In addition, Rodgers and Antony (2019), Lukrafka *et al.* (2020), Alblooshi *et al.* (2020), Costa *et al.* (2020) and Patel and Patel (2021), suggest further research to develop a generalized framework to guide the implementation of Lean in some specific sectors, such as the public sector. In the same vein, Madsen *et al.* (2017) emphasize that there is a significant need for a measurement system for Lean performance as most organizations' failure is due to the lack of a Lean maturity model. These authors believe that public organizations need a guide to the successful implementation of Lean in each sector, especially for those who want to start Lean from scratch. Finally, Keramida *et al.* (2022) suggest further research on the impact of Lean adoption in Greek CSCs.

From the above identified gap in the literature as well as the suggestions of authors for further studies, it is apparent that there is a need for a broader and more in-depth

treatment of Lean in the public administration sector. Against this background the purpose of the present study is to highlight the impact of Lean adoption in public administration services organizational performance and in particular the Greek CSCs.

CSCs were established by the Greek Government in 2002, stimulated by the principles of the New Public Management (NPM) and quality management theory. These centers are located all over Greece in approximately 1,000 locations, providing over 1,000 certified administrative processes (ekep, 2022). They constitute a sub-sector of the Greek public administration and operate as one-stop shops aiming at providing assistance to citizens in order for them to effectively accomplish administrative processes which refer to almost all bodies of the public sector. It is worth noting that more than 77 countries across the globe have established physical and/or digital CSCs to better serve their citizens (Fredriksson, 2020). However, empirical research concerning the assessment of these services is limited (Psomas *et al.,* 2020; Fredriksson, 2020). So, the CSCs, as innovative public service organizations in Greece, constitute fertile ground for evaluating the quality of the services, citizens' satisfaction and therefore the quality improvement programs (Keramida *et al.,* 2022).

In addition, CSCs was selected, as a case study, because of its particularities related to the Greek public sector pathology, as even today it suffers from time-consuming services, complex procedures, bureaucracy, opacity, inefficiency, lack of meritocracy and a culture of indifference toward corrupt practices (diaNEOSis, 2021). In this context and since the ultimate goal of Lean is mainly to "combat" several types of waste through continuous improvement activates focus on the identification and reduction or elimination of non-value adding activities to the products or services provided (Sony *et*

al., 2020; Vadivel *et al.,* 2021; Abdelmalek and Houfaidi, 2022), the Lean methodology can significantly contribute to improving the performance of CSCs.

It is worth noting that, while the number of publications has been increasing steadily on an almost year on year basis, as has the number of countries in which Lean has been applied in various parts of the public sector (Rodgers *et al.*, 2021; Rodgers and Antony, 2019; Abdelmalek and Houfaidi, 2022), this study focuses exclusively on the research that has been done in the Greek public sector. Thus, according to the literature review, regarding the adoption of Lean in the Greek public sector, only four studies were identified. However, in the research of Angelopoulos and Pollalis (2019), Pollalis and Angelopoulos (2021) and Psomas and Antony (2018), CSCs, were outside their scope and objectives, as these studies investigated the Critical Success Factors (CSFs) of Lean and the degree of adoption of Lean principles while they concerned services and enterprises of the wider public sector public such us utility organizations that specialize in renewable energy sources (e.g power, water), prefectures, municipalities, social insurance organizations, organizations of ministries and central government etc. Only, Keramida *et al.* (2022) investigated CSCs but examined the CSFs of Lean.

In other words, to the best of the authors' knowledge, no research studies were found linking Lean principles to results achieved by public organizations and in particular by CSCs. So, although Lean methodology has been implemented in the Greek public sector, additional work is required to better evidence the benefits and organizational performance that can be delivered. Thus, from the above mentioned the originality and the contribution of the present study are apparent. The present study contributes to the existing body of literature by empirically determining how the adoption of Lean

methodology in the public sector and in particular in the Greek CSCs affects organizational performance in relation to operational performance, citizen and employee satisfaction. The findings of this study can help public services organizations adopt more effectively Lean principles in their effort to reduce waste, improve quality and efficiency.

The rest of the paper is structured as follows: In the next paragraph, a relevant literature review is presented and the research questions are formulated. The research methodology, the findings of the study and their discussion follow. The next part presents the conclusions, the theoretical and practical implications. Study limitations and future research suggestions are summarized in the final section.

Literature review and research questions

Lean in the public sector

Lean is a management concept which is inspired by ideas and practices developed by the Toyota car company several decades ago. Lean can be understood in four different ways, as an organizational trend, a management philosophy, a set of principles, or a set of practices (Madsen *et al.,* 2017; Gupta *et al.,* 2016). Some Lean users view it as an abstract concept (e.g., philosophy or culture) or a philosophical approach guided by specific principles (Allaoui and Benmoussa, 2020) while others have a stronger emphasis on the use of concrete Lean-related tools and techniques such as PokaYoke, Kanban, SMED and Value Stream Mapping (Zefaj, 2020; Lukrafka *et al.*, 2020). Allaoui and Benmoussa (2020) state that in order for Lean to be successfully implemented in the public sector, it is necessary to firstly understand its principles and then comes the phase of using Lean tools and methods to apply this philosophy.

In recent years, several studies have been conducted on how and to what extent Lean principles can be successfully applied in public sector organizations, (Bateman *et al.,* 2018; De Almeida *et al.,* 2017; Madsen *et al.,* 2019; Abdelmalek and Houfaidi, 2022). These studies are based, among others, on the following five fundamental principles identified by Womack and Jones (2003): define value precisely from the perspective of the end customer, identify the entire value stream and eliminate waste, make the remaining value-creating steps flow, follow the pull approach and pursue perfection. Although these principles sound clear, in order to apply them correctly and be useful for the organization, it is imperative that they are clear and shared by all staff at all levels of a public organization in order to be best practiced (Zefaz, 2020; Smith, 2016).

At the same time, these studies indicate that Lean in the public sector, is used in different ways and that different actors apply the Lean concept (e.g., different Lean principles and tools) to different degrees, depending on the type of services provided (Bateman *et al.,* 2014; Gupta *et al.,* 2016; Lukrafka *et al.,* 2020; Psomas and Antony, 2018; Madsen *et al.,* 2019). According to Lins *et al.* (2019) though the Lean principles are more or less the same and generally appropriate (Gupta *et al.,* 2016; Lukrafka *et al.*, 2020), for the entire service industry, each attempt of incorporation is unique and specific for every organization. So, every attempt to intergrade the principles of Lean Management must be developed individually depending on the needs of each public organization and its employees (Antony *et al.,* 2019). In the same line, Bateman *et al.* (2018) and Caiado *et al.* (2020) argue that, even though, the Lean methodology is industry-oriented, it makes it necessary to adapt or personalize their adoption in public service organizations, in response to the specificities of public administration (De

Almeida *et al.,* 2017; Lukrafka *et al.,* 2020). Due to the particularities of the public sector compared to the private services sector or the manufacturing sector, the public services organizations face some difficulties in applying the principles of Lean management (Gupta *et al.,* 2016; De Almeida *et al.,* 2017).

Radnor and Walley (2008) examined whether public services organizations regard Lean merely as a set of tools and techniques or whether they also consider Lean principles as prerequisite conditions for its sustainable implementation. Although all the service organizations studied implemented all five principles of Womack and Jones (1996), however each individual public organization placed different degrees of adoption on Lean principles. In the same line, the studies of Madsen *et al.* (2017; 2019) and Psomas and Antony (2018) found that public services adopt the five Lean principles to varying degrees. In addition, according to Womack *et al.* (1990) Lean can be adopted by any organization regardless of size, culture, and geographical location. However, it must be taken into account that organizations should not copy Lean practices to the letter, but rather adapt them to their work environment and their sector of activity (Foris *et al.,* 2020; Benkarim and Imbeau, 2021). According to Toyota, organizations that copy its processes exactly are generally doomed to failure. It stipulates that they can borrow its ideas and adopt its principles in a way that corresponds to their context (Foris *et al.,* 2020; Bateman *et al.,* 2018).

Organizational Performance in the public sector

The issue of the performance of public sector organizations is considered critical to a country's economy (Tensay and Singh, 2020) and is a topic that is receiving increasing attention. Alkunsol *et al.* (2018) refer to organizational performance as the

actual results or outputs of an organization as measured against that organization's intended outputs. The measurement of the performance of the public sector is a process of assessing the progress of work against pre-determined goals and targets, including information on efficiency in the production of goods and services, the quality of goods and services, the results of activities compared to the intended purpose, and the effectiveness of actions in achieving the goals, vision and mission of the organization (Silitonga and Widodo, 2017). According to de Almeida *et al.* (2017), it is essential to measure performance in the public sector, as it helps ensure that citizens enjoy high quality services and enables governments to ensure that taxpayers receive value for money. This also concerns the Lean adoption as many studies in the public sector have shown that Lean has had a significant impact on improving overall organizational performance (Hadid and Mansouri, 2014; Bakar *et al.,* 2017; Antony *et al.,* 2019; Caiado *et al.,* 2020; Benkarim and Imbeau, 2021; Abdelmalek and Houfaidi, 2022). More specifically, proponents of Lean (e.g. Lean "gurus" and consultants) generally argue that the concept can help organizations improve organizational performance and productivity by reducing waste (e.g. time and resources spent on unnecessary and non-value-generating activities and processes).

Since organizational performance is a multidimensional concept several researchers in the literature have proposed ways and tools to measure organizational performance in the public sector, using sub-dimensions such as operational performance, financial performance, efficiency, quality, productivity, flexibility, profitability, production cost, citizens and employees satisfaction etc. Especially, Hadid and Mansouri (2014) measured total organizational performance in two dimensions: operational and

financial performance. Vadivel *et al.* (2021) investigated the impact of adoption of Lean methodology on the operational performance of public post offices by including multidimensional measures such as productivity, employee performance, employee process understanding, cleanliness, inventory reduction, cycle time reduction, human errors. In the same vein, Bakar *et al.* (2017) used internal productivity, service quality and citizen satisfaction to measure organizational performance in local government. Zefaz (2020) revealed benefits derived from Lean implementation in public sector (municipality) by focusing on items describing service quality, processes, employee service quality, employee satisfaction and citizen satisfaction. To measure organizational performance of Lean adoption in the public sector (municipality), Madsen *et al.* (2017) based their study on measures with regard to productivity, citizen/user satisfaction, employee satisfaction, quality, resource utilization, flexibility and response time, sickness leave and financial performance. Madsen *et al.* (2019) also assessed organizational performance in terms of operational performance, financial performance, service quality, employee and citizen satisfaction. In addition Patel and Patel (2021) through a literature review in various service industries including public, identified performance dimensions related to operational performance, employee and citizen satisfaction, among others. Finally, in the same line, Caiado *et al.* (2020) showed similar results studying Lean adoption in public administration.

The impact of Lean adoption on organizational performance

Lean has been successfully deployed in public services and has shown the promise to improve public service quality (Antony *et al.*, 2017b). According to the international literature, the adoption of Lean principles positively affects many

dimensions of the organizational performance of a public organization (Bakar *et al.,* 2017; Madsen *et al.,* 2017; Antony *et al.,* 2017b; Antony *et al.,* 2019; Caiado *et al.,* 2020; Sony *et al.,* 2020; Benkarim and Imbeau, 2021; Abdelmalek and Houfaidi, 2022).

In particular, Shannon and Barron (2016), Monteiro *et al.* (2015) and Psomas and Antony (2018) found that the adoption of Lean methodology can help public services organizations reduce waste and cost and thus improve quality and the services they provide to citizens. Lean can be used by governments to improve public services, which will result in improved social conditions for the incumbents (Sony *et al.,* 2020). Madsen *et al.* (2019) mentioned that in public sector, Lean is a management concept which have positive or very positive effects on areas such as quality, employee and citizen satisfaction, productivity and flexibility. Antony *et al.* (2017b) reported that Lean is a robust methodology that can be incorporated by all public sector organizations, bringing significant benefits such as increasing efficiency, improving process and quality, saving resources, reliable and timely provision of services and therefore an increase in citizen satisfaction.

Agbodzakey and McCue (2015) argued that the adoption of Lean methodology in the public sector helps to improve process, product and results, reduce redundancies and citizen satisfaction. Fletcher (2018) identified that public organizations can, in fact, incorporate Lean philosophy and methodology to streamline and improve organizational processes, produce cost-savings, improve organizational culture and improve the quality of goods and services and therefore increasing citizen satisfaction. Caiado *et al.* (2020) reviewing the literature in public administration showed that Lean methodologies are private sector practices that when implemented in a public organization, bring a number

of benefits related to costs, service and process quality, efficiency, satisfaction of employees, innovation, saving space and resources, reducing the response time to citizens' requests and, in general, the modernization of public services. In the same line, Patel and Patel (2021) identified that Lean is a methodology that contributes to the overall improvement of organizations, including service organizations (public and private). Finally, Madsen *et al.* (2017) stated that the main goals of Lean adoption are related to increasing productivity and improving citizen and employee satisfaction.

From the above, it is obvious that different researchers use alternative approaches and indicators to measure Lean organizational performance. The theoretical framework of Lean performance formulated in the present study is in line with Bakar *et al.* (2017), Leyer *et al.,* (2021), Zefaz (2020) and Vadivel *et al.* (2021) and it includes three dimensions related to organizational performance as follows: operational performance, employee satisfaction and citizen satisfaction.

The present study contributes to the literature by formulating a framework of Lean adoption performance measures in specific public organizations called CSCs. Thus, having this in mind, the purpose of the present study, the existing literature gap and the future research proposals suggested by several authors, the following research questions are formulated and examined:

H1: The adoption of Lean in public administration, i.e. CSCs, has a significant positive impact on operational performance.

H2: The adoption of Lean in public administration, i.e. CSCs, has a significant positive impact on employee satisfaction.

H3: The adoption of Lean in public administration, i.e. CSCs, has a significant positive impact on citizen satisfaction.

At this point, it is worth noting that, given that the organizations of interest of the present study are non-profit public service organizations, as they have no economic or administrative autonomy, they have fixed budgets with no relation to performance and they also have no competitors (Psomas *et al.,* 2020) the financial or market performance indicators were excluded from the measured variables collected.

Methodology

Questionnaire development and Sample

In order to answer the above formulated research questions, a research project was carried out within the Greek CSCs, using a structured questionnaire as the data collection method. The population of the present study includes all the employees of the Greek CSCs. The main goal of the data collection process was to obtain a representative sample of the employees of the CSCs throughout the Greek territory. The questionnaire was checked by three academicians and two practitioners to further confirm its content validity. Moreover, a sample of 20 Greek employees of CSCs was asked to ensure that all items could be clearly understood with no ambiguity. The final questionnaire consisted of three parts. The first part contained questions regarding the respondents' profiles. The second part contained statements reflecting the five Lean principles. The third part contained statements reflecting measures of organizational performance of Lean adoption. Respondents were asked to indicate the degree of agreement or disagreement with these statements using a seven-point Likert scale, where 1 represented "strongly disagree" and 7 represented "strongly agree". The measured variables – questionnaire

items of the selected dimensions of organizational performance were drawn from the studies of Madsen *et al.* (2017), Bakar *et al.* (2017), Zefaz (2020), Leyer *et al.* (2021) and Vadivel *et al.* (2021).

An e-survey was carried out similar to the research studies conducted in the public sector by Hamza *et al.* (2021) and Klein *et al.* (2022). The Uniform Resource Locator (URL) of the questionnaire survey was sent via e-mail nationwide to all CSCs, i.e. a total of 1060 CSCs (Safari *et al.,* 2020; Klein *et al.*, 2022). The email invitation also contained a brief explanation of the purpose of the study, as well as an explicit instruction to the recipient to forward the email to all employees (from all hierarchical levels) of the specific CSC (Madsen *et al.,* 2017; Angelopoulos and Pollalis, 2019; Pollalis and Angelopoulos, 2021). This URL led potential respondents to the questionnaire home page, which provided information on the research objectives, confidentiality, and anonymity. The survey was completed within two months (March to April of 2022) and six hundred and seventy two employees of the CSCs fully completed the questionnaire, giving a response rate equal to 29.21%.

Preliminary analysis

At first, the respondents of the first and second month of the survey were compared in terms of their profile (Mann Whitney Test) and the questionnaire items (T-test) and no statistically significant differences were found. So, from the above, it is apparent that non-response bias is not a cause for concern in this study.

A preliminary analysis was also applied to check the accuracy of the data. All respondents completed the questionnaire individually and independently while the number of the responding employees in the present study is large enough (672) for

multivariate data analysis (Hair *et al.,* 2017). According to Hair *et al.* (2017), before multivariate data analysis we examined the assumptions regarding the sample size, outliers, variables (continuous – categorical), their multicollinearity and multivariate normal distribution. Observed variables that caused violations in meeting these assumptions were excluded from the analysis. Consequently, calculating the Mahalanobis (D^2) distance, no observations exceeded the threshold value of 3 (or 4 for large samples) and so, no more data points were deleted from the analysis (Hair *et al.,* 2017). Finally, based on the correlation coefficients among the variables included in the model ($r < 0.85$), the histograms, p-p and q-q plots, skewness and kurtosis ($< \pm 1$) and the standardized residuals ($< \pm 2.5$) of the variables used in the proposed model, it is concluded that there are no serious indications that the basic assumptions of multivariate analysis are violated. The Lean principles and performance measures were validated through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Lean adoption is described as a second-order factor in terms of the main Lean principles. The structural relationships between Lean adoption and performance measures were examined through Structural Equation Modelling (SEM). The Statistical Package for Social Sciences (SPSS 28) and Analysis of MOment Structures (AMOS 28) were used for data processing.

Data analysis and results

The respondents are adequately distributed among all Greek administrative as the survey involved respondents - CSCs employees from all over Greece. Almost half of them work in CSCs with one or two employees, while out of the remaining employees of the sample, 135 work in CSCs with 3-4 employees and 161 work in CSCs with more than

5 employees. In addition an equal percentage of males (50.4%) and females (49.5%) participated in the survey. As far as the hierarchical level of the respondents is concerned, 7.89% of them are managers, 11.9% of them are heads of departments, while the remaining 80.21% are simple employees (without subordinates). The majority of respondents is at least university graduates (74.71%) and have more than 11 years' experience in the CSCs (81.56%).

Exploratory and confirmatory factor analysis

First, EFA (varimax rotation method) is applied in order to extract the latent constructs of Lean principles. Low loading items (< 0.5) were excluded from the subsequent data analysis in order to guarantee the convergent and discriminant validity. Thus four latent factors (constructs) were established into which the Lean principles are analyzed (Kaiser-Meyer-Olkin=0.826, Bartlett's test of Sphericity=3786.711, p=0.000, Measures of Sampling Adequacy (MSA)>0.735, eigenvalue>1, cumulative variance=78.303% and Cronbach's alpha>0.858). These constructs are explained based on the measured variables' loadings (>0.729) and can be labeled as follows: understanding customer needs, establishment of value streams, creating flows within the value streams and value perfection.

EFA is also applied to extract the latent constructs of the performance dimensions of CSCs, extracting three latent factors (Kaiser-Meyer-Olkin=0.713, Bartlett's test of Sphericity =1990.602, p=0.000, MSA>0.645, eigenvalue>1, cumulative variance = 71.081% and Cronbach's alpha= 0.708). These latent factors are explained using the measured variables' loadings (> 0.780) and can be labeled as follows: employee satisfaction, citizen satisfaction and operational performance (Table I). Low loading

items (< 0.5) were also excluded here from subsequent data analysis. From Table I we observe that the factor loadings (EFA) are well above the threshold of 0.5, which means that each measured variable is significantly related to the respective latent construct at $p < 0.001$. In order to determine whether the extracted latent factors show acceptable fit to the empirical data, the CFA (maximum likelihood estimation technique) is also applied in addition to EFA in each of the two sub-models (Lean principles and organizational performance model). Thus, a series of tests are performed to further determine the construct validity of the latent factors. It is worth noticing that their standardized regression weights are all above 0.622 (Table I). Table II presents the goodness of fit of the two models to the observed data. The fit indices indicate that the measurement models are appropriate (Hair *et al.,* 2017).

The mean values of all the latent constructs varied from 4.29 to 5.71, which indicate that the public services organizations (CSCs) adopt the Lean principles at a medium to high degree. From Table I, it is apparent that, among the Lean principles considered in the present study, "Establishment of value streams" (5.71), "Understanding customer needs" (5.15) and "Creating flows within the value streams" (5.11) are those mostly adopted by the public services organizations. The construct "Value perfection" (4.29) was the least important. Regarding the mean values of the latent constructs of the Lean performance, they varied from 4.58 to 5.49. From Table I, it is apparent that Lean organisational performance is achieved at a high level by the CSCs. More specifically, the construct of "operational performance" (5.49) is achieved to a high degree, followed by the constructs of "citizens satisfaction" (4.67) and "employee satisfaction" (4.58).

The reliability of all the extracted factors is confirmed through Cronbach's alpha coefficients that are higher than 0.746 (Hair *et al.,* 2017), indicating that all factors are measured by reasonably reliable items (Table III). According to Hair *et al.* (2017) construct validity was confirmed through the CFA by evaluating convergent validity (standardized regression weights>0.622, AVE>0.515, construct reliability>0.705), discriminant validity (AVE>$Corr^2$) (Table III), face-content validity (questionnaire review by experts on the field) and nomological validity (significant correlations among the latent constructs in the measurement model). Based on the above, the construct validity of the extracted latent constructs is strongly confirmed.

According to Hair *et al.* (2017) when there is a latent factor with several correlated dimensions and furthermore the structural relationships between the dimensions and the latent factor are strongly supported by the literature, then a second-order factor model is applicable. The second-order model explains the co-variations among first-order factors in a more parsimonious way (Hair *et al.,* 2017). Having assured the reliability and validity of the first order latent factors – the Lean principles – (Table II) and in order to determine whether a higher order latent factor is extracted (that would represent Lean adoption), a second order CFA is applied. So, in the case of the present study, a higher order model is constructed using "Lean adoption" as a second-order factor that explains the four first-order factors (the Lean principles). In the second order factor model, it is hypothesized that the "Lean adoption" factor explains the association between the four first-order dimensions of Lean principles, thus avoiding the problem of correlated measurement errors (Hair *et al.,* 2017). The second order model is represented in Figure 1. The fit statistics of the second-order CFA indicate a good fit of the second-order

measurement model. Furthermore, in the second-order model, the standardized regression weights of the four first-order latent factors are positive and statistically significant at $p < 0.001$. This means that a high amount of the variance of Lean principles is explained by the second order latent factor (Lean adoption). This is also obvious from the Target value = 0.906 (Table II) that, according to Runge *et al.* (2004) if it ranges between 0.8 and 1.0, a higher order latent factor can be extracted explaining the covariance among the first order latent factors. The results of CFA confirmed the tow sub-models revealed by EFA. Thus, the extracted latent factors show acceptable fit to the empirical data (Table II). Finally, construct, convergent, discriminant and nomological validity are confirmed indicating strong evidence that the proposed latent factors meet rigorous tests of these types of validities (Table III).

<< Insert Table I here>>

<< Insert Figure 1 here>>

<< Insert Figure 2 here>>

<< Insert Table II here>>

<< Insert Table III here>>

The structural model

In this study, the two-step procedure approach is chosen as the most suitable for testing the hypothesized structural model. In the first step CFA is conducted, while in the second step the hypothesized model is tested (Hair *et al.,* 2017). Thus and according to the literature we specified the relationships between the latent constructs that express respective research sub-hypotheses and then we examined the structural model's fit to the observed data. In Table II, we observe that the structural model provides a good overall

fit, while as far as the goodness of fit indices there are no significant differences with the respective indices of the CFA model. The measurement model and the hypothesized structural model are depicted in Figure 2 and Figure 3 respectively. Overall, as shown in Table IV, all research hypotheses (H_1, H_2, and H_3) are supported. So, we conclude that "Lean adoption" significantly affects all dimensions of "organizational performance". More specifically, "operational performance" (p=0.00, Standardized Regression Weights= 0.386), "citizen satisfaction" (p=0.00, Standardized Regression Weights= 0.286) and "employee satisfaction" (p=0.00, Standardized Regression Weights= 0.156) are positively affected by "Lean adoption".

<< Insert Table IV here>>

<< Insert Figure 3 here>>

Discussion

Respondents – employees of CSCs from all over Greece participated in the survey, which means that the respondents are adequately distributed among all Greek administrative districts. In addition, the employees of the CSCs responding to the present survey are almost equally distributed among all CSCs throughout the Greek territory.

In terms of profiles of the employees of the CSCs, the majority of them are simple employees (without subordinates), highly educated and with ample experience. Similarly, the employees participating in the study of Psomas and Antony (2018) in public sector were highly experienced professionals with sufficient competence to evaluate the Lean degree of their work environment.

This study offers empirical evidence on the contribution of Lean adoption to organizational performance in the public sector and in particular CSCs. Data analysis,

applying EFA and CFA, revealed four latent constructs that represent the main principles that describe the adoption of Lean namely: understanding customer needs, establishment of value streams, creating flows within the value streams and value perfection. Assessing the importance of these constructs, using the mean values of the latent constructs, we observe that the Greek CSCs adopt these four Lean principles at a medium to high extent, similar to the public services organizations studied by Psomas and Antony (2018). Among the Lean principles considered in the present study, "understanding customers' needs" and "establishment of value streams" are those mostly adopted by CSCs than "creating flows within the value streams" and "value perfection". These findings are also consistent with the researches of Psomas and Antony (2018) and Madsen *et al.* (2019). However, the results of this study did not validate the application of the "pull approach" principle, as all its measured variables were dropped due to their very low loadings (< 0.5). In the same vein, Psomas and Antony (2018) and Madsen *et al.* (2019) demonstrated that the above four Lean principles are mostly adopted in the public sector in contrast to the application of the pull approach which is adopted to a moderate or very low degree. Netland and Powell (2017) claim that the five fundamental principles of Womack and Jones (1996) are not necessarily universally applicable. For example, in the service sector there is ambiguity as to the pull principle (Bateman *et al.,* 2014). The broader idea of pull in a service is considered to be providing a service, as and when required by the customer, in which case then the wording of "pull" may be a misnomer (Bateman *et al.,* 2014). Bateman and Hines (2017) suggest that "demand readiness" is a more appropriate term than pull in the context of public services where the withdrawal and replenishment materials are not necessarily the signal for authorizing work. In addition, Madsen *et al.*

(2017; 2019) reported that public services vary in terms of how they interpret and apply the Lean principles, with most developing their own "home-made" Lean model.

Furthermore, the present study investigated the impact of Lean adoption on organizational performance of Greek CSCs. Data analysis confirmed the existence of the significant dimensions of service organization organizational performance identified in the literature relating to operational performance, citizen satisfaction and employee satisfaction. Hypothesis testing also revealed that Lean adoption contributes statistically significantly and positively to organizational performance and in particular to operational performance, citizen and employee satisfaction, in order of priority.

More specifically, the findings of this research revealed that the adoption of Lean principles in the CSC environment can reduce the time required to provide services by limiting the excessive movement of people among public departments, reduce the response time to citizen requests while reducing the waiting time of citizens to receive the service. Bureaucracy is suppressed and productivity is enhanced by reducing waste, simplifying the process with systematic flows and saving time procedure. In fact, human errors are reduced, the quality of services provided is improved and the organization can become more effective and efficient. In addition, adopting Lean principles and in particular "understanding citizens needs" and "establishment of value streams", focusing on added value for the citizen, through eliminating non-value-added activities and providing value-added activities, reduce citizen complaints, increase the frequency of their repeat visit and therefore their satisfaction.

Regarding employees, the research revealed that a Lean work environment is linked to employee well-being and satisfaction. Focusing on Lean principles, a Lean work

environment includes several aspects that trigger a person's intrinsic motivation to work, through a sense of responsibility or positive emotions resulting from experiencing flow at work, reducing wasted time, and in addition to the underlying culture of continuous improvement that entails the strengthening of teamwork. This result can also be explained in combination with the positive influence of established value streams and leadership style, which create a well-defined and adequately supported work environment. Furthermore, given that Lean adoption also implies awareness of the employee's role in the process chain, knowledge of the usefulness of the services he offers to citizens as well as the awareness of his work results, through the evaluation it shows that the Lean philosophy is not only present in the work environments, but it also contributes to employee expectations and satisfaction by increasing opportunities for growth and careers in such environments.

The findings of this work are in line and confirm the similar study by Madsen *et al.* (2017; 2019) according to which the Lean adoption in the public sector initially contributes to operational performance (better use of resources, improved quality and enhanced productivity) followed by increased employee satisfaction and citizen satisfaction. These findings also are consistent with research by of Zefaz (2020) in local authorities. In the same vein Antony *et al.* (2017a) demonstrated that the Lean methodology positively affects the operational performance of public organizations. In particular they revealed a set of benefits including internal customer satisfaction, process effectiveness and efficiency, employee engagement and morale, service quality, productivity and process innovation. The essential role of Lean adoption in the operational performance of a public service became also evident in the research of

Vadivel *et al.* (2021). However, contrary to the findings of the present study, they do not mention the benefits of Lean adoption in terms of employee and citizen satisfaction. In addition, Patel and Patel (2021) reviewing the literature in various service industries, including public, identified, similar to the present study, that the Lean adoption positively influences operational performance, employee and citizen satisfaction, among others. In the same line, Caiado *et al.* (2020) showed similar results studying Lean adoption in public administration. Bakar *et al.* (2017) and Fletcher (2018) have also determined, similar to the present study, the positive effects of Lean adoption on the operational performance of public services and citizen satisfaction. The only exception concerns the impact on employee satisfaction, which is determined as a Lean result only by the Greek service organizations of the public sector. Finally, Monteiro *et al.* (2015) and Adaku *et al.* (2018) also proved that Lean adoption has a significant positive effect on the organizational performance of a public service.

Conclusions

The Greek CSCs constitute an unexplored sub-sector of public administration in terms of Lean. This fact, as well as the gap identified in the literature and the future research studies suggested by experts, has motivated the authors of the present study to focus on the impact of Lean adoption in specific public service organizations operating in Greece, namely CSCs.

The main conclusion to be drawn from this study is that there are four key areas that should be considered by the CSCs that seek to adopt Lean. These areas constitute the main Lean principles that require attention and are the following: understanding customer needs, establishment of value streams, creating flows within the value streams and value

perfection. Thus, they reflect the underlying structure of Lean adoption in CSCs that require attention. If these latent constructs are carefully taken into consideration in the Lean transformation program, it is more likely to gain success and ensure the sustainability of Lean in public services organizations such as the CSCs. Furthermore, the empirical research presented in this paper revealed the positive impact of Lean adoption on the organizational performance of CSCs in relation to their operational performance, citizen and employee satisfaction. The internal environment of the organization, the internal human resources involved (employees) and its external stakeholders, i.e. the citizens themselves, appear to be the recipients of the benefits arising from Lean implementation. However, the impact of Lean on the results concerning the internal organizational environment seems to be slightly stronger.

Finally, the findings suggest that Lean constitutes a dynamic management paradigm which can help public service organizations to eliminate waste, reduce costs and human errors, increase added-value activities, improve production processes and the quality of the services provided and therefore increase citizens and employee satisfaction.

Practical Implications

Significant implications arise from the present study findings from the practical as well as academic-research perspective. More specifically, the latent constructs of the Lean principles revealed will serve as a source of reference for the managers and decision-makers of innovative public services organizations such as the CSCs, in order for them to set the foundations for successfully adopting the Lean methodology and therefore, harvesting its potential benefits. Lean adoption is described as a second-order factor in terms of four underlying dimensions. By focusing on the improvement of these

dimensions, managers and decision makers of the respective Greek public service organizations could develop and measure Lean adoption and accordingly direct their efforts to further increase its adoption degree. In addition, the findings suggest that the adoption of Lean can significantly contribute to making improvements in the organizational performance of public organizations, in order for the effectiveness and the quality of the services offered to citizens to be improved. In other words, adopting the Lean principles revealed can certainly be strong motives not only for the public servants themselves but also for the public managers and policymakers to help organizations eliminate all waste and costs, improve quality management initiatives and satisfy the end recipients of their services and generally all stakeholders (citizens, workers, government, etc.) The unsatisfactory adoption of these Lean principles in CSCs will lead to the failure of the overall attempt aiming at the reshaping these public services organizations. The present study findings may also be useful for managers and decision makers in other countries with similar public services organizations and provide valuable managerial implications for reforming the public sector in general.

The present study findings also benefit academics and researchers. This study offers a theoretically developed and empirically proven reliable and valid model to measure the Lean adoption to organizational performance. More specifically, the present study contributes to the literature by empirically determining the main Lean principles adopted, the respective results achieved on organizational performance, and the impact of Lean on the respective dimensions of organizational performance in specific public service organizations, in CSCs. So, the existing knowledge about the Lean adoption in the services sector or the general public services sector is expanded, updated and

modified accordingly based on the conditions of the CSCs. Nevertheless, this is the first study to propose a construct second order CFA to measure the Lean adoption and its contribution to the performance of public organization. This represents the significant contribution of this study to the existing literature in the area.

Finally, the model formulated can also help academics and researchers develop valid theoretical models that relate Lean principles to the performance dimensions of these organizations or serve as a reference to generate new research ideas that will have major practical significance.

Limitations and future research agenda

The present study suffers from some limitations that should be carefully considered while generalizing the findings. The small percentage of the responding employees of the CSCs, given their large population, and the subjective instead of objective nature of the data collected constitute the main limitations of the present study. Given the specific research area of the present study meaning the Greek CSCs, the generalization of the findings to other public services sub-sectors operating in Greece, should be carefully considered. In other words, while the present study findings derived from the CSCs may be relevant to other Greek public services organizations, they should be carefully interpreted to fit to the whole Greek public sector. The same also applies to the public services organizations operating to other countries worldwide which are similar to the Greek CSCs.

The above-mentioned limitations provide directions for further research. Firstly, it is suggested increase the sample of the respondents from the CSCs throughout Greece approximating the population of these employees. In addition, expanding the present

research to more public services sub-sectors in Greece and in many other countries is strongly suggested, diachronically. By collecting multi-sectoral and multi-national data in the passing of time, the differences among public services organizations of different sub-sectors and countries can be identified in terms of the main principles of Lean adoption. Finally, it is proposed that the model of this study be further investigated so that it can be validated in other public sector services. Thus, based on such studies, the structure of Lean adoption and benefits in the public sector in general can be validated, while the relationships between Lean adoption and organizational performance can be further explored, in other public services as well.

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Table I: Exploratory and confirmatory factor analysis

Measured variables	FL[a]	SRW[b]
Lean Principles		
Understanding customer needs *(Mean Value=5.15)*		
I know the utility of the services I offer (VAR_01)	0.882	0.951
I am continuously interested in increasing the utility of the services I offer (VAR_02)	0.866	0.840
I know how satisfied the citizens are with the services I offer (VAR_03)	0.874	0.836
Establishment of value streams *(Mean Value=5.71)*		
I know which services my actions contribute to (VAR_04)	0.876	0.822
I am continuously coordinating my actions with the actions of other colleagues involved in providing the same services to citizens (VAR_05)	0.854	0.725
Creating flows within the value streams *(Mean Value=5.11)*		
Reducing the time it takes to process citizens' requests is a daily main goal of my work and that of the colleagues involved (VAR_06)	0.841	0.836
My workspace is by definition designed in such a way as to ensure the smooth and delay-free execution of my duties (VAR_07)	0.895	0.875
My supervisors and colleagues have the decision-making skills to solve problems should they arise in the execution of my duties (VAR_08)	0.871	0.831
Value perfection *(Mean Value=4.29)*		
Citizen complaints that are documented and correct are taken into account to improve the procedures (VAR_09)	0.729	0.726
Actions to avoid mistakes are determined in cooperation with the employees involved (VAR_10)	0.806	0.678
I identify opportunities to improve processes and the corresponding services offered to the citizen (VAR_11)	0.784	0.746
Organizational Performance		
Operational performance *(Mean Value =5.49)*		
Employee efficiency (VAR_12)	0.807	0.622
Employee effectiveness (degree of achievement of the objectives) (VAR_13)	0.850	0.858
Service quality (VAR_14)	0.831	0.729
Employee satisfaction *(Mean Value=4.58)*		
Employee satisfaction (VAR_15)	0.837	0.784
Employee alteration rate (VAR_16)	0.852	0.748
Personal development and career of employees (VAR_17)	0.841	0.766
Citizens satisfaction *(Mean Value =4.67)*		
Citizens' complaints (VAR_18)	0.780	0.647
Citizen satisfaction (VAR_19)	0.886	0.897
Reducing the waiting time of citizens (VAR_20)	0.817	0.707

Notes: [a] Factor Loading (EFA), [b]Standardized Regression Weights (CFA)

Table II: Goodness of fit measures

Goodness of fit measures	Lean principles model (1st order)	2nd order of Lean	Organizational Performance model	CFA Model (overall)	Structural model
Target coefficient (x^2 of first order CFA/x^2 of second order CFA)	0.906				
The basics of goodness of fit					
Chi-square (χ^2)	75.904	88.168	50.728	323.675	334.451
Degrees of freedom (*df*)	38	40	24	160	162
Probability level	0.00[a]	0.00[a]	0.00[a]	0.00[a]	0.00[a]
Absolute fit indices					
Chi-square/degrees of freedom (χ^2/df)	1.997	2.204	2.114	2.023	2.360
Root Mean Square of Approximation (RMSEA)	0.039	0.042	0.041	0.039	0.045
Standardized Root Mean Square Residual (SRMR)	0.021	0.033	0.031	0.040	0.057
Goodness of fit index (GFI)	0.980	0.977	0.984	0.953	0.948
Incremental fit δείκτες					
Normed fit index (NFI)	0.980	0.977	0.975	0.947	0.945
Incremental Fit Index (IFI)	0.990	0.987	0.986	0.972	0.971
Tucker-Lewis coefficient (TLI)	0.985	0.982	0.980	0.967	0.966
Comparative Fit Index (CFI)	0.990	0.987	0.986	0.972	0.971
Parsimonious fit δείκτες					
Parsimonious Comparative Fit Index (PCFI)	0.684	0.718	0.658	0.819	0.828
Parsimonious Normed Fit Index (PNFI)	0.677	0.710	0.650	0.797	0.806

Notes: [a] According to Hair *et al*. (2006) in case of n >250, m (variables) ≥ 30, RMR < 0.08, RMSEA < 0.07, CFI > 0.90.

Table III: Model reliability and validity

Latent constructs	**Cronbach's alpha**	**Average variance Extracted***	**Construct Reliability****	**(Corr)^2 *****
Lean Principles				
Understanding customer needs	0.907	0.769	0.887	0.388
Establishment of value streams	0.746	0.605	0.705	0.170
Creating flows within the value streams	0.884	0.718	0.799	0.213
Value perfection	0.760	0.515	0.791	0.388
Organizational performance				
Employee satisfaction	0.810	0.587	0.723	0.144
Citizens satisfaction	0.784	0.574	0.842	0.144
Operational performance	0.780	0.552	0.884	0.096

Notes: *AVE = $\Sigma\lambda_i^2/n$, (number of items i = 1 . . . n, λ_i = standardized factor loading); **CR = $(\lambda_i)^2/[(\lambda_i)^2 + (\delta_i)]$, (number of items i = 1. . .n, λ_i = standardized factor loading, δ_i = error term); ***the highest squared correlation between the construct of interest and the remaining constructs

Table IV: Results of the basic research hypotheses

Relationships	Standardized regression weights	Standard error	p-Value	Hypothesis test results
H_1:Operational Performance => Lean adoption	0.392	0.071	0.00	Accepted
H_2:Employee Satisfaction => Lean adoption	0.163	0.114	0.00	Accepted
H_3:Citizen Satisfaction => Lean adoption	0.290	0.068	0.00	Accepted

Figure 1: The second order model

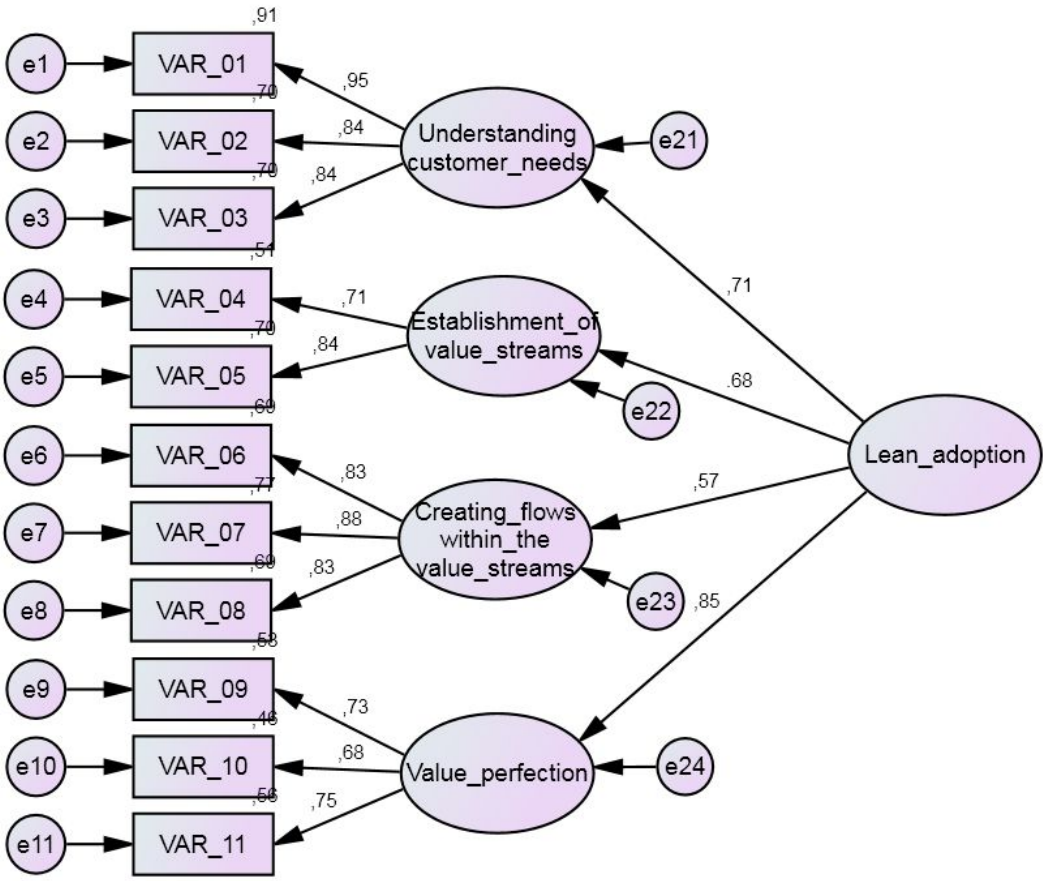

Figure 2: The measurement model

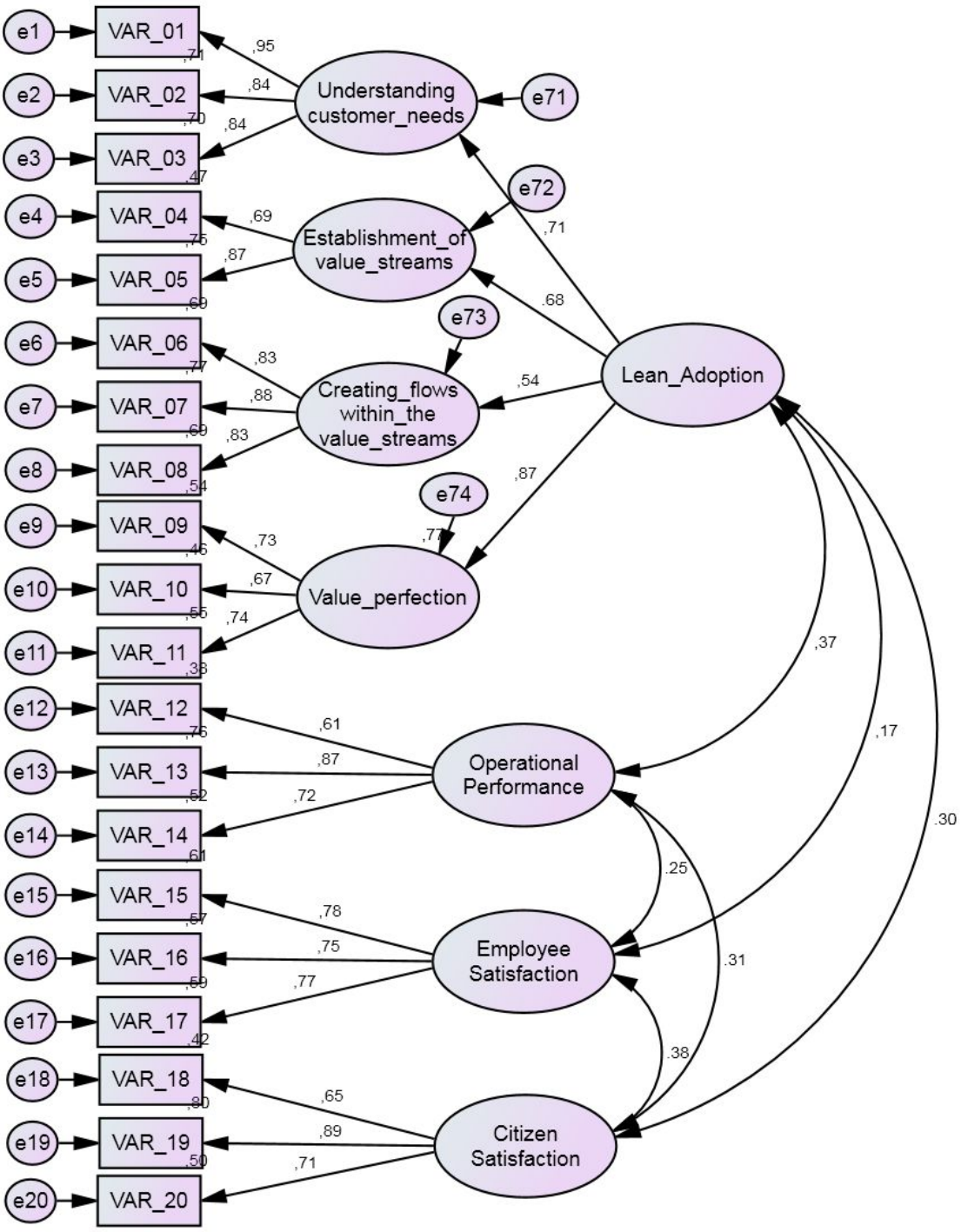

Figure 3: The hypothesized structural model

Notes: *statistically significant at p=0.001