Economic Crisis and Government Digital Transformation – Some Positive Evidence

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Abstract. Economic crises are an inherent problem of market-based economies, which is repeatedly appearing with various levels of intensity, resulting in 'recessions', meant as significant contractions of economic activity. They have negative consequences on organizations (both private and public ones), as they decrease their financial resources, and therefore their operational and investment expenses and activities. In this paper we focus on public organizations and investigate the effects of economic crisis on a highly important activity of them: their digital transformation activity. For our study we have selected a highly appropriate national context: Greece, which has been hit by a strong economic crisis between 2010-2018. We investigate the effects of this economic crisis on the digital transformation of a large, costly and highly important for the society and the economy public organization: the Ministry of Education. For this purpose, we have constructed a research framework, based on the 'Resource-based View' (RBV) of the firm, as well as a comprehensive conceptualization of government digital transformation, as our theoretical foundations. Data have been collected through a combination of qualitative and quantitative techniques. It has been concluded that the above economic crisis resulted in a serious decrease of the ICT-related investment and operating expenses (for the acquisition of ICT resources) of the Ministry of Education. However, despite this decrease the economic crisis has led to a significant increase of the digital transformation developments of this Ministry, and a significant advancement in all the main dimensions of the digital transformation of it.

Keywords: digital transformation, government, economic crisis, resource-based view, resources and capabilities.

1 Introduction

Economic crises are an inherent problem of market-based economies, which is repeatedly appearing with various levels of intensity and geographic scope, and result in 'recessions', meant as significant contractions of economic activity, that have quite negative consequences on organizations (both private and public ones) [1-6]. They can be initiated by various different kinds of events, such as banking crises, droughts, large increases in the prices of important goods (e.g., oil, gas, food, etc.), hostilities between countries or groups, epidemics, etc., which give rise to decline of economic

activity. Numerous economic crises of various intensities, geographic scopes and origins have appeared in the last century and have caused serious problems to the economy and the society, resulting in significant increases of unemployment, poverty and finally social unrest and political-government crises (a comprehensive review of them is provided in [2]). In the beginning of this century, we experienced the 2007 Global Financial Crisis, which had quite negative impact on the economies and the societies of most countries of the world [7]; recently the COVID-19 pandemic initiated another economic crisis [8], while the war in Ukraine has caused price increases in oil and food, which might give rise to one more recessionary economic crisis. Since the beginning of this century economic crises have become more frequent than in the past, so 'economically normal periods' tend to become shorter, and economic crisis periods longer.

However, most of the research that has been conducted about various activities and aspects of organizations concerns 'economically normal periods', but there has been much less research concerning economic crisis periods. Despite their increasing frequency, duration and negative consequences, much less empirical research has been conducted about the effects of these economic crisis periods on various activities and aspects of organizations; a brief review of this research is provided in section 2.1. As explained in more detail in this section, this empirical research has dealt mainly with the effects of economic crises on financial aspects of organizations. Only a very small part of this research is dealing with the effects of economic crises on the digitalization and digital transformation activity of organizations, though the activity is widely recognized as of critical importance for modern organizations (with the only exception of the COVID-19 crisis, since it necessitated increased use of digital technologies to reduce the spread of the virus, as explained in section 2.1). Though information systems (IS) research traditionally investigates the effects of various elements of the external environment of organizations (e.g., competition, dynamism, legal frameworks) on the exploitation of digital technologies by them (e.g. [9-11]), this has not occurred for the most severe disruption that repeatedly emerges in their external environment: the recessionary economic crises. Another important gap of this limited empirical research is that it has dealt exclusively with the private sector, but not with the public sector, despite the importance of the latter for social and economic life, especially in economic crisis periods.

This paper contributes to filling these important research gaps by investigating empirically the effects of economic crisis on the digital transformation of government organizations. So, our main research question is:

RQ: What are the effects of economic crisis on the main dimensions of the digital transformation of government organizations?

For investigating the above research question, we have constructed a research framework, which is based on the 'Resource-based View' (RBV) of the firm (see section 2.3), as well as a comprehensive conceptualization of government digital transformation (see section 2.2), as theoretical foundations. Data have been collected through a combination of qualitative and quantitative techniques.

We have selected a highly appropriate national context for this study: Greece, which has been hit by a strong economic crisis between 2010-2018 [12]; furthermore, Greece lags in 'digital development' in comparison with the other EU countries (e.g. note its low position in the 'Digital Economy and Society Index' (DESI) (https://digital-strategy.ec.europa.eu/el/policies/desi)), and this creates an unfavorable environment for the digital transformation of the Greek public sector. We focus on a large, highly important and quite costly government organization: we investigate the effects of the Greek economic crisis on the digital transformation of the Ministry of Education. According to its Action Plan for 2024 its administrative personnel includes 170,570 public servants, while its teaching personnel incudes 130,575 primary and secondary education teachers, and its budget for 2024 amounts to 6,5 billion Euro. At the same time the quality of education it provides is of critical importance for the Development of the Grek economy and society.

The findings of this research can be quite interesting and useful for both political and administrative managers of public organizations, as well as consultants offering services to government organizations, in order to develop effective strategies for managing their digitalization and digital transformation activities during such tough periods of recessionary economic crisis (which as mentioned above have become more frequent than in the past).

Our paper consists of five Sections. The following section 2 presents the background of our study, and then in section 3 its method and data are described. In Section 4 the results are presented in section 4, a discussion of them flows in section 5, while in the final section 5 the conclusions are summarized, and future research directions are proposed.

2 Background

2.1 Effects of Economic Crises on Organizations

According to relevant economic literature [1-6] economic crises result in significant contractions of economic activity, which are referred to as 'recessions, and have quite negative effects on organizations (both private and public ones), as they decrease their financial resources, and therefore their operational and investment expenses and activities; these lead to personnel salaries' reduction or even dismissals, as well as reduction of procurement of equipment and materials. However, the above relevant economic literature [1-6] highlights that crises can also have positive effects on organizations, as they can serve as drivers for significant rationalization and cost reduction of their processes, as well as better exploitation of their resources and improvements of their overall efficiency.

Some empirical studies have been conducted concerning the effects of economic crises (with most of them focusing on the 2007 Global Financial Crisis) mainly on the financial aspects of private sector firms [13-18]. However, there has been limited empirical research on the effects of economic crises on the digitalization and digital transformation activities of organizations. There is only one study presented in [19]

that investigates empirically the ICT-related impact of the strong economic crisis that hit Greece between 2010-2018 on the five main 'system-relevant' Greek banks.

The only exception was the COVID-19 crisis, as it was not a typical recessionary crisis: on one hand it caused recession, as it led to reduction of activities of numerous organizations, and also the shutdown of many others (which reduced the available financial resources for digitalization and digital transformation); on the other hand it necessitated increased use of digital technologies for the operations and transactions digital technologies of organizations in order to reduce the face-to-face contacts and therefore the spread of the virus (which was a strong driver of increasing digitalization and digital transformation in organizations). For this reason, there has been some empirical research on the effects of the COVID-19 crisis on the digitalization and digital transformation of organizations (e.g. [20-22], [32]). However, the findings of this COVID-19 related research do not hold for the 'typical' recessionary economic crises (as they do not create such compelling need for increased use of digital technologies). So, extensive further empirical research is required concerning the effects of the 'typical' recessionary economic crises (which as mentioned in the Introduction appear more frequently than in the past) on the digitalization and digital transformation activities of organizations.

This paper contributes to filling this important research gap. Focusing on the public sector (which has been under-researched with respect to economic crises effects, since as mentioned above most research in this area has dealt with private sector firms), we investigate the effects of economic crisis on the digital transformation of public sector organizations. For this purpose, we construct a research framework, which is based on the 'Resource-based View' (RBV) of the firm (outlined in 2.3) and a comprehensive conceptualization of government digital transformation (discussed in 2.2).

2.2 Government Digital transformation

The digital transformation of private sector firms is a major trend in the world economy and has become of critical importance for the competitiveness and even the survival of firms, so it has attracted significant research attention; comprehensive reviews of this research are provided in [23-26]. This private sector trend has encouraged and motivated the public sector to start moving in this direction as well, however adapting this digital transformation concept to its own objectives, challenges and specificities; so, some interesting research has been conducted concerning these first government digital transformation efforts [27-31], which however is still much less than the research that has been conducted on private sector digital transformation.

In [27] a conceptualization of government digital transformation has been developed, based on a series of interviews with experts, which includes the main reasons for government digital transformation, the main dimensions of it, the steps/processes it follows and its results (outputs, outcomes and impact). Quite interesting are the main dimensions of government digital transformation it has identified: transformations based on the use of digital technologies of a) internal processes of government organizations, b) public services provided to the citizens, c) as well as products,

d) relationships with citizens and with other government organizations, e) technology and f) business models.

Furthermore, there have been some interesting studies concerning the implementation of digital transformation of government. In [28] the implementation of government digital transformation in the administrative divisions of the Zhejiang Province in China is empirically investigated. It is examined how digital transformation is implemented in a hierarchical bureaucracy context and how flexibility can be created in order to enable its progression. A study that aims to provide a better understanding of the factors that cause complexity in government digital transformation projects through an in-depth case study is described in [29]. It analyses complexity elements from the dimensions of organization, technology and innovation, as well as the interplay between them. The problem of lack of the required knowledge for implementing digital transformation in local government is analyzed in [30]. Based on interviews with the CIOs of 11 Canadian local governments the knowledge that local government managers require in order to lead digital transformation is determined, and then a theoretical model for the acquisition of this knowledge through public-private partnerships is developed. The driving and the impeding factors of government digital transformation are investigated in [31] through a quantitative approach. Data are collected through a survey from 491 Italian government organizations (mainly large municipalities), which are used in order to estimate a structural equation model that reveals the main government digital transformation driving and impending factors.

Also, the effects of a severe disruption of the external environment, the COVID-19 pandemic, on several important dimensions of government digital transformation are investigated in [32], for the cases of 10 Austrian federal government organizations. It is examined if and how the COVID-19 pandemic has influenced these dimensions of government digital transformation. However, such an investigation has not been conducted for the recessionary economic crises, which are also severe disruptions of the external environment of organizations and appear much more frequently. This paper contributes to filling this research gap.

2.3 Resource-based View of the Firm

The 'Resource-Based View' (RBV) of the firm [33-37] constitutes one of the most 'classical' and widely recognized theories in management science, which has been extensively used both in research and practice. According to this theory the output of firm is determined on one hand by its 'resources' (meant as all kinds of firm's assets, such as equipment, buildings, personnel, etc.) and on the other hand by its 'capabilities', meant as its abilities to select, deploy, exploit and manage these resources in order to perform the main activities of the firm efficiently and effectively). The RBV theory, though initially developed for private sector firms, has been subsequently used successfully for public sector organizations as well [38-40].

The RBV theory holds not only for the whole organization, but also for each of its activities viewed separately as well. Especially for the ICT-related activity of an organization there has been extensive research [41-50], which has concluded that its output is determined:

- on one hand by its ICT-related resources, such as ICT hardware, ICT software, ICT personnel, ICT-related external services, etc.
- and on the other hand, by its ICT-related capabilities; according to the relevant literature [41-50] the most important of them are the capabilities for development of ICT plans, ICT project management, ICT equipment and services procurement, ICT contracts management, ICT software development, modification and integration, ICT operations, ICT users support, ICT internal partnership, ICT external partnership, etc.

Therefore, in order to conduct a comprehensive analysis of the effects of economic crisis on the digital transformation of an organization it is necessary to examine the effects on the availability ICT-related resources (determined by the ICT-related investments in hardware, software, etc. and the ICT-related operating expenses), on the ICT-related capabilities and finally on the ICT-related output (developments of IS for the digital transformation of the organization).

3 Method and Data

For the development of the research model of this study we have taken into account that as mentioned in section 2.1 relevant economic research [1-6] has revealed that economic crises:
i) on one hand have negative effects on organizations, as they lead to a decrease of their financial resources, and therefore their operational and investment expenses and activities;
ii) but on the other hand, economic crises can have also some positive effects, as they put pressure on organizations for making significant improvements, rationalizations and cost reductions in their processes, and also for making better use and exploitation of their resources, increasing their relevant capabilities.

So as economic crises affect both the resources of organizations (see above point i) and their capabilities (see above point ii), the RBV is an appropriate theoretical foundation for a comprehensive investigation of the effects of economic crises on organizations (both the overall effects, and also the effects on specific activities of them, such as the ICT-related ones); it enables the identification of both negative effects (concerning decrease of resources) and also possible positive effects (concerning improvements of capabilities as well as resources' utilization).

Therefore, our research model, which is shown in Fig.1, consists of four components, which correspond to the three main elements of the RBV: analysis of the effects of economic crises on the expenses for the ICT-related resources (discriminating between investment and operational expenses), on the ICT-related capabilities and on the digital transformation. For each of these components a set of more detailed items/questions were defined. In particular:

a) The first component includes five items/questions, which concern the assessment of the effects of the economic crisis on the expenses for ICT-related investment in general, as well as for each of the main kinds of ICT-related investment: for ICT hardware, for ICT software, for training of ICT personnel as well as of ICT users.

b) The second component includes six items/questions, which concern the assessment of the effects of the economic crisis on ICT-related operating expenses in general, as well as on the main kinds of ICT-related operating expenses: for ICT personnel payroll, for new ICT personnel, for ICT consulting services, for ICT outsourcing and for cloud services.
c) The third component includes nine items/questions, which concern the assessment of the effects of the economic crisis on the improvement and rationalization of the ICT-related processes in general, and therefore on the improvement of ICT-related capabilities in general, as well as on the main particular ICT-related processes, and therefore on the improvement of the corresponding ICT-related capabilities (as they are defined in relevant literature [41-50]): for the development of ICT plans, for the implementation and management of ICT projects, for the procurement of ICT hardware, software and services, for the internal development, modification and integration of software, for the operation and support of IS, for the support of the ICT users, for the co-operation of the ICT unit with the business units that use ICT (ICT internal partnership) and for the co-operation of the ICT unit with the external suppliers of ICT hardware, software and services (ICT external partnership).
d) The fourth component includes eight items/questions, which concern the effects of the economic crisis on the output of the digital transformation activities in general, as well as with respect to (i.e. developments of IS for) the main dimensions of government digital transformation, which are defined in the conceptualization of government digital transformation proposed in [27]: digital transformation of processes, services, products, relationships with citizens, relationships with other government organizations, technology and business models.

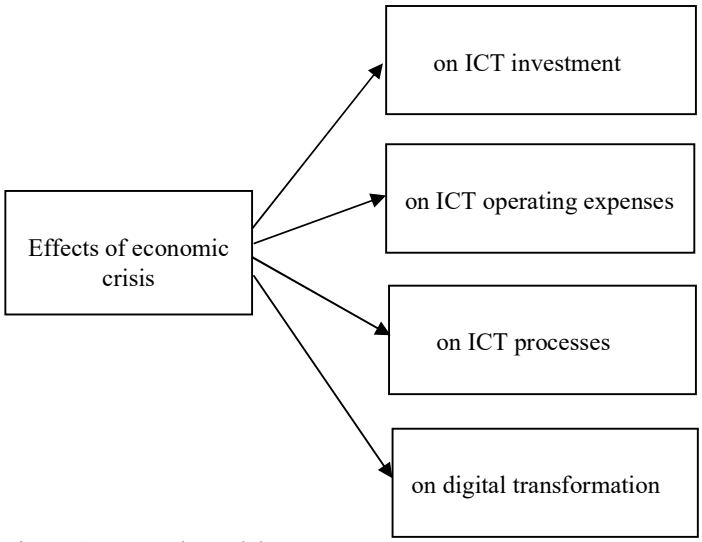

Figure 1. Research Model

For collecting data about the above components and items of the above research

model a focus groups discussion of about two hours duration was conducted, in which participated the ICT Director of the Ministry of Education, as well as four experienced personnel of the ICT Directorate, who all had a good knowledge of the ICT projects and in general the digital transformation activity of the economic crisis period 2010-2018. In order to collect data from them we used a combination of qualitative and quantitative techniques:

- the focus group participants initially answered-filled collaboratively a questionnaire, which included one question for each item of the four components of our above-mentioned research model. For each question the focus group participants had some internal discussion and finally arrived at one consensus response;
- and then followed an in-depth qualitative discussion between the authors focus group participants about the answers that the latter had provided to these questions, in order to give justification and further clarifications and explanations about them.

4 Results

4.1 General/overall Effects

In Table 1 are shown the responses of the focus group to the four general questions, which concern the general/overall effect of the economic crisis on the ICT-related investments, the ICT-related operating expenses, the improvement and rationalization of the ICT-related processes/capabilities and the digital transformation of the Ministry of Education.

Table 1: General/overall effects of the economic crisis

on ICT-related investments	7(large decrease/decrease)
on ICT-related operating expenses	7 (large decrease/decrease)
on the improvement/rationalization of ICT-related processes/capabilities	4 (to a large extent)
on the digital transformation	4 (to a large extent)

*The first and second questions are assessed in a 7-points Lickert scale (*1 = large increase/increase 2 = moderate increase, 3 = small increase, 4 = no effect, 5 = small decrease, 6 = moderate decrease, 7 = large decrease/decrease*); the third and fourth questions are asessed in a 5-points Lickert scale (1 = not at all, 2 = to a small extent, 3 = to a moerate extent, 4 = to a large extent, 5 = to a very large extent.)*

We can see that there has been a substantial decrease of ICT-related investments and ICT-related operational expenses in the crisis period 2010-2018. In the focus group discussion, it was mentioned that during this period a strict austerity program had been put into effect in Greece for overcoming the crisis, which included significant cuts in the expenses of all government organizations, including the Ministry of Education. This led to substantial decrease in all kinds of investments, including the ICT-related ones. Furthermore, during this crisis period, the regulations for the public procurement regulations became much stricter, and the relevant processes more com-

plex and demanding (requiring more central control and approvals), which increased significantly the time required for conducting and completing public tenders. So, for many public tenders for procurement of ICT hardware and software (having high levels of complexity due to highly elaborate requirements and specifications) it was not possible to be completed within the strict deadlines defined by the abovementioned regulations, so they had to be cancelled and repeated. Furthermore, these long times required for conducting and completing these complex public tenders for procurement of ICT hardware and software made the initial specifications obsolete at the time of the completion, so they had to be cancelled and repeated. A more elaborate picture concerning the effects of the crisis on different kinds of ICT-related investment of the Ministry of Education is provided in 4.2.

With respect to the substantial reduction of the ICT-related operational expenses in the focus group discussion it was mentioned that this was due to: a) the decrease of the ICT personnel, as there was not recruitment of new ICT personnel for replacing the older ones who retired, and also the termination of the contracts of the temporary ICT personnel; b) the decrease of their salaries (which was a 'horizontal' policy throughout the public sector during the crisis period). A more elaborate picture concerning the effects of the crisis on different kinds of ICT-related operating expenses of the Ministry of Education is provided in 4.3.

However, in Table 1 we can see that the crisis has led to the improvement and rationalization of the ICT-related processes and corresponding capabilities of the Ministry of Education to a large extent, as well as to an increase in its digital transformation activity and output (i.e. significant increase in the developments of new IS that lead to important transformations in the Ministry of Education). In the focus group discussion, it was mentioned that during the crisis due to the austerity program there has been limited recruitment of new personnel for replacing the retired ones, and this resulted in a significant decrease of the personnel of the Ministry. So, some critical core activities of this Ministry (such as the operation of the schools, the massive university admission applications and exams, etc.) had to be carried out with less personnel. This necessitated the development of new IS that support/transform substantially these activities, so that they can be carried out with less personnel. So, during the crisis period were developed for this purpose some of the largest, most important and transformational IS that have ever been developed in this Ministry, such as:

- A shared IS that supports/transforms all the administrative operations of all primary and secondary schools of Greece (more than 10,000): registration of students, allocation of them to classes, classes schedules, assignments to teachers, monitoring of absences and grades, students' graduation certificates, etc. Tt is centrally hosted in the Ministry of Education and is accessed remotely as a service by all primary and secondary schools, transforming substantially schools' administrative processes and operations, and reducing significantly the personnel required for carrying them out.
- A large and complex IS that supports/transforms the whole lifecycle of applications of high school students for participation in the national university admission exams (more than 100,000 yearly). It enables the students to submit their applications through the Internet, then the processing of these applications in combination with the grades of the students in these examinations and finally their allocation to university

departments based on their preferences and grades. On one hand it provides a very useful electronic Internet-based service to high school students, and on the other hand it transforms significantly the internal processes of handling these applications by the Ministry, reducing significantly the personnel required for this.

- Another IS that supports/transforms the whole lifecycle of application of students for transfer to another university department (with the same or similar subject) within the same city where a sibling is enrolled at a local university; This possibility has been provided for long time in Greece, as part of a social policy aimed at alleviating the financial burden on their parents, however it is contingent upon several preconditions defined by relevant legislation, such as the income of the parents, the number of their children, etc. This IS enables the university students to submit their transfer applications through the Internet, and then proceeds to a complicated processing of each of these applications, which includes data extraction from various government IS, such as data about parents' income (from the taxation IS), the number of siblings (from citizens' registry IS), etc., in order to examine whether the above preconditions are fulfilled. It provides a very useful electronic Internet-based service to university students interested in being transferred to another university department, and also transforms significantly the processes of handling these applications by the Ministry, as well the processes of co-operation, and in general the relationship, with the abovementioned other involved government organizations, reducing significantly the personnel required for this.
- An IS that supports/transforms all the administrative operations of the regional departments of the Ministry throughout Greece.
- An electronic Internet-based service for students, which enables them to enrol in university through the Internet. These enrolments are then sent electronically to university departments in order to be imported in their own IS. It transforms significantly the whole process of students' enrolment both for the students and for the administrative units of the university departments and reduces dramatically the time required for both.
- An electronic Internet-based service primary and secondary education teachers, which enables them to submit applications for participation in educational programmes through the Internet; it also includes a module for the processing of these applications.
- Development of digital educational content (digital schoolbooks with interactive enrichments of them, as well as additional educational resources, such as educational video, software, practical exercises, simulations, etc.), as well as a platform enabling easy access to it through the Internet by teachers, students, parents, etc. This was a revolutionary novel electronic Internet-based service for all the abovementioned groups, which provides them valuable educational products that can drive dramatic innovations in the teaching/learning processes.

A more elaborate picture concerning the effects of the crisis on the main dimensions of the digital transformation of the Ministry of Education is provided in 4.5.

Furthermore, the participants of this focus group discussion emphasized that these great digital transformation developments during the economic crisis period were achieved with less ICT personnel (because as mentioned above there was not recruit-

ment of new ICT personnel for replacing the retired ones) and less financial resources for ICT-related investment and ICT-related external services. In order to respond successfully to the abovementioned strong pressures to develop several new IS that enable the Ministry of Education to carry out its core activities with less personnel, despite the abovementioned decreases of ICT personnel and financial resources, they adopted the following strategies:

a) Improvement and rationalization of their ICT-related processes and work practices, resulting in an increase of their ICT-related capabilities. A more elaborate picture concerning the effects of the crisis on the ICT-related processes/capabilities of the Ministry of Education is provided in 4.4.

b) Better utilization of its ICT personnel, who were under-utilized previously, as they were assigned less development tasks, of lower complexity, that did not fully leverage their development skills and abilities.

c) Furthermore, for the above digital transformation developments was leveraged not only the ICT personnel of the central department of the Ministry of Education, but also personnel with high ICT skills of the research institutes of the Ministry.

d) Also, were leveraged teachers with high ICT skills for the development of the abovementioned digital educational content.

e) Finally, there was a better utilization of the existing ICT equipment (e.g. servers), though most of it was obsolete,

f) and also utilization of cloud services (mainly infrastructure as a service), mostly from the Greek government cloud (G-cloud).

4.2 Effects on the Main Kinds of ICT-related Investment

In Table 2 are shown the responses of the focus group to the more detailed questions concerning the effects of the economic crisis on the main kinds of ICT-related investment of the Ministry of Education.

Table 2: Effects of the economic crisis on the main kinds of ICT investment

in ICT hardware	5 (decrease)
in ICT software	4 (small decrease)
in training of ICT personnel	4 (small decrease)
in training of ICT users	4 (small decrease)

All four questions are assessed in a 5-points Lickert scale (1 = increase, 2 = small increase, 3 = no effect, 4 = small decrease, 5 = decrease)

We can see that during the crisis period there has been a substantial decrease in the investments in ICT-related hardware, and a smaller decrease in the investments in ICT software. Furthermore, there was a small decrease in the investment in training of ICT personnel and the ICT users. In the qualitative focus group discussion the participants stated that due to the dramatic reduction of the funding from the central government during the crisis only the absolutely necessary ICT hardware procurements and training were made. This resulted in a gradual obsolescence of its ICT hardware

(especially its servers), which posed a significant barrier to the abovementioned required digital transformations (which were absolutely necessary due to the decrease of the personnel of the Ministry). The decrease in ICT software investments was smaller, as it is necessary to renew the licenses of some existing important software, to acquire new versions of it, and some other software-related expenses that cannot be avoided.

4.3 Effects on the Main Kinds of ICT-related Operating Expenses

In Table 3 are shown the responses of the focus group to the more detailed questions concerning the effects of the economic crisis on the main kinds of ICT-related operating expenses of the Ministry of Education.

Table 3: Effects of economic crisis on the main kinds of ICT operating expenses

for ICT personnel payroll	4 (small decrease)
for new ICT personnel	5 (decrease)
for ICT consulting services	5 (small decrease)
for ICT outsourcing	4 (small decrease)
for cloud services	2 (small increase)

All five questions are assessed in a 5-points Lickert scale (1 = increase, 2 = small increase, 3 = no effect, 4 = small decrease, 5 = decrease)

We can see that during the crisis period there has been a substantial decrease of the expenses for new ICT personnel and for ICT-related consulting services, and smaller decrease of expenses for ICT personnel payroll (as there was a central government policy for a 'horizontal' reduction of all salaries in the public sector during the crisis period) and for ICT-related outsourcing. On the contrary there was a small increase in the expenses for cloud services. In the qualitative focus group discussion it was mentioned that due to the abovementioned decrease in ICT-related hardware investments leading to obsolescence of the ICT hardware infrastructure, a good solution was the use of cloud services (mainly infrastructure as a service), most of them from the Greek government cloud (G-cloud).

4.4 Effects on the Main ICT-related Processes/Capabilities

In Table 4 are shown the responses of the focus group to the more detailed questions concerning the effects of the economic crisis on the improvement and rationalization of the main ICT-related processes/capabilities of the Ministry of Education.

Table 4. Effects of economic crisis on the improvement and rationalization of the main ICT processes/capabilities

for the development of ICT plan	4 (to a large extent)
for the implementation and management of ICT projects	4 (to a large extent)

for the procurement of ICT hardware, software and services	4 (to a large extent)
for the internal development, modification and integration of software,	4 (to a large extent)
for the operation and support of IS	4 (to a large extent)
for the support of the ICT users	3 (to a moderate extent)
for the co-operation of the ICT unit with the business units	4 (to a large extent)
the co-operation of the ICT unit with the suppliers of ICT	3 (to a moderate extent)

All eight questions are assessed in a 5-points Lickert scale (1 = not at all, 2 = to a small extent, 3 = to a moderate extent, 4 = to a large extent, 5 = to a very large extent)

We can see that the crisis led to the improvement and rationalizations of most of the examined processes/capabilities to a large extent, with the only exception of the ones for the support of the ICT users and for the co-operation of the ICT unit with the suppliers of ICT (external partnership) that were also improved and rationalized but to a moderate extent. In the qualitative focus group discussion it was mentioned that as most of the software of the new transformational IS developed during the crisis period (such as the ones mentioned in 4.1) had to be developed internally by the ICT personnel of the Ministry, it was particularly important to improve and rationalize its processes/capabilities for: a) the internal development, modification and integration of software, b) co-operation of the ICT unit with the business units (in order to understand their work practices and needs before developing software for supporting/transforming them), and c) implementation and management of ICT projects. Furthermore, as both the pre-existing and also the new IS developed during the crisis period had to be operated and supported by the existing reduced ICT personnel it was absolute necessary to improve and rationalize its processes/capabilities for the operation and support of IS. Finally, since as mentioned in 4.1 during the crisis period the public procurement regulations became stricter and more demanding, so it was difficult to conduct and complete public tenders within the deadlines defined by these regulations, it was imperative to improve and rationalize processes/capabilities for procurement of ICT hardware, software and services.

4.5 Effects on Digital transformation

In Table 5 are shown the responses of the focus group to the more detailed questions concerning the effects of the economic crisis on the main dimensions of the digital transformation of the Ministry of Education.

Table 5. Effects of economic crisis on the digital transformation

of internal processes	5 (positive)
of services	5 (positive)
of products	4 (moderately positive)
of relationships with citizens	4 (moderately positive)

of relationships with other government agencies	5 (positive)
of technology	4 (moderately positive)
of business models	4 (moderately positive)

All seven questions are assessed in a 7-points Lickert scale (1 = negative, 2 = moderately negative, 3 = no effect, 4 = moderately positive, 5 = positive)

We can see that the economic crisis had positive effects on three of the dimensions of the digital transformation of the Ministry of education: on the digital transformation of internal processes, services and also relationships with other government agencies. Furthermore, it had moderately positive effects on the other four dimensions: on the digital transformation of its products, relationships with citizens, technology and business models.

In the qualitative focus groups discussion the participants emphasized that the economic crisis served as a strong driver for the digital transformations of highly important processes of the Ministry, which reduced the personnel required for carrying them out, such as: the internal administrative processes of all primary and secondary education schools, the processes of the regional departments of the Ministry throughout Greece, the processes of the massive national university admission exams, the processes of students transfer to other university departments, etc. (see section 4.1).

Also, it was mentioned that the economic crisis was a strong catalyst for the digital transformation of important services provided by the Ministry, by enabling the electronic provision of them with higher quality through the Internet, such as the applications of high school students for participation in the national university admission exams, the enrolment of university students, and also their applications for transfer to another department, the applications of primary and secondary education teachers for participation in educational programmes, etc. (see section 4.1).

Furthermore, the participants in the focus group mentioned that the economic crisis served as a strong driver for the digital transformations of the co-operation with other government organizations (such as taxation authorities, citizens' registries, etc.) which provide necessary data for conducting and completing important processes (e.g. the process of handling students' applications for transfer to another department, which requires data about parents' income, number of children, etc.), through the electronic extraction of these data from the IS of other government organizations.

Also, it was pointed out that the economic crisis was a catalyst to a moderate extent for digital transformations of the 'products' provided in education as well as of its business model (by providing various kinds of useful digital educational content through a platform, such as schoolbooks with interactive enrichments, educational simulations and software, etc.). Finally, the crisis led to a moderate extent to transformations of the technology used in the Ministry of Education with respect to its ICT hardware: as the existing hardware infrastructure became gradually obsolete, it was supplemented by the utilization of cloud services (infrastructure as a service).

5 Conclusions

Economic crises according to relevant literature [1-6] can have two opposite effects on the digital transformation of organizations: a negative effect (due to the decrease of the available financial resources for it) and a positive effect (by putting pressure on organizations to increase their efficiency through various kinds of digital transformations). It depends on the specific characteristics and the context of each organization which of these two opposite effects dominates. In this paper we investigated empirically this question the digital transformation of government. Our study was conducted in an appropriate national context: Greece, which has been hit by a strong economic crisis between 2010-2018. In particular, we investigated the effects of this economic crisis on the digital transformation of a large, costly and highly important for the society and the economy public organization: the Ministry of Education.

For this purpose, initially we have constructed a research framework, by combining the RBV of the firm with a comprehensive conceptualization of government digital transformation proposed in [27] as our theoretical foundations, which can be of wider usefulness for future research on the effects of recessionary economic crises on different activities and aspects of pubic and private sector organizations.

Based on it we have gained some interesting and useful insights: we have found some positive evidence concerning the effects of the economic crisis on the digital transformation of this Ministry. In particular, the economic crisis had a positive effect on three main dimensions of the digital transformation of this Ministry: on the digital transformation of its internal processes, services and relationships with other government agencies. Also, we found that the economic crisis had moderately positive effects on the other four dimensions: on the digital transformation of its products, relationships with citizens, technology and business models. These were achieved despite the serious decrease of the availability of resources due to the crisis (less ICT-related investment and operating expenses for the acquisition of ICT resources, and less ICT personnel). Furthermore, our study revealed that for this purpose six strategies were employed (described in the final paragraph of 4.1), which might be of wider applicability in such tough periods of low resources availability and high demands for IS developments and digital transformations.

Our study has important implication for research and practice. With respect to research, it makes a contribution on one hand to the government digital transformation literature, and on the other hand to the literature on the effects of economic crises on the various activities and aspects of organizations. Furthermore, the research model we have developed for our study, which has sound theoretical foundations, can be useful for future research in both the above areas. With respect to practice, our study reveals some interesting digital transformation dimensions that can be highly beneficial for government organizations during crisis periods, and also some strategies for overcoming the inherent challenges and limitations that exist in these tough periods (pressure for developing some necessary IS for coping with the crisis, but with less financial resources for ICT investments and operations, and less ICT personnel).

Further similar research is required for other government organizations, both of the same administrative layer (i.e. Ministries), as well as of other administrative layers

(e.g. Municipalities), and also for private sector firms, in different national contexts, with different types and intensities of economic crises. Also, further research can be conducted for the further development and enhancement of our research model, using additional theoretical foundations, e.g. from strategic management research concerning turnaround strategies or strategic response to crisis [51].

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