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Evaluation of Critical Success Factors for Enterprise Resource Planning Implementation Using Quantitative Methods in Agricultural Processing Companies

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Abstract: This study aims to evaluate critical success factors (CSFs), considering the perspectives of various stakeholders who are involved in enterprise resource planning (ERP) implementation in agricultural processing companies in Central Macedonia (Greece). This evaluation—combined with aspects from the literature—may show how a digital production system can be managed and redesigned to become sustainable for a company. Research was conducted through the use of a specially designed questionnaire that was addressed to various stakeholders in the ERP implementation in agricultural processing companies. Descriptive statistics, Grey Relational Analysis (GRA), and Friedman test methods were used in order for relevant information to be identified and valid conclusions to be drawn. Given the results of the grey relational analysis (GRA), respondents consider 33 out of 37 critical success factors to be "very important". Friedman test results seem to differ from GRA results in 19 out of 37 factors with regard to their ranking. Based on this, and using two different methods, the most important ERP critical success factors are highlighted. For the objective aim of this paper to be fulfilled, there is a contribution giving insights into stakeholders' perspectives regarding the management of a digital production system in the field of agricultural processing companies. It also contributes to the literature, as it highlights methods that refer to the evaluation of critical success factors for ERP implementation.

Keywords: enterprise resource planning; critical success factors; sustainability; agricultural processing companies; Greece; grey relational analysis; Friedman test

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1. Introduction

Enterprise resource planning (ERP) systems have become the new trend in the modern business field, which is dedicating huge investments to it [1], and their implementation serves small, medium, and large enterprises [2]. In [3], it was reported that many companies are introducing ERP systems in order to provide accurate data aimed at sustainable development. In this regard, [4] (p. 61) state that *"There is no doubt that the ERP system as a representative of digitalization tools aims at optimization of resources and processes, while also contributing to sustainability"*. At this point, it should be made clear that an enterprise resource planning (ERP) system is essentially software or another solution that helps companies to integrate their whole range of business functions, using a common database and shared information [5,6].

The functional aspects that are supported by ERP systems are those of accounting, finance, marketing, planning, sales, distribution, human resources management, maintenance services, inventory management, production management, and so on [2,3]. In short,

it could be said that ERP systems include the whole range of a company's processes in a single—or a digital—system [7,8]. The efficient management of a company can be achieved providing that the organizational structure and processes are outlined from an ERP system point of view [7,9]. Specifically, the recognition and management of critical elements are of paramount significance for ERP implementation to be successful [10]. Critical success factors are those that increase the probability of ERP success [11] and set management guidelines for professionals in order to achieve sustainability and address risks.

In view of the above [1–11], it could be argued that ERP success contributes to sustainability. Consequently, if the elements (CSFs) that characterize this success are studied from a user point of view, it essentially indicates the way in which a company's sustainability can be achieved. Moreover, it is noted in [11] that a good understanding of users' perspectives toward CSFs contributes to the design of more effective and successful ERP systems.

The existing literature studies on ERP critical success factors in the field of agriculture mainly concern agricultural processing or food companies in general. Some of these surveys concern the investigation of critical elements that may be appropriate for a successful ERP implementation on palm oil and pig processing organizations [12,13]. Another type of research related to the critical factors and the successful implementation of ERP in this business area concerns CSFs' evaluation by systems' users. An example of this research is [14], which ranked the CSFs according to their degree of relationship in ERP success using the Friedman test method.

Studies in various sectors of the economy [15,16] are carried out with a similar research object and methodology. The studies of [11] and [17], which evaluate the ERP critical success factors in terms of their importance, are of great interest, since they introduce a new methodology, which is called grey relational analysis (GRA). In accordance with the above, and with a desire that there will be development in the object of CSFs' evaluation in agricultural processing companies, a relevant analysis was carried out in the prefecture of Central Macedonia (Greece). The area's selection was based on the literature, as based on a review of it, it seems that there is no similar survey. It is also worth mentioning that a large processing industry is located in the prefecture of Central Macedonia. To be precise, food and beverage industry represents the largest number of companies [18]. This fact also helped significantly in data collection.

All of the above facts point to a literature gap, which this study aims to fill in through the evaluation of critical factors according to Greek agricultural processing companies' ERP users. Taking into account the study of [19], who identified 37 critical success factors, this paper conducts research to answer a specific question:

> *How are critical success factors evaluated by Greek companies' respective members who are involved in the business activities, either from an administrative or an executive point of view, and are directly involved in the use of the ERP system?*

This question represents the above-mentioned objective aim that is to be fulfilled in this paper. The present study's authors go into more depth in the field of agricultural processing companies' management through the evaluation of ERP critical success factors. This evaluation—combined with aspects from the literature [19]—may show if the examined sector (agricultural processing) is actually interesting in the context of ERP, and how a digital production system can be managed and redesigned to become sustainable for a company.

2. Literature Review

It is mentioned in [19,20] that an ERP system, apart from the wide range of its practical application in various economic sectors, is an equally active field of interest regarding research and literature. As is mentioned in [19], many surveys conduct literature reviews investigating the implementation of critical success factors of ERP [5,11,17,21–24]. In this way, a CSF's general mapping is achieved [19,25]. Some of these studies, subsequently, conduct a further analysis—such as CSFs' evaluation—using a specially designed questionnaire to specify the CSFs that are important for ERP implementation success in particular

economic sectors, or in a set of them [11,14,17,23]. The general investigation of critical factors was covered by the effort of [19], while ERP CSFs' evaluation is to be covered in this study for a specific sector of the economy, specifically, agriculture in the context of agricultural processing companies.

In this section, a brief overview of corresponding studies will be carried out. The studies that are going to be presented include a similar subject to that of the present study, such as the evaluation of critical success factors for ERP implementation.

Critical success factors were identified in [23] for the automobile ancillary industries. Firstly, through a systematic literature review, a number of critical factors were found, and ERP consultants, as well as project teams, were then interviewed in order for further data to be collected for analysis [23]. By use of the Friedman test, it was determined that the factors of "advanced hardware and software" and "training and development" ranked first in the order of critical success factors for ERP implementation [23]. Similarly, [14] aimed to identify critical success factors and study their relationship with ERP implementation in an Iranian dairy products company. They used the structural equation model method together with the hypothetic model and Friedman test, which identified the degree of influence that each of the accepted factors has on successful implementation [14]. The aim of [11] was the evaluation of critical success factors for ERP implementation, based on the users' perspective. Initially, they identified CSFs from the literature, and then further research on 123 members of a German industry was conducted. By use of grey relational analysis, factors were classified in order, based on their importance, and their results showed that 7 out of 13 factors are taken into account as the most important in successful ERP implementation with regard to the users' perspective [11]. In addition, [26] conducted a study on the factors that affect intention to adopt cloud-based ERP using a comprehensive approach. The empirical analysis showed that the factors of organizational culture, regulatory environment, relative advantage, trialability, and vendor lock-in all had a significant influence on the intention to adopt cloud-based ERP, while information and communications technology skill, complexity, observability, data security, and customization had no significant influence on the intention to adopt cloud-based ERP. Finally, [27] presented the new factors of ERP implementation related to the usage of cloud-based and blockchain information technology.

As mentioned earlier, the general identification of CSFs was achieved in the paper of [19] where the identified factors with short descriptions are listed in its context [19]. The present study—as a continuation—evaluates them according to the agricultural companies' stakeholders' opinions in order for the present research objective aim to be fulfilled. Therefore, according to a set of literature studies [11,14,15,17,23], it was decided to evaluate the ERP critical success factors based on their importance, using GRA and Friedman test methods. Grey relational analysis (GRA), in specific, was selected after reviewing the studies of [11] and [17], which are the only ones that approach the ranking of CSFs through this method. Correspondingly, Friedman's method seems to be used more in the literature [14–16,23]. As a result, it was decided to use both methods and study the differences in the results obtained.

Through these methods, useful conclusions will be drawn about the elements that can contribute to the design of more effective, successful, and sustainable ERP systems in Greek agricultural processing companies.

3. Research Design and Methods

Taking into consideration the theoretical framework of [19], who identified 37 CSFs for ERP implementation, this study conducts a further survey on the field of agricultural processing companies. As for data to be collected, a specially designed questionnaire was used. The questionnaire, which fulfills the present study's purpose, includes questions on the respondents' demographic profile [11,12,21] and set questions about the critical factors. Its last part was formatted with Likert-scale questions to assess the degree of importance of critical success factors in ERP implementation. The values that were defined

in this case were: 1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, and 5 = very important [11]. Once the questionnaire was prepared, the survey was sent through e-mail to agricultural processing companies in the prefecture of Central Macedonia (Greece). The email addresses were collected after an internet search, as the real existence and number of Central Macedonia's agricultural processing companies could not be investigated. The identification of companies' processing activity was carried out through visits and direct telephone contacts with many of the companies' managers.

This research was directed to all members of these companies who are involved in the implementation of an ERP system [12], that is, the top managers, managers, and other employees who are ERP users. In order for the research on these people to be extended, all of their views about CSFs for ERP implementation in agricultural processing companies were equally taken into account. Once data had been collected, they were processed in Microsoft Excel, and entered into the statistical package SPSS version 25. The use of these programs helped to describe the companies and demographic profiles using descriptive statistics [12,26], and to conduct the critical success factors' ranking, which was achieved by the use of grey relational analysis [11,17] and Friedman test [14–16,23].

Descriptive statistics were exported to frequency tables and measures.

The grey relational analysis method is an appropriate method for the extraction of the most important CSFs according to the ERP systems' users [11,28,29]. The first step of GRA method implementation is to determine a multi-criteria problem [11]. This determination is achieved by using the set of examined variables (such as critical factors) $\{x_1, x_2, x_3, \ldots, x_m\}$ and their observations (criteria) $\{k_1, k_2, k_3, \ldots, k_n\}$, which represent the values of a Likert scale (from k_1: not important to k_5: most important) [11]. The observations (criteria) are assigned to each variable (critical factors), and a decision matrix is created (Equation (1)) [11].

$$D = \begin{Bmatrix} x_1(k_1) & \cdots & x_i(k_1) & \cdots & x_m(k_1) \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ x_1(k_j) & \cdots & x_i(k_j) & \cdots & x_m(k_j) \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ x_1(k_n) & \cdots & x_i(k_n) & \cdots & x_m(k_n) \end{Bmatrix} \quad (1)$$

This matrix is then normalized. This is achieved through the use of the following equation (Equation (2)), and the matrix turns into a new form (Equation (3)) [11].

$$x_i(k_j)' = \frac{x_i(k_j) - \min\limits_{\forall j}\{\dot{x}_i(k_j)\}}{\max\limits_{\forall j}\{x_i(k_j)\} - \min\limits_{\forall j}\{x_i(k_j)\}} \quad (2)$$

$$D' = \begin{Bmatrix} x_1(k_1)\prime & \cdots & x_i(k_1)' & \cdots & x_m(k_1)' \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ x_1(k_j)' & \cdots & x_i(k_j)' & \cdots & x_m(k_j)' \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ x_1(k_n)' & \cdots & x_i(k_n)' & \cdots & x_m(k_n)' \end{Bmatrix} \quad (3)$$

The grey relational coefficient is then calculated [11]. This coefficient represents the relationship between the ideal and the actual normalized values (Equation (4)) [30]. The values extracted from Equation (4) can range between 0 and 1. The letter ζ refers to the equation's contrast control, and its value is usually equal to 0.5 [11,28].

$$\gamma(x_0 * (k),\ x_i * (k)) = \frac{\Delta\min + \zeta\Delta\max}{\Delta 0j(k) + \zeta\Delta\max} \quad (4)$$

Equation (4) is based on the $\Delta_{0j}(k)$ calculation (Equation (5)), which represents the deviation (Δ_0) between the reference ($x_{0*}(k)$) and comparability ($x_{i*}(k)$) sequences [31].

$$\Delta_{0i} = |x_{i(k)} - x_{i*(k)}| \quad (5)$$

The mean value of the grey relational coefficients forms the grey relational value (Equation (6)) [11]. The CSFs' evaluation was based on ranking them in order of importance, at a level of optimization (such as the successful implementation of the agricultural processing companies' ERP system).

$$x(x_o, x_i) = \frac{1}{n}\sum_{j=1}^{n} X(Xo(k), Xj(k)) \quad (6)$$

Another method used to evaluate the critical factors is the Friedman test [14–16,23]. Friedman test implementation essentially aims to compare the variables' repeated measures [32] whose data are ordinal or quantitative and not normally distributed [33]. In the case of this study, the Friedman test is used for the ranking of variables, detecting the differences in the CSFs' importance scores [15]. During the implementation of this method, the data are placed in a two-way table with m rows (respondents) and K columns (observations: from 1 = not important CSF to 5 = most important CSF) [34]. The rank value is defined in each observation, and its sum is calculated [23] (p. 219). Then, the observations are arranged in ascending order [35]. The Friedman test also enables the implementation of statistical tests to clarify whether or not there are significant differences between the mean ranks of the different critical success factors [23]. The *p*-value is subsequently calculated through the following equation (Equation (7), $d_k = k - 1$) [32]:

$$F = \frac{12}{mk(k+1)}\sum_{i=1}^{k} R_i^2 - 3m(k+1) \quad (7)$$

where K is the number of samples, m is the size of samples, and R_i is the degrees' sum of i sample (= 1, 2, . . . , k).

The Friedman test was chosen to be used as an alternative method in order for the collection of further answers to be achieved. These answers concern the CSFs' level of importance in ERP success and the determination of whether or not there are any result differences between the Friedman test and the first method (GRA method) of evaluation analysis. These possible results' differences are worth studying because the methods described above are characterized by different natures. That is, the Friedman test is a non-parametric method that does not impose limitations on data distribution, and grey relational analysis is a multicriteria method that imposes the previously mentioned kind of limitations.

4. Results

4.1. Profile of Agricultural Processing Companies That Participated in the Survey

The collection of primary data was accomplished within a period of four months (October 2019–February 2020), using Google Forms. A total of 1008 companies' respondents received the online questionnaire, but only those of 157 companies completed it correctly and sent it back (Table 1). Regarding these results, it could be said that the Greek agricultural processing sector is actually interesting in the context of ERP, due to the number of companies that participated in the survey or refused to participate even though they implement such systems.

Companies are divided according to the raw material they process, such as olives, milk, nuts, fruit, vegetables, meat, wheat, cereals, bee products, tea, and coffee. Thus, 13 types of agricultural processing emerged (Table 2), among which the participation of companies involved in wheat processing, where dough, flour, and pasta are produced, was higher than the others (15.3%).

Table 1. Response rate (survey).

Response Rate	Total	Percent (%)
Ignorance of the questionnaire	569	56.4
No existence of ERP	246	24.4
Cessation of business operation	6	0.6
Refusal to participate in the research	30	3.0
Participants in the research	157	15.6
Total	1008	100

Table 2. Types of agricultural processing companies that participated in the research.

Company Type	Frequency	Percent	Cumulative Percent (%)
Olive processing	13	8.3	8.3
Vegetable and fruits processing	8	5.1	13.4
Fruit processing	18	11.5	24.8
Fruit processing for brewing of alcoholic beverages	21	13.4	38.2
Vegetable processing	10	6.4	44.6
Milk processing	19	12.1	56.7
Cereal processing	7	4.5	61.1
Wheat processing	24	15.3	76.4
Nut processing	11	7	83.4
Meat processing	15	9.6	93
Fish and seafood processing	6	3.8	96.8
Bee products processing	3	1.9	98.7
Processing of tea and coffee	2	1.3	100
Total	157	100.0	
Mean	12		
Minimum	2		
Maximum	24		

4.2. Ranking of the Critical Success Factors for ERP Implementation

In order for the respondents' perspective on 37 critical success factors [19] to be evaluated, the method of grey relational analysis [11,17] was initially used, the results of which are presented in the following table (Table 3).

In the analysis above, the emphasis that was put on each one of the critical success factors by the respondents was not the same, which is something that exists in the study of [17] as well. This essentially points out that through the respondents' answers, a different level of importance was attributed to each factor, something that may happen due to the dissimilarity of the grey relational values. The higher the respondents' score per factor is, the more important the element of this factor is in the successful implementation of the ERP system, and vice versa. The score that respondents gave to each factor could also be considered as the importance placed by the agricultural processing field on each one of the critical success factors.

Another method that is also used in the literature for the evaluation of critical success factors is the Friedman test [14–16,23], which is a criterion that provides the ability to implement statistical tests. The Friedman test was chosen to be used in order to acquire further answers regarding: (1) the level of importance of the factors in the successful implementation of ERP, and (2) whether there are any differences between the Friedman test and the first method of evaluation analysis. The results from Friedman test implementation are presented below (Table 4).

Friedman test results show that the most important CSF in successful ERP implementation is that of "accuracy, quality, and data integrity", which was indicated in the case of the GRA method as well. After this, the factor of "system quality" follows. The less important factors, in this case, are "competitive and external pressures" and "national culture".

Table 3. Ranking of CSFs by the use of grey relational analysis.

ID	Critical Success Factors	GRA Value	Rank
1	Accuracy, quality, and data integrity	0.837	1
2	ERP package selection	0.803	2
3	Communication, collaboration, and trust	0.801	3
4	System quality	0.800	4
5	Top management support and commitment	0.799	5
6	Training	0.796	6
7	ERP, business, and business processes alignment	0.791	7
8	System support/maintenance and further training	0.780	8
9	Service quality	0.761	9
10	Business plan, goals, scope, mission, and vision	0.751	10
11	Organizational culture	0.749	11
12	ERP vendor selection	0.748	12
13	IT infrastructure/business and IT legacy systems	0.744	13
14	Composition of a capable and balanced project team	0.738	14
15	Change management	0.736	15
16	Implementation strategy and goals achievement timeframe	0.730	16
17	Use of consultants	0.729	17
18	Company-wide support and commitment	0.728	18
19	Software testing, customization, and troubleshooting	0.727	19
20	Knowledge management	0.725	20
21	Post-implementation audit	0.717	21
22	Project management	0.716	22
23	Existence of empowered decision-makers	0.715	23
24	Users' characteristics, skills, and capabilities	0.713	24
25	Business process re-engineering	0.708	25
26	Realistic expectations	0.706	26
27	Monitoring, evaluation, and feedback	0.693	27
28	Well-defined budget of project	0.688	28
29	Users and stakeholders' involvement	0.684	29
30	Implemented modules	0.679	30
31	Minimum customization	0.671	31
32	Communication plan	0.664	32
33	Recognition of qualifications, reward, and motivation	0.654	33
34	Presence of project champion and adequate role	0.639	34
35	Controlled ROI on ERP implementation	0.633	35
36	Competitive and external pressures	0.596	36
37	National culture	0.568	37

Table 4. Ranking of CSFs by use of the Friedman test.

ID	Critical Success Factors	Rank
1	Accuracy, quality, and data integrity	24.95
2	System quality	23.38
3	ERP package selection	23.20
4	Communication, collaboration, and trust	23.01
5	Top management support and commitment	22.92
6	ERP, business, and business processes alignment	22.63
7	Training	22.41
8	System support/maintenance and further training	22.13
9	Service quality	21.14
10	IT infrastructure/business and IT legacy systems	20.42
11	Business plan, goals, scope, mission, and vision	20.41
12	Organizational culture	20.41
13	ERP vendor selection	20.37
14	Change management	20.12
15	Composition of a capable and balanced project team	19.61
16	Implementation strategy and goals achievement timeframe	19.53
17	Use of consultants	19.46

Table 4. *Cont.*

ID	Critical Success Factors	Rank
18	Software testing, customization, and troubleshooting	19.45
19	Company-wide support and commitment	19.35
20	Knowledge management	19.33
21	Project management	18.85
22	Post-implementation audit	18.80
23	Existence of empowered decision-makers	18.61
24	Users' characteristics, skills, and capabilities	18.58
25	Business process re-engineering	18.43
26	Realistic expectations	18.17
27	Monitoring, evaluation, and feedback	17.60
28	Well-defined budget of project	17.54
29	Implemented modules	17.38
30	Users and stakeholders' involvement	17.27
31	Minimum customization	16.31
32	Communication plan	15.92
33	Recognition of qualifications, reward, and motivation	14.81
34	Controlled ROI on ERP implementation	14.27
35	Presence of project champion and adequate role	13.97
36	Competitive and external pressures	11.96
37	National culture	10.32

Through the statistical hypothesis testing, which the Friedman test allowed (Table 5), it appears that there are significant differences regarding the values of importance that are given by respondents to critical factors for the successful implementation of ERP [15].

Table 5. Statistical test of Friedman criterion.

Test Statistics [a]	
N	227
Chi-Square	1011.799
df	36
Asymp. Sig.	0.000

[a] Friedman Test.

As can be seen from the above table, Friedman test results differ from those of grey relational analysis. Particularly, these differences are found in 19 out of 37 factors (Table 6). Critical success factors' differences in ranking may be explained by the diversity of the methods. Essentially, these discrepancies are explained by the fact that the GRA method is multicriteria [11,29] and imposes limitations on distribution and data. The second method (Friedman test) is non-parametric [32] (p. 187), and it does not impose similar limitations. The majority of ranking differences in each method's level of importance are found by the factors' particular positions. For example, the critical factor of "change management", according to the GRA method, is ranked as the 15th most important factor for ERP implementation, while, according to Friedman test results, it is the 14th (position difference = 1). There are, of course, a few cases in which the factors' rankings differ by two (system quality) or three positions (IT infrastructure/business and IT legacy systems).

Table 6. Differences in the ranking of CSFs by evaluation method.

ID	Critical Success Factors	GRA Position	Friedman Position	Position Difference
1	System quality	4	2	2
2	ERP package selection	2	3	1
3	Communication, collaboration, and trust	3	4	1

Table 6. *Cont.*

ID	Critical Success Factors	GRA Position	Friedman Position	Position Difference
4	ERP, business, and business processes alignment	7	6	1
5	Training	6	7	1
6	IT infrastructure/business and IT legacy systems	13	10	3
7	Business plan, goals, scope, mission, and vision	10	11	1
8	Organizational culture	11	12	1
9	ERP vendor selection	12	13	1
10	Change management	15	14	1
11	Composition of a capable and balanced project team	14	15	1
12	Software testing, customization, and troubleshooting	19	18	1
13	Company-wide support and commitment	18	19	1
14	Project management	22	21	1
15	Post-implementation audit	21	22	1
16	Implemented modules	30	29	1
17	Users and stakeholders' involvement	29	30	1
18	Controlled ROI on ERP implementation	35	34	1
19	Presence of project champion and adequate role	34	35	1

5. Discussion

As shown in Table 3, all of the grey relational values have a value above the "ζ" symbol [11]. This fact means that critical factors can be identified as "very important" and "important", according to the merging of five levels of importance of [17] into the three levels of "very important", "important", and "not important". Specifically, the factors that have values above 0.65 are considered as "very important" for the successful implementation of an ERP system, while factors whose values are lower than this limit (<0.65) are just considered as "important". Factors with values lower than "ζ" (<0.5) are considered as "not important" [17]. This is something that does not exist in the context of the present study, given the fact that the CSFs [19], which were suggested to the respondents, are all considered very important or simply important.

The CSFs that belong to the category of "very important" are the first 33 and seem to be superior to the remaining 4 that are just defined as "important". In general, the order in which the CSFs should be taken into account for the successful implementation of ERP and companies' sustainability to be achieved can be attributed to the interpretation of their meaning, as was elaborated by the study of [19]. For example, the most important CSF (Table 3) for achieving successful ERP implementation is that of "accuracy, quality, and data integrity". This means that, during the evaluation, members of Greek agricultural processing companies assert—in a first phase—that the data entered into the ERP systems from the legacy information systems, or during the execution of business procedures, should be accurate and reliable in order for valid information to be retrieved [19]. This requirement may be perceived as a suggestion for the creation of an algorithm that alerts ERP users about incorrect data. Consequently, the above facts will result in the improvement of decision making and the reduction of cost [36].

The next factor that people who are involved in ERP implementations in agricultural processing companies place enormous importance on is "ERP package selection". According to [11], the more careful the selection of the ERP package is, the greater the possibility of successful ERP implementation is. In this regard, it is proposed to top managers to conduct a market investigation before the selection of an ERP supplier. This market investigation should concern the possibilities of ERP systems' customizations according to the production conditions of an agricultural processing company.

Through the statistical hypothesis testing, which the Friedman test allowed (Table 5), it appears that there are significant differences regarding the values of importance that are given by respondents to critical factors for the successful implementation of ERP [15]. This is something that, in the case of the GRA method, is supposed to be judged empirically, based on the dissimilarity of grey relational values. The statistical differences are also

explained by the fact that the chi-square value is higher than the mean ranks, and the level of statistical significance is less than 0.0001 (Table 5), as is indicated in the study of [15].

Critical success factors' differences in ranking (Table 6) may be explained by the diversity of the methods, since the first one is multicriteria [11,29], and can define a complete factor ranking in terms of the respondents' preferences concerning the characteristics of the critical success factors. The second method that was used (Friedman test) is non-parametric [32] (p. 187), and it does not impose any limitation on distribution and data. Friedman test results could be discussed, as in the context of grey relational analysis implementation, with an emphasis on important and less important factors [15] and on the ranking order that was indicated by the implementation of the criterion. At this point, it should be mentioned that the results of Friedman ranking order of ERP critical success elements can be based on the analysis of [19].

6. Concluding Observations

6.1. Conclusions

This study aimed to evaluate critical success factors, considering the perspective of various stakeholders who are involved in ERP implementation in agricultural processing companies of Central Macedonia (Greece). This evaluation—combined with aspects from the literature [19]—may show how a digital production system can be managed and redesigned to become sustainable for a company. Taking into account the study of [19] which identified 37 critical success factors, this paper evaluated them by ranking them in order based on their importance. This order was extracted by the use of grey relational analysis and Friedman test methods. Through these methods, the order in which the critical factors' characteristics must be taken into account for the ERP implementation in agricultural processing companies to be successful and sustainable is highlighted in two different ways.

GRA results showed that the survey's respondents consider 33 out of 37 critical success factors to be "very important". The results from the Friedman test showed dissimilarities for 19 factors of these factors. The most important critical success factors of ERP implementation are highlighted based on these two methods. This paper's contribution is multifaceted, as it may be a guide for researchers, agricultural companies' stakeholders, ERP consultants, and vendors. Regarding researchers, this study covers a literature gap that could motivate investigations in various other economic sectors. Firstly, it should be made clear that in case there are researchers who want to evaluate critical factors for the successful implementation of ERP system in an economic sector, they can choose either of the two methods that are presented in this study, as they produce objective results. This is proven by their use in the scientific literature. However, it is worth mentioning that the Friedman test method is applied in the majority of the literature and allows further statistical checks, making it a most likely valid evaluation method. Even so, the implementation of the grey relational analysis method proved that it can highlight the "most important" ERP elements for agricultural processing companies' sustainability. This fact also contributes to the operational research literature field through the application of a multicriteria approach.

Through this study, vendors and consultants on ERP solutions may also provide guidance to all the stakeholders regarding the order in which the CSFs should be taken into account in order to achieve a system's success. These ranking orders are also reinforced by the CSFs' meanings listed in the study of [19].

6.2. Contribution and Implications

The existing literature studies about the evaluation of ERP critical success factors in the field of agriculture mainly concern agricultural processing or food companies. Based on a literature review, it seems that there is no similar survey in the prefecture of Central Macedonia of Greece that has been carried out until now. This is a literature gap which this study aimed to fill in with the evaluation of critical factors by respective companies' members who are involved in the implementation of ERP. In order for this paper's ob-

jective aim to be fulfilled, there is a contribution to the field of agricultural processing companies through the management of a digital production system, such as an ERP. It also contributes to the literature by highlighting methods of evaluating critical success factors for ERP implementation.

CSFs' evaluation helped with understanding the order in which they are taken into account during ERP implementation in Greek agricultural processing companies. This investigation could be considered as an original contribution both for the literature and for the agricultural processing sector's sustainability. The choice of using the grey relational analysis method may be another original contribution of this study, given that it has been implemented less in CSFs' evaluation for ERP implementation, or in Greek agricultural processing companies at all. In addition, this method was worth considering by virtue of it being a multicriteria method, which can define the order in which specific characteristics must be taken into consideration. These characteristics can determine the successful—and sustainable—implementation of an ERP system.

6.3. Limitations and Further Research

This study actually responds to some of the further suggestions given in the paper of [19]. Therefore, the present paper could be characterized as its continuation. However, other suggestions can also be made, such as corresponding research in other economic sectors in order for useful conclusions to be drawn that will help managers and/or users to manage ERP implementation and to achieve sustainability. The main limitation of this study is probably that this survey is restricted only to areas of Central Macedonia's prefecture. This is something that does not help to form a universal view of what exists, in terms of the ERP critical success factors in Greek agricultural processing companies. Consequently, it is strongly proposed to extend this research across more areas of Greek prefectures. As also mentioned in the Section 3, this survey proceeded by sending a questionnaire through e-mail to the companies. The email addresses were collected after an internet search, as the real existence and number of Central Macedonia's agricultural processing companies could not be investigated. Thus, the original sample of 1008 companies, although thoroughly taken, is necessarily biased. This fact emphasizes another limitation of this study.

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