

EMPIRICAL INVESTIGATION INTO ICT SERVICES EVALUATION WITHIN A PUBLIC INSTITUTION

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ABSTRACT

The aim of the paper is to investigate the quality of Information and Communication Technology (ICT) services provided to employees in a public administration organization. The Region of Central Macedonia (RCM) was chosen as the examined enterprise/organization. The provider of these services is exclusively the Department for Transparency and eGovernment (DTeG). After a presentation of the theory behind service quality measurement in general and in ICTs specifically, a quantitative research was carried out, utilizing a SERVPERF-derived, ICT-adapted, short form 13-item/4-dimension instrument approach. This research indicated that RCM employees value both the quality of the ICT services, as well as the satisfaction from them, as provided by DTeG, highly. The adapted SERVPERF instrument exhibited high internal consistency values, as well as strong correlation between its items and the overall perceived quality and satisfaction. Dimensionality tests indicated that two dimensions of the service quality constructs are measured: a combined “reliability”, “responsiveness” and “assurance” dimension and an “empathy” one. The findings can be used by the targeted organization to improve the quality of ICT services and better meet the needs of their users.

KEYWORDS

Service quality, user satisfaction, Information and Communication Technologies, SERVPERF, Public Administration

1. INTRODUCTION

The rapid technological revolution in Information and Communication Technologies (ICT), enabled both private companies and public organizations to increase their efficiency. Regardless of the type of ICT solution, the final users are at the centre of this solution, as both the information receivers and providers [1]. First, they are the consumers of services related to information and communication technologies. And, second, the quality of these services provided to them can also improve the business/organization itself [2].

The public sector utilizes ICT systems to a large extent. A central element to the success of these systems is always the employee / user who, in the context of his everyday interaction with them encounters issues that should be resolved, makes enhancement requests, adapts to changes in technologies through training, etc. [3]. For these issues and processes the user receives services from either the organization itself or from external / third parties. Extensive research indicates that improvement in ICTs affects organizational improvement, with the quality of ICT services provided to the user being a key factor [3-6].

Therefore, the assessment of the quality of ICT services provided by the public sector to its employees/users, is a crucial factor in organizational improvement [7-9]. It is important to

measure the quality and performance of an information system in the public sector because [10-17]:

- The public sector, which has the responsibility to ensure fundamental rights such as democracy, openness, transparency, and privacy, and to improve citizens' quality of life., utilizes ICT systems to a large extent, and the quality of these systems affects organizational improvement.
- Measuring the quality and performance of an information system helps to identify areas for improvement and enhance the satisfaction of employees/users.
- It enables public sector organizations to make data-driven decisions and allocate resources effectively.
- Measuring the quality and performance of an information system can also help to increase transparency and accountability in the public sector.

The assessment of ICT Services in a Public Organization has been the objective of many research initiatives [10, 14-20). Based on authors' knowledge limited research has been carried out in the Greek public sector. This paper's main aim is the lack of knowledge regarding the quality of ICT services offered by the public organization to its citizens and employees in Greece. By presenting a case study on the quality of ICT services offered by the Department for Transparency and eGovernment (DTeG) to the final users of a specific public organization (Region of Central Macedonia, RCM), and evaluating their perceptions of the quality and satisfaction of these services, the paper attempts to fill the gap in the literature.

The DTeG offers services to citizens directly through the website or other applications for the electronic processing of requests or indirectly by providing support to the other organic service units of the Region of Central Macedonia. Furthermore, there is a key difference between private and public sector service providers. In the public sector, employees do not have the option to choose a different service provider to resolve issues they encounter with Information and Communication Technology (ICT) systems. For example, if a computer breaks down or the phone is not working, the employee cannot choose a different provider to fix the issue. They are obligated to use the services provided by the Department for Transparency and eGovernment (DTeG). This is different from the private sector, where customers have the option to choose a different provider if they are not satisfied with the service they receive. Also, this emphasizes the requirement that the DTeG provide excellent services to guarantee employee happiness and organizational progress.

Additionally, the employee's satisfaction with the service provider is not expressed in a specific way. In other words, the employee cannot express their satisfaction with the service provider in a way that would allow them to choose a different provider. They are required to use the services provided by the DTeG, regardless of their level of satisfaction. So in this case there are two issues which are common in B2E/G2E services. Firstly, employees do not give feedback to the organization about the quality of its services or whether they are satisfied with the service provided by its employees. Secondly, the organization itself does not know where it needs to improve its services. Thus, it is important to create a research tool for measuring the perceived quality of ICT services provided by DTeG from the aspect of the employees.

Based on the above, the research objectives of this paper are to:

- Evaluate the perceived value and satisfaction of the ICT services offered to employees of the Region of Central Macedonia in Greece by the Department for Transparency and eGovernment (DTeG).
- Encourage organizational development in the public sector, identify areas where the ICT services offered by the DTeG need to be improved.
- Use a SERVPERF-derived, ICT-adapted, 13-item, 4-dimension short-form instrument to assess service quality in the context of public sector ICT services.
- Determine which aspects of service quality are most significant to employees of the Region of Central Macedonia by analyzing the survey findings.

The study uses a SERVPERF-derived, ICT-adapted, short form 13-item/4-dimension instrument to assess the perceived value and satisfaction of these services. The study highlights the importance of user experience and service quality for the success of ICT systems in the public sector, which can shape future policy and decision-making in this area. Moreover, the findings can be used by the targeted organization to improve the quality of ICT services and better meet the needs of their users.

2. ICT SERVICES IN PUBLIC SECTOR

2.1. The Ontology of the Service

Service is the result of specific actions taken by the provider, the performance of those actions, and the outcomes of those actions for the recipient or buyer of the service [21-22]. The research also introduces two types of services, namely pure services and augmented services. Moreover, Gunaris highlights distinctive features of the service sector, such as the intangible nature of services and the inseparability of their production and consumption [21].

2.2. The Public Services and the “Internal Customers”

The complexity and diverse nature of the public service involve providing essential services that contribute to the well-being of citizens and the effective functioning of society as a whole. The significance of maintaining high-quality public services cannot be emphasized enough, as it ensures that citizens have access to outstanding services. Public sector organizations are under increasing pressure to deliver superior services and improve their operational efficiency [23]. According to Brown et al. [24], public services share common characteristics with other services, such as intangibility, indivisibility, heterogeneity, and perishability. The "service profit chain" perspective, proposed by Heskett, Jones, and Loveman [25], suggests that employees within an agency responsible for delivering a service can be viewed as "internal customers" within the service value chain. In other words, just like external customers who receive the service, internal customers - the employees - also play a crucial role in service delivery, and their satisfaction is vital for the overall success of the service [26, 27]. Information and Communication Technologies (ICTs) play a critical role in promoting transparency and accountability in the public sector. Digital systems enable the gathering, retention, and assessment of data, leading to improved monitoring and documentation of activities, expenses, and outcomes. This enhanced transparency acts as a deterrent against corrupt practices while also fostering accountability [28].

2.3. Service Quality and Employees Satisfaction in Public Sector

Existing literature defines service quality as the difference between customers' expectations of service and their actual perceptions of the service they receive. In simpler terms, it refers to the gap between what customers anticipate and what they experience [13, 29-30]. This concept of service quality is multifaceted and includes various dimensions, such as reliability, responsiveness, assurance, empathy, and tangibles. These dimensions serve as metrics for evaluating service quality and identifying potential areas for improvement [13, 31]. Gowan et al. propose that providing services in the public sector goes beyond meeting expressed needs [32]. It also involves identifying unexpressed needs, prioritizing them, allocating resources, and being accountable and transparent in the actions taken. Therefore, public sector service providers must consider a multitude of factors that extend beyond immediate customer satisfaction [32]. Caron and Giauque [33] add that public sector employees encounter new challenges due to the implementation of new principles and tools influenced by the shift to new public management. This requires public sector service providers to adapt to new ways of working and delivering services, which can be a challenging process [33]. Furthermore, employee experiences and behavior in the workplace affect their perceptions and attitudes towards service quality, which, in turn, influence citizen perceptions and expectations. Improving employee satisfaction can lead to positive outcomes for service organizations [34].

2.4. The Public Sector and the Impact of ICTS on Organizational Improvement

Governments invest resources in public sector information systems to enhance operational efficiency and improve the effectiveness of policies [35, 36]. The adoption of ICTs in the public sector is often associated with embracing private sector and corporate methods to optimize organizational efficiency and effectiveness while reducing bureaucratic obstacles [37, 38]. Cordella and Tempini [39] propose that ICTs can make bureaucratic organizations more suitable for delivering public services than the organizational structures prescribed by the New Public Management ideology, known as the "Contract State". According to Millard [40], the government has a role in leveraging ICT to create public value impacts. This involves identifying, brokering, matching, orchestrating, and coordinating assets that can be shared [40]. Digital technology has enhanced the delivery of public sector services through online portals, mobile applications, and digital platforms, providing citizens with efficient access to government services. By simplifying processes like permit applications, tax payments, and healthcare information accessibility, ICTs have the potential to streamline service delivery, resulting in a more citizen-centric and responsive public sector [41, 42]. The impact of ICT solutions on improving organizational performance in the public sector is diverse, including considerations of digital inclusion and accessibility. Addressing the digital divide is crucial to ensuring that all individuals have equal opportunities to leverage technology and its associated digital services. Promoting digital literacy and providing infrastructure in underserved regions are essential steps toward ensuring equitable distribution of the benefits of ICTs [26, 27].

2.5. Assessing ICT Services by Employees in the Public Sector

Assessing ICT services from the perspective of government employees is crucial for identifying areas that can be improved, addressing relevant concerns, and ensuring that the services align with the workforce's needs. When evaluating ICT services in the public sector, several approaches and factors need to be considered [10]. One important step is to design and distribute surveys or questionnaires among employees to gather their feedback on various aspects of ICT services. These inquiries should cover accessibility, usability, reliability, responsiveness, training

and support, and overall satisfaction to ensure a comprehensive evaluation [43]. Conducting user experience testing sessions with a sample of employees is also essential in the realm of ICT. This method allows observation of employees' interactions with ICT services, providing insights into usability issues, pain points, and areas for improvement [44, 45]. Utilization analytics should be employed to carefully scrutinize the extent of employees' usage of ICT services. This approach helps to understand usage patterns, preferred features, and areas requiring further training or enhancement [46, 47]. Establishing feedback mechanisms is crucial for encouraging employees to continuously provide input and suggestions regarding ICT services. This can be achieved through suggestion boxes, dedicated communication channels, or regular feedback sessions to foster engagement and promote ongoing improvement [48]. Another valuable evaluation tool is benchmarking, which involves comparing practices of similar organizations in the same industry or industry best practices. This allows for the evaluation of performance and identification of areas for enhancement, learning from successful approaches [49].

2.6. Measuring ICT Services in Public Sector

In the previous sections, concepts such as "quality", "service", "quality of service" have been presented at a general level, while reference has been made to "satisfaction" in the public sector. In the literature there are many theoretical models that refer to the quality approach as a method of measuring customer satisfaction. Some refer to cases of application to measuring citizen satisfaction in the public sector [50-54], the SERVQUAL model [13, 55-56), the SERVPERF model [57-58]. In this research, the SERVPERF model of Cronin and Taylor [59] was chosen who held a different perspective on using the CQA (Customer Questionnaire Approach) to assess service quality. They disagreed with the idea that expectation confirmation alone determines perceived service quality, which is a crucial element in the SERVQUAL model. Instead, they believed that expectation confirmation only acts as a mediator in determining perceived service quality. In the SERVPERF model, they advocated using performance evaluation alone as the measure of service quality, effectively disregarding the need for assessing service quality through the lens of expectation confirmation. Their measurement tool for evaluating service quality comprised only the 22 questions from SERVQUAL that pertain to the perceived quality of the service provider under consideration. They omitted the 22 questions related to expectation because, according to their viewpoint, performance evaluation was sufficient for assessing service quality. This approach offered a significant advantage in terms of time required for completion. Moreover, it did not necessitate specific expectations from the user, which was particularly beneficial when users lacked knowledge about other service providers offering similar services to the one being evaluated.

3. RESEARCH METHODOLOGY

The main purpose of the research is to record the level of quality of the ICT services provided by the Department for Transparency and eGovernment (DTeG) of the Region of Central Macedonia (RCM) in Greece, to the employees of the organization. Sub-objectives of the survey are identify the factors:

- that most influence the quality of the ICT services provided to the employees of the organization, and
- the factors that most influence the satisfaction of the organization's employees with the ICT services provided by DTeG.

Although SERVQUAL theoretically has greater diagnostic power (gap between perceived performance and expectation), a prerequisite for its application is that the service consumer must have a benchmark/expectation measure of what the leading companies in the industry provide. The worker in the targeted public organisation, does not have this kind of expectation (expectation of service level from peer operators, for example in other National Regions). With the exception of a few employees who have come from other entities through transfer and secondment procedures, the vast majority of employees have not known any other service that supports them in ICT matters. On its own, the above reason would reject any methodological approach using a gap model. However, there is a second reason: in reality there is a formed expectation of quality ICT services to each employee, but from contact with private ICT service providers (e.g. telecoms, internet and mobile companies). It was deemed appropriate to examine service provision in terms that do not include the expected quality, so the SERVPERF model was chosen for the purposes of the survey, which has the additional advantage of half the completion time compared to SERVQUAL.

The primary data collection tool was the questionnaire proposed by the SERVPERF model. SERVPERF adopts the same tool as SERVQUAL, a scale of 22 indicators in 5 dimensions. For the needs of the research, two problems were identified: 1) One of the dimensions is tangibility (material elements, appearance of employees, appearance of facilities, equipment, etc.). As a factor it is of particular interest in services where the recipient has physical contact with the provider (e.g. banks), but there are significant issues when the measurement tool is applied to services of companies provided remotely. In this case, no opinion can be formed and the dimension of remoteness can "damage" the reliability of the results, and 2) The standard tool is in English, so it goes without saying that it needs to be adapted into Greek.

For the validation, we have involved experts and following a rigorous validation process, we ensured that our measurement tool accurately captures the nuances of ICT service quality within our specific organizational context. This process contributed to the validity and reliability of our research findings and enhanced the overall quality of our study, especially by Identifying experts in the field of ICT service quality assessment or related domains who can provide valuable insights into the tool adaptation and validation process. Experts included academics, practitioners, and professionals with extensive experience in ICT service management and quality assessment. We asked the experts to review the content of the questionnaire and provide feedback on the clarity, wording, and relevance of the questions. Afterwards, we run a pilot test of the questionnaire with a small group of employees to identify any issues or ambiguities. Then we organized workshops or focus groups with the selected experts to discuss the questionnaire in detail. Incorporated the feedback and insights gathered from experts and cognitive interviews into the final version of the questionnaire. Finally, we conducted a reliability analysis on the final questionnaire to assess the internal consistency of the items within each dimension.

For the first issue, an abbreviated version of the measurement tool (simply "measurement tool" in the following), designed specifically for use by ICT service providers, was chosen, consisting of 13 indicators in 4 dimensions, one of which the dimension of tangibility has been eliminated [61]. Subsequently, the tool was part of the overall questionnaire, which was structured as follows:

- Part A: the measurement tool presented above, consisting of 13 questions (factors) grouped in 4 dimensions, on a 7-point Likert scale, from "1: I strongly disagree" to "7: I strongly agree". The table below shows the dimensions of the measurement tool and the questions corresponding to it.

Table 1. Dimensions/measuring tool questions.

Dimension	Number of questions	Questions
Reliability	3	A1 – A3
Responsiveness	3	A4 – A6
Assurance	3	A7 – A9
Empathy	4	A10 – A13
Total	13	A1 - A13

- Part B: which includes 2 questions concerning: 1) the extent to which the employee uses the Y/H in performing his/her daily tasks, and 2) the frequency of contact with the DTeG.
- Part C: overall service quality and satisfaction, through 2 questions:
 - C1: Quality of services provided is: “, on a 7-point scale, from "1: Extremely poor" to "7: Extremely good", and
 - C2: «Provided services leave me: “, on a 7-point scale, from "1: Completely unsatisfied" to "7: Completely satisfied".
- Part D: demographic data (gender, age group, level of education, years of service).

The questionnaire was initially distributed to approximately 10 employees to check semantic and syntactic issues, the fidelity of the measurement tool translation, and the time of completion. It was modified and posted in the Google Forms environment, where an invitation was then sent via email to all employees in any employment relationship (approximately 1,800 people). The questionnaires were collected from 3/3-21/3/2022, 223 responses were collected which gives a response rate of 12.8%. In order to improve the validity of the results, certain overtly incorrectly completed responses were removed by performing only the first step of the iterative algorithm of Jozsa and Morgan [60]. Specifically, pre-recoding of negatively worded responses:

- those with an average score of 7 (the maximum Likert score) for each dimension in positive responses and a negative response on the same dimension with a score above 4 (corresponding to "neither disagree nor agree"), indicating blind responses to "7", are removed from the responses,
- respectively, those responses with an average of 1 on each dimension in the positive, and the respondent answered a negative response below 4, (blind response "1") are subtracted,
- then subtract from the responses those with an average of 7 negative responses for each dimension and a positive response on the same dimension greater than 4 (the respondent was blindly answering '7'), and
- finally, those answers are subtracted which have an average of 1 for each dimension in the negative questions and a positive answer of less than 4 (the respondent was blindly answering '1').

After performing the above steps, 57 responses were removed and kept as a separate data set. The remaining steps of the algorithm were not performed to avoid losing potentially useful responses. In the end, the survey participation rate was found to be equal to 9.5%. In this survey, the following hypotheses are tested:

- $H_{i,SQ}$: the Part C factors (C_i) and the service quality factor (Part D) are statistically dependent, and

- $H_{i,SF}$: the Part C (C_i) factors and the service satisfaction factor (Part D) are statistically dependent,
 - where $i=1, \dots, 13$. That is, we will examine the correlation of each of the questions of the instrument (Part C) with both user perceived quality (Part D-1) and user satisfaction (Part D-2) with the services provided.
- $H_{Q,S}$: The variables 'quality of services provided' and 'satisfaction of employees receiving them' are statistically dependent.

4. FINDINGS

The Cronbach's reliability coefficient α was found to be .940, while the α coefficients for the dimensions of reliability, responsiveness, assurance and empathy were found to be .886, .863, .851 and .801 respectively (aligned with those of the original research .896, .883, .861 and .895 respectively [61]).

4.1. Responses Analysis

The table below shows the demographic data of the sample.

Table 2. Demographic characteristics of the sample.

<i>Gender</i>	Men: 69 (41.6%) Women: 97 (58.4%)
<i>Age group</i>	Έως 30: 0 (0%) 31-40: 15 (9.0%) 41-50: 84 (50.6%) 51-60: 59 (35.5%) Higher than 60: 8 (4.8%)
<i>Highest Level of Education</i>	Secondary school: 19 (11.4%) Bachelor: 82 (49.4%) Master degree: 53 (31.9%) Ph.D.: 12 (7.2%)
<i>Years of experience</i>	Up to 11: 15 (6.6%) 11-20: 97 (58.4%) Higher than 20: 58 (34.9%)

Regarding the answers to Part B, and first of all, the frequency of use of their office computer, almost all employees at 95.8% use it daily. On the second question, which asks about the frequency of contact with DTeg to solve problems and/or provide specific services, in the last 12 months, approximately two out of three respondents (63.9%) indicated that they had been contacted between 1 and 10 times (specifically, between 1 and 5 times, 34.9% of the sample responded with 1-5 times, while 6-10 times was answered by 28.9%). Of the remaining cases, 15.1% responded that they had been contacted 11-20 times and 18.1% responded that they had been contacted more than 20 times. Only 3% of respondents answered that they had not been in contact with DTeg at all. In the Part C questions, based on the applied SERVPERF model, the responses showed a high degree of satisfaction with the services provided in both positive and negative questions (Table 3):

Table 3. Responses to the measurement tool.

Part C/ Questions (%)	1	2	3	4	5	6	7	M
Reliability								
Question A1: "When top management commits to provide me with its services within a certain timeframe, does it keep its commitment?"	2.4	3.0	4.2	7.2	11.4	34.3	37.3	5.8
Question A2: "The problems I report to top management are resolved correctly the first time"	1.8	4.8	3.0	13.9	11.4	35.5	29.5	5.5
Question A3: "Top management provides me with its services within the specific timeframe communicated to me»"	3.6	1.8	4.8	11.4	11.4	27.7	39.2	5.7
Responsiveness								
Question A4: "The top management employees provide me with their services without delay"	1.2	2.4	4.8	9.6	13.9	34.3	33.7	5.7
Question A5: "The top management staff is not always willing to help/serve me"	53.0	22.9	5.4	6.0	5.4	6.6	0.6	2.1
Question A6: "The top management staff responds to my requests, even if they are very busy"	1.2	4.8	3.6	10.8	18.1	32.5	28.9	5.5
Assurance								
Question A7: "The behavior of the top management staff inspires confidence in me"	0.6	3.0	1.8	6.6	12.7	25.3	50.3	6.0
Question A8: "The top management staff is always kind to me"	0.6	1.2	3.6	4.8	7.8	20.5	61.4	6.3
Question A9: "The top management staff has the expertise to answer my questions"	1.8	1.2	3.6	6.6	8.4	33.7	44.6	6.0
Empathy								
Question A10: "My top management provides personalized services"	0.6	2.4	6.0	10.8	18.7	31.9	29.5	5.6
Question A11: "The top management staff doesn't pay attention to me personally"	42.2	24.7	8.4	9.0	5.4	6.6	3.6	2.5
Question A12: "Top management does not aim at my (official) interest"	45.8	18.7	4.2	13.9	5.4	9.0	3.0	2.5
Question A13: "The top management staff does not know my specific work needs"	24.7	21.1	13.9	12.0	12.7	9.6	6.0	3.2

Finally, the results of the processing of two key questionnaire responses are illustrated: 1) the overall assessment of the quality of the services provided by DTeG, and 2) the satisfaction perceived by employees. The following figures present the results (%):

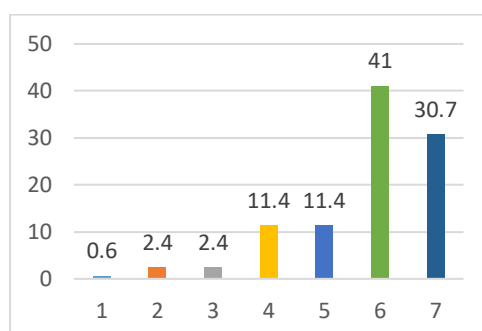


Figure 1. Assessment of quality of services

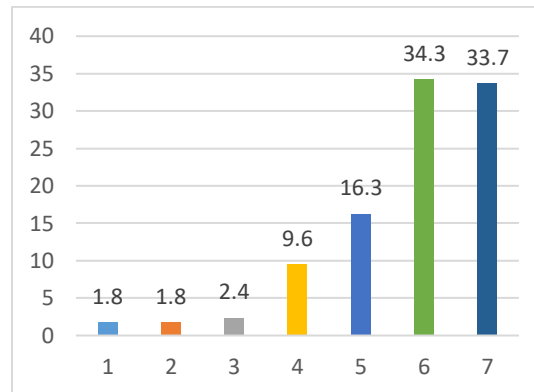


Figure 2. Assessment of satisfaction of services

Specifically, in the first question, respondents were asked to rate the quality of the services provided to them by DTeG. The rating was done on a 7-point scale, where 1 corresponds to "extremely poor" and 7 to "extremely good". As shown in the chart, 71.7% of the responses rated the services provided as 6 to 7. Specifically, 41.0% of the sample responded with a 6, while 30.7% responded with a 7. Of the remaining responses, the ratings of 4 and 5 stand out, representing 11.4% and 11.4% of respondents.

In the second question, respondents were asked to rate their level of satisfaction regarding the services provided by DTeG by completing the sentence "The top management services leave me...". The response chosen was assigned values from a seven-point scale of agreement, with 1 corresponding to "...totally unsatisfied" and 7 to "...totally satisfied". According to the results, 68% of the responses were answered with values between 6 and 7. In particular, 33.7% answered with 7, while 34.3% answered with 6. Of the remaining responses, the ratings of 4 and 5 stand out, corresponding to 9.6% and 16.3% of respondents.

4.2. Dimensions' Analysis

In this section the characteristics of the sample means corresponding to the individual dimensions of the tool are discussed. Specifically, 4 scaled variables were defined, one for each of the scale dimensions (reliability, responsiveness, assurance, and empathy) related to the quality of the services provided by DTeG to the employees of the public organisation. Each of them was then assigned the sample mean of the corresponding questions. i.e.:

- For the reliability dimension: the mean of questions A1-A3, namely Mean=5.6 (Std deviation=1.37).
- For the responsiveness dimension: the average of questions A4-A6, namely Mean=5.7 (Std deviation=1.31).
- For the assurance dimension: the average of the answers A7-A9, namely Mean=6.1 (Std deviation=1.13), and finally
- For the empathy dimension: the average of the responses A10-A13, namely Mean=5.3 (Std deviation=1.38).

Next, a principal component analysis (PCA) was performed, selecting those eigenvalues with a value above 1, as recommended by Kaiser. An oblique rotation (direct oblimin) was used and the threshold was again set to show loading results greater than 0.4 in absolute value. The Kaiser-

Meyer-Olkin index certified the adequacy of the sampling of the analysis. KMO = .941 "marvelous" according to Hucheson and Sofroniou [62]. Bartlett's test was found to be statistically significant ($p = .000 < .05$), so the 13 variables are correlated. which is necessary to perform PCA, and the horizon was found to be 0.00003, greater than the threshold of 0.00001 so there is no question of multicollinearity. Two eigenvalues greater than unity were found, cumulatively explaining 69.335% of the total variability:

Table 4. Principal component analysis (PCA) after oblimin rotation (loadings less than .4 in absolute value are excluded).

	Factor	
	1	2
A01_REL1	.905	
A02_REL2	.630	
A03_REL3	.945	
A04_RESP1	.817	
A05_RESP2		.571
A06_RESP3	.727	
A07_ASSUR1	.681	
A08_ASSUR2	.754	
A09_ASSUR3	.873	
A10_EMP1	.436	.418
A11_EMP2		.741
A12_EMP3		.780
A13_EMP4		.855
Eigenvalue	7.934	1.079
% of interpreted dispersion	61.031	8.303
Cronbach <i>a</i>	0.945	0.836
<i>Extraction Method: Principal Component Analysis.</i>		
<i>Rotation Method: Oblimin with Kaiser Normalization.</i>		
<i>a. Rotation converged in 6 iterations.</i>		

The above PCA test performed by selecting this time eigenvalues greater than unity gave different results. It resulted in 2 eigenvalues instead of 4. explaining 69.3% of the total variability. Interestingly:

- As in the previous case. the reliability indicators are all loaded on the same component.
- This time the assurance indicators are also loaded onto the same component. which is also the reliability component.
- Empathy is loaded on the 2nd component (with the exception of the indicator of A10. which is loaded on two components).
- Responsiveness as before is loaded separately with positive responses in component 1 and negatively worded in component 2.
- We finally conclude that the measurement tool seems to detect two dimensions:
- A combined dimension of reliability - responsiveness - assurance.
- An empathy dimension.

Commenting on the conclusion about the dimensions of the measurement tool used for the needs of the present research, there is in no way a pure loading in 4 dimensions of the abbreviated SERVQUAL tool of 13 questions. as claimed by Kettinger and Lee [61]. Moreover, no clear one-dimensional loading, as claimed by the exponents of SERVPERF (and opponents of

SERVQUAL) [59, 63], in a review of their instrument found that the responsiveness and assurance dimensions were identical in their original 5-dimensional analysis. Interestingly, they argued that if the sample generally scores high marks throughout the questionnaire, it would be difficult to distinguish dimensions. Generally extensive research by Carman [64], as well as Babakus and Boller [65], did not verify the dimensionality robustness of SERVQUAL and in a meta-study Ladhari [66] found the same problem when adapting the instrument outside the United States or even over time.

Of particular interest are the studies concerning the adaptation of SERVQUAL to other languages: the studies by Cui et al. [67] in a survey using SERVQUAL in the South Korean banking sector found in their dimensional control of their sample that the questions loaded on 3 dimensions (tangibility, empathy, reliability and responsiveness/empathy). While research by Gounaris [68] in the B2B service industry showed that loading on two factors (tangibility on one dimension and the other 4 dimensions on the other) gave the best fit to the data. Finally, research by Arasli et al. [69] using SERVQUAL in the banking sector of Cyprus found loading on a three-dimensional construct, with dimensions of tangibility, reliability and a combined responsiveness/empathy. If the dimension of tangibility is removed from the above 3 studies, as in the present study, then the similarities between them and the present study are evident, verifying our own conclusions about 2 dimensions.

In addition, the wording of the empathy questions and the one responsiveness question seem to be problematic, a problem that seems to be inherent in the original 22-question instrument and which Babakus and Boller [65] criticised. The empathy dimension has a disproportionately large number of negatively worded sentences (3 out of 4), while the use of the negative molecule "don't/don't" makes understanding more difficult.

Examining the pattern matrix, one finds that, in order of decreasing importance, the following questions/factors play the most important role in the combined reliability-responsiveness-assurance component (Questions with coefficients $> .7$ are reported):

- DTeG's delivery of services on time/times stated to employees (A3/A1 - reliability). The result is of particular interest since typically employee requests are made via an online form, i.e. in a way in which the user is not notified of the time of resolution of his/her problem. In the context of verbal communication with DTeG employees there is always the informal information 'soon' or 'in 5 minutes'.
- the expertise of DTeG staff (A9 - assurance). It should be mentioned that the employee is generally unaware of the level of staff expertise. What he scores is the first person's perceived expertise of the second person. Staff training actions by the DTeG employees themselves augment the perceived expertise.
- the lack of delay between the employee's request and the undertaking of an effort to resolve it (A4 - responsiveness) - the courtesy of DTeG staff (A8 - assurance) and finally
- The responsiveness of DTeG staff, even if they are (always perceived by the employee) to be in busy conditions.
- Similarly, with regard to component 2 of the PCA analysis ('empathy'), the following play a more important role: a) DTeG's interest in meeting employees' specific job needs and maximizing the employee's service interest (A12-A13 - empathy), and b) The personal contact with the employee himself (A11 - empathy).

Regardless of the absence of sufficient evidence of dimensions, it was deemed appropriate to examine the correlation between the 4 dimensions, in order to analyze the correlations between

them. if any. Firstly, their mean was extracted and then a normality test was performed, which showed that the dimensions do not follow a normal variable. The calculation of the Spearman correlation coefficient r_s indicated that there is a statistically significant high correlation between the dimensions (values from .675 to .807), while empathy seems to have the lowest correlation with the other structural variables: with reliability $r_s = .675$. responsiveness $r_s = .747$ and assurance $r_s = .688$. The consideration of the existence of dimensions is a key point in SERVQUAL, but in contrast. SERVPERF rejects the existence of dimensions and prefers unidimensionality. For this reason. the correlation coefficients between the A1-A13 indicators of the tool were calculated and are depicted in the following Table 5:

Table 5. Correlation of tool indicators: (a) above the diagonal: Spearman r_s correlation coefficients - with bold text statistically significant results at .01 level of significance (two-sided). (b) below the diagonal: significance p.

	A01	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12	A13
A01	1.000	.736	.831	.741	.606	.727	.690	.623	.760	.590	.598	.552	.481
A02	.000	1.000	.642	.634	.620	.694	.714	.618	.706	.626	.601	.502	.582
A03	.000	.000	1.000	.716	.563	.674	.628	.592	.701	.574	.522	.477	.411
A04	.000	.000	.000	1.000	.752	.778	.711	.674	.662	.625	.585	.525	.535
A05	.000	.000	.000	.000	1.000	.691	.763	.648	.620	.598	.619	.594	.518
A06	.000	.000	.000	.000	.000	1.000	.744	.691	.701	.662	.599	.490	.524
A07	.000	.000	.000	.000	.000	.000	1.000	.757	.795	.637	.616	.581	.541
A08	.000	.000	.000	.000	.000	.000	.000	1.000	.612	.541	.537	.498	.367
A09	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.614	.517	.548	.449
A10	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.598	.560	.561
A11	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.615	.589
A12	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.532
A13	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000

Examining the above table, we observe that within each dimension the indicators show statistically significant strong positive correlations between them. hence measurement convergence (although it should be noted that Bagozzi's criterion of uniform distribution is not necessarily ensured). The positive correlation (0.701) between top management providing services within a specific timeframe (A03) and their expertise in answering questions (A09) suggests that when leaders are responsive and punctual in in-service delivery, they are also more likely to possess the necessary knowledge and expertise. In the realm of public IT management, this implies that effective and timely services are often associated with knowledgeable leadership, contributing to effective decision-making and problem-solving. The correlation (0.744) between the responsiveness of top management staff (A06) and their behavior inspiring confidence (A07) indicates that when staff members promptly respond to requests even in busy times. it contributes to building a sense of confidence and trust in their abilities. In the context of public IT management, this suggests that a commitment to responsive communication. even during peak workloads. can positively influence stakeholders' perceptions of leadership's competence. The correlation A07 and A09 (0.795) implies that when top management staff exhibit behavior that inspires confidence (A07), they are also likely to have the expertise to answer questions (A09). In the realm of public IT management, this signifies that leaders who project confidence and competence tend to possess the knowledge required to address complex IT issues. This combination can foster a sense of assurance among stakeholders about the organization's IT capabilities. These strong positive correlations highlight the interconnection of various dimensions of top management behavior and performance in the context of public IT management. Effective service delivery, responsiveness, expertise, and confidence-inspiring

behavior are closely linked and contribute to building a positive perception of leadership's capabilities and trustworthiness within the realm of IT services in the public sector. The strong positive correlation between A07 and A08 (0.757) suggests that when top management staff demonstrate behavior that inspires confidence through their actions, decisions, and interactions (A07), they are also more likely to consistently exhibit kindness and approachability (A08). This combined behavior contributes to a holistic image of leadership that is both competent and personable. This positive correlation suggests that top management staff who inspire confidence through their behavior are also approachable and kind. This is likely to lead to better relations with stakeholders, fostering open communication and a positive perception of leadership. A combination of confidence-inspiring behavior and kindness can make leaders more effective in conveying their messages to different audiences. The strong positive correlation (0.744) between A06 and A07 implies that when the top management staff is responsive to requests even during busy periods (A06), it leads to a perception of behavior that inspires confidence (A07). This suggests that timely and considerate responses to inquiries and concerns contribute to building trust and a positive perception of leadership's commitment to addressing stakeholder needs. This combination of timely responsiveness and confidence-inspiring behavior is crucial for building trust, effective stakeholder engagement, and successful IT management in the public sector.

Moreover, with regard to measurement divergence, which states that 'indicators between different constructs (dimensions) should show a strong correlation. Nevertheless, at lower values than the correlations between indicators of the same construct', things are different: for example, reliability indicator A02 shows a correlation of .736 and .642 with the other reliability indicators, but also corresponding or even higher values with A07 of assurance (0.714) and A06 of responsiveness (0.694). Overall, it appears that the dimensions do not show measurement discrepancies. The results on the number of dimensions are also consistent in this direction, where it was found that no 4 dimensions emerge, but probably 2.

Finally, a number of χ^2 tests were then conducted between the questions concerning demographic data other than gender (Part A) with: a) frequency of contact with DTeG (Part B) and b) quality of service satisfaction (Part D) in which no statistically significant relationship emerged.

4.3. Hypotheses Testing

Pearson χ^2 correlation tests were conducted using Pearson χ^2 of each of the questions of the measurement tool, in relation to question C1, which expresses the quality of the services provided by DTeG, in order to test the hypotheses statistically:

- $H_{i,SQ}$: the Part C factors (C_i) and the service quality factor (Part D) are statistically dependent. and
- $H_{i,SF}$: the Part C (C_i) factors and the service satisfaction factor (Part D) are statistically dependent.
 - where $i=1, \dots, 13$. That is, we will examine the correlation of each of the questions of the instrument (Part C) with both user perceived quality (Part D-1) and user satisfaction (Part D-2) with the services provided.

The results of the χ^2 tests between the 13 questions of Part C and the 2 questions of Part D are presented in Tables 6 and 7. In order to draw reliable statistical conclusions, in both sets of tests, the recoding of the 13 dimensions and the satisfaction dimension on a 3-point scale was followed

due to the large number of cells with a frequency of less than 5. In particular, this was 71.4% at best and 85.7% at worst, significantly higher than the commonly accepted threshold of 20%.

Table 6. Pearson χ^2 tests between variables of measurement tool and service quality assessment tool.

Variable / Hypothesis	Pearson χ^2	<i>df</i>	<i>P</i>	Percentage of cells of expected frequency < 5
A1 & C1 / $H_{1.SQ}$	64.955	4	.000	33.3%
A2 & C1 / $H_{2.SQ}$	83.412			
A3 & C1 / $H_{3.SQ}$	75.314			
A4 & C1 / $H_{4.SQ}$	78.160			44.4%
A5 & C1 / $H_{5.SQ}$	47.882			33.3%
A6 & C1 / $H_{6.SQ}$	74.259			44.4%
A7 & C1 / $H_{7.SQ}$	100.568			33.3%
A8 & C1 / $H_{8.SQ}$	41.785			22.2%
A9 & C1 / $H_{9.SQ}$	65.579			33.3%
A10 & C1 / $H_{10.SQ}$	47.420			22.2%
A11 & C1 / $H_{11.SQ}$	44.136			33.3%
A12 & C1 / $H_{12.SQ}$	36.577			
A13 & C1 / $H_{13.SQ}$	36.112			

We note that:

- In all 13 cases, there is statistical evidence that each of the measurement instrument variables is dependent with respect to the service quality variable (in all cases $p < .05$). Therefore, we accept all alternative hypotheses $H_{i.SQ}$ ($i = 1 \dots 13$).
- Despite the compression of categories and reduction of degrees of freedom, in all 13 questions the percentage of cells with expected frequency remained higher than the 20% threshold, but in this case the percentages ranged from 22.2% to 44.4%. That is, significantly lower than the corresponding percentages for the variables before coding.

Table 7. Pearson χ^2 tests between measurement tool variables and satisfaction with services provided.

Variable / Hypothesis	Pearson χ^2	<i>df</i>	<i>P</i>	Percentage of cells of expected frequency < 5
A1 & C1 / $H_{1.SF}$	52.356	4	.000	33.3%
A2 & C1 / $H_{2.SF}$	89.595			
A3 & C1 / $H_{3.SF}$	59.495			
A4 & C1 / $H_{4.SF}$	76.125			
A5 & C1 / $H_{5.SF}$	57.418			
A6 & C1 / $H_{6.SF}$	100.887			
A7 & C1 / $H_{7.SF}$	134.835			
A8 & C1 / $H_{8.SF}$	62.194			
A9 & C1 / $H_{9.SF}$	60.804			
A10 & C1 / $H_{10.SF}$	67.553			22.2%
A11 & C1 / $H_{11.SF}$	48.337			
A12 & C1 / $H_{12.SF}$	32.853			
A13 & C1 / $H_{13.SF}$	36.492			

We note that:

- In all 13 cases, there is statistical evidence that each of the measurement tool variables is not independent with respect to the service satisfaction variable (in all cases $p < 0.05$). Therefore we accept all alternative hypotheses $H_{i,SF}$ ($i = 1...13$).
- Despite the compression of categories and reduction of degrees of freedom, in all 13 questions the percentage of cells with expected frequency remained higher than the 20% threshold, but in this case the percentages ranged from 22.2% to 33.3%.

Finally, to test the research hypothesis: “ $H_{Q,S}$: The variables 'quality of services provided' and 'satisfaction of employees receiving them' are statistically dependent”, a regression test was performed with the dependent variables being the quality and satisfaction assessment (Part D) and the independent variables being the averages of the Part C dimensions (stepwise method). The results showed, that:

- There is statistical evidence ($p < 0.05$) that the dimensions that most influence the quality of service provided are reliability and assurance, with the latter having the most important role. In particular, quality can be explained by 62.4% of these dimensions while assurance alone explains 57% of the variance in quality provided. Looking more closely at the regression coefficients, it can be seen that in terms of predicting quality using assurance alone, a statistical significance of 0.063 is obtained for the constant coefficient of the model, hence unreliable at the 0.05 level of significance. On the other hand, if the use of both the assurance mean for predicting quality is chosen, then both the constant coefficient of the regression and the coefficients of the assurance and assurance means are statistically significant at the 0.05 level. With these, quality is obtained as:

$$\langle \text{Quality of services} \rangle = 0.496 * \langle \text{Mean Assurance} \rangle + 0.356 * \langle \text{Mean Reliability} \rangle + 0.731$$

- There is statistical evidence that the dimensions that most influence the quality of service provided are reliability and assurance and empathy, with assurance playing the most important role. In particular, satisfaction can be explained by 60.1% of these dimensions while assurance alone explains 55% of the variance in quality provided. The differences from the regression of service quality on the one hand are to be expected: the construct of service quality is different from satisfaction and there is strong research evidence that the former is an antecedent of the latter - e.g. Cronin and Taylor [59]. At first sight it is therefore surprising that the second variable in the regression model of satisfaction has given way to empathy instead of assurance. In fact there is no differentiation, and the corresponding linear interpolation equation is:

$$\langle \text{Satisfaction} \rangle = 0.534 * \langle \text{Mean Assurance} \rangle + 0.180 * \langle \text{Mean Empathy} \rangle + 0.209 * \langle \text{Mean Reliability} \rangle + 0.355$$

In the above equation it is evident that reliability has a higher weight (.209) than empathy (.180). Nevertheless, in the regression model if two independent variables have to be chosen, reliability is not preferred here but empathy. The explanation lies in the way stepwise linear regression works: the variable that explains the largest amount of variability is found first, then the variable that explains the largest percentage of the remaining unexplained variability is selected as the second variable, and so on [70]. In short, after assurance, empathy explains the largest percentage of the remaining variability. It seems striking, however, from the regression equation that a one-

point increase in the assurance rating (on the seven-point Likert scale) results in an increase of more than half a point in employee satisfaction.

5. CONCLUSIONS

The aim of the research is to investigate the quality of ICT services provided to employees, because it is a critical factor in improving an organization through the Information Systems it has. The Region of Central Macedonia (RCM) was chosen as the company/organization, so the object of evaluation will automatically be the level of ICT services provided to its employees. The provider of these services is exclusively the Department for Transparency and eGovernment (DTeG) of RCM.

Having only two dimensions instead of four simplifies the interpretation of the results. It makes it easier to understand the overall service quality assessment by employees as primarily driven by these two overarching dimensions. This could lead to a more straightforward and concise narrative when discussing the outcomes of the study. While simplification can be beneficial, it might lead to a loss of nuanced insight into specific aspects of service quality. The original four-dimensional structure provided a more detailed understanding of the different facets of the services offered by DTeG. Reducing the dimensions could mask variations in perceptions and experiences within each overarching dimension. A reduction in dimensions could lead to a loss of granularity in the analysis. Researchers and practitioners might not be able to delve deeply into specific issues or attributes that contribute to overall service quality. This could hinder the ability to make precise recommendations for improvements in the IT management strategy. The modification in dimensions could affect the comparability of the findings with previous research. If the original four-dimensional framework was used in prior studies, comparing results across studies might become challenging due to differences in measurement and categorization. Reducing dimensions might oversimplify the complex nature of service quality assessment. It's possible that the two-dimensional representation might not capture the full complexity of employee perceptions. This could lead to oversimplified conclusions and potentially overlook critical areas that require attention.

From the primary results of the survey, no correlations were found between the demographic variables of age group, highest level of education and organizational unit in relation to the variables of quality of service delivery and satisfaction. Also, no heterogeneities were found in the distributions of quality and satisfaction of respondents when they were categorized by the same demographics. Finally, the measurement instrument adapted from the Kettinger and Lee (1997) study was found to provide results strongly correlated with perceived quality and satisfaction, providing an analytical tool for similar studies [61]. The survey delivered a set of data concerning the provision of ICT services to public service employees, creating a body of knowledge that can be used in secondary future surveys, but also as a "reference" result in a replication of the survey in the same population (RCM employees) and with the same subject matter (ascertaining satisfaction levels and level of services provided).

Although there is a plethora of studies on the original SERVQUAL/SERVPERF tools in the last 30 years both abroad and in Greece, there are no studies in Greece using adapted tools in the field of ICT, let alone in the field of Public Services. A large part of the research contribution of this paper was the adaptation of a shortened SERVPERF measurement tool for ICT services for the first time to Greek data, which was tested not using a gap model / expectation confirmation model, but using SERVPERF methodology.

In the context of the examination of the tool, it was found to be governed by high internal consistency, confirming the corresponding research of the abbreviated original tool of Kettinger and Lee (1997) [61]. The latter extended in their research that the tool measures 4 dimensions of service quality and using Cronbach's α they found high index values and per dimension. which is also in agreement with our results.

In contrast, an examination of the dimensionality of the abbreviated ICT tool revealed not four dimensions, but two dimensions: empathy and a combined reliability-responsiveness-assurance dimension. The findings indirectly verify the corresponding ones about the lack of the reported 5 dimensions of SERVQUAL [65] and extend them to the 4-dimensional abbreviated ICT service tool. The present study did not verify the multiple dimensions of SERVQUAL [30], nor those on unidimensionality of Cronin and Taylor (1992) [59], but it is in agreement with meta-studies by Ladhari (2009) in which the dimensionality of SERVQUAL tools appears to be 3 dimensions (if tangibility is included)[66].

As established by the dimensionality check, the existence of the dimensions invoked by Kettinger and Lee [61] was not verified. However, we can say from the tests of factors influencing the perceived service quality that the dominant reason in the perceived service quality are issues of assurance and reliability, as these dimensions are expressed by the corresponding questions of the instrument. In addition, employee satisfaction is also a variable in D&M's model of PS success, which is significantly influenced by the same factors as perceived service quality, but additionally by the empathy inspired by DTeG staff.

Along these lines, and taking into account the results of both the component check. it is proposed to prioritize high levels of adherence to the following areas, which correspond to questions in the tool (the order of reference is in descending order):

- the provision of services at the times declared to the employee(s),
- improving the perceived expertise of DTeG staff, through DTeG's own training of employees. DTeG's own promotion of its own CA projects. etc.,
- DTeG's interest in meeting the specific work needs of its employees and in maximizing the employee's service interest,
- the lack of delay between the employee's request and the undertaking of the effort to resolve it,
- the courtesy of DTeG staff,
- the personal contact with the employee himself, and
- the responsiveness of DTeG staff. even if they are (always perceived by the employee) to be in a busy situation.

At the administrative level, the DTeG's ticketing system is used to a small extent for administrative use, mainly for reporting on periodic reports on the resolution of requests. In the context of providing information that can improve the perceived quality of service by employees and their satisfaction. the following is proposed:

- Since the time to take a request is positively and strongly correlated with both perceived service quality and user satisfaction, it is suggested that: 1) providing DTeG employees with a directive to declare a request to be taken up for resolution at the time it is initiated. rather than summarily when the resolution of the request is complete (at which time it is re-reported to the logging system by the DTeG employee), and 2) having DTeG management track, where feasible. the average time to take up a request.

- A request already contains information on priority, take-up time and resolution information. It is proposed to modify the system (osTicket) so that after the request is completed, a sample or all email is sent where it will receive from the employee at least the following information, which will be stored with the rest of the request information: 1) whether the request was successfully completed, how it judges the quality of service, and how satisfied the user was with the resolution, etc.

The managerial approach should be balanced, addressing both strengths and weaknesses identified in the study. This ensures that improvements are made in areas that need enhancement while maintaining the positive aspects of the existing IT service quality. By addressing the implications outlined above, the organization can refine its approach to service delivery, enhance employee experiences, and continuously strive for excellence in its IT services. Given the strong correlation between the dimensions of reliability, responsiveness, and assurance, the management strategy should focus on consistently delivering services within specified timeframes (reliability), promptly responding to employee requests (responsiveness), and building a sense of trust and confidence through transparent communication and staff expertise (assurance). These dimensions form a critical foundation for positive employee perceptions of service quality. While the findings suggest mixed results in the responsiveness dimension, there is an opportunity to improve by offering more personalized services and showing genuine interest in meeting individual employee needs. Implementing training programs that emphasize customer-centric communication and responsiveness could contribute to a more positive overall service experience. Recognizing the impact of cultural and linguistic factors on service quality perceptions is important. This insight suggests the need for culturally sensitive communication strategies and adapting the IT management approach to accommodate diverse employee backgrounds and expectations. The evolving nature of service quality perceptions requires continuous monitoring and feedback collection. Implementing regular surveys or feedback mechanisms can help track changes in employee perceptions over time and identify areas for improvement. Managers should be aware of the dimensional complexity in service quality assessment. While the findings suggest a conjunction of dimensions, acknowledging the interactions between reliability, responsiveness, assurance, and empathy is crucial for developing targeted improvement strategies. Clear communication about service timeframes and problem-solving processes is crucial. Addressing the concern of delays between employee requests and service initiation (responsiveness) can lead to increased employee satisfaction. Improved communication can also mitigate any misunderstandings related to service delivery expectations. In conclusion, the findings offer valuable insights into the effectiveness of the public IT management strategy and its impact on employee satisfaction.

The tool should first be modified in two important respects:

- Due to the PCA results, consideration should be given to using two dimensions instead of the four of the original tool, possibly with other methods (e.g. Principal Axis Factoring and Confirmatory Factor Analysis).
- The existence of negatively worded Likert questions has conflicting views. Research tends towards their use, but not in the form they appear in the standard SERVQUAL/SERVPERF tools where there is a strongly uneven distribution between dimensions. It is suggested that negatively worded questions be used without the use of negative molecules (e.g. question A13 could be formulated as "Top management staff is indifferent to my specific job needs").

Also, the tool used should be examined in terms of its validity. Part of this process includes running it on different public and non-public bodies, comparing it with other tools that measure the quality of ICT services, etc. Of course, the results of the existing survey should also be verified by third party surveys, possibly outside the field of the examined organization employees, in order to avoid problems of bias of beliefs.

It's important to acknowledge the limitations and potential biases in our study to provide a comprehensive and honest assessment of the research findings. The study had a relatively small sample size, with a response rate of 12.8%. This could raise concerns about the representativeness of the sample and the generalizability of the findings to the entire employee population of the Department for Transparency and eGovernment (DTeG) in the Region of Central Macedonia (RCM). A small sample size might limit the robustness of statistical analyses and the ability to detect significant relationships. Participation in the survey was voluntary, which could lead to self-selection bias. Employees who were more interested in or satisfied with ICT services might have been more likely to participate, while those with negative experiences might have chosen not to participate. The study relied on self-reported data collected through a questionnaire. Self-report data can be influenced by response biases, such as social desirability bias, where participants might provide answers they think are expected rather than their true opinions. The study did not explicitly account for potential external factors that could influence employee perceptions of ICT services, such as changes in technology trends, organizational culture, or broader economic conditions. These factors might have affected the results. The study used self-reported measures of service quality and employee satisfaction. While these measures provide valuable insights, they might not capture the complete picture of actual service quality or employee perceptions. The study did not explicitly account for potential external factors that could influence employee perceptions of ICT services, such as changes in technology trends, organizational culture, or broader economic conditions. Future research with larger samples, a mix of research methods, and consideration of external factors could further enhance the understanding of service quality and employee satisfaction in this context.

Since the tool's dimensionality was found to be influenced by cultural and linguistic factors, validating it in diverse cultural contexts is crucial. Conducting the study in different countries or regions with distinct cultural backgrounds can help assess whether the dimensions hold across various cultures. This would involve translating the tool, adapting questions to fit cultural norms, and verifying its effectiveness in capturing service quality perceptions. Longitudinal studies that track changes in service quality perceptions over time can provide insights into the stability and consistency of the adapted tool's dimensions. By administering the tool at multiple time points, researchers can assess whether the dimensions remain consistent or evolve. Furthermore, testing the tool with different employee groups, such as different job roles or hierarchical levels, can determine if the dimensions are perceived uniformly across the organization. For instance, validating the tool with both frontline employees and managers can reveal if the dimensions apply consistently at various organizational levels. Conducting qualitative interviews or focus groups alongside the quantitative survey can provide deeper insights into participants' understanding of the dimensions and the tool's relevance. This can help refine and validate the tool's constructs from a qualitative perspective. Before widespread validation, conducting pilot testing and pretesting in different settings can identify any ambiguities, challenges, or cultural biases in the tool. This iterative process ensures that the tool's questions are clear, relevant, and applicable to the target groups.

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