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Using multicriteria decision analysis to evaluate the effect of digital transformation on organisational performance: evidence from Greek tourism SMEs

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Abstract

The phenomenon of digital transformation has changed the traditional economy, leading to valuable changes in the tourism industry. Customer experience is heavily influencing the decision processes. The implementation of new digital technologies could enable tourism firms' transformation and improve their organisational performance. Although the prior literature discusses the benefits of digital transformation, the measurement of its impact on organisational performance is still vague. The aim of this study is to evaluate the level of CEOs, CIOs and other senior executives' satisfaction and to propose solutions on how to increase the level of satisfaction by using multicriteria analysis. A multicriteria user satisfaction analysis was employed so that the satisfaction could be measured and moreover, to reveal the strengths and weaknesses of satisfaction. The results of the questionnaire revealed that the average level of overall satisfaction is high (81%) indicating that CIOs and other senior executives are somehow satisfied regarding the effects of digital transformation on organisational performance in the Greek tourism industry. Besides, these stakeholders attributed great importance to the criteria of "customer retention", "increase in sales revenue" and "increase in ROI" in order to feel satisfied. The improvement diagram depicts that the first priority for the management committee of the Greek tourism SMEs, in order to enhance the level of satisfaction, is to improve their products or services. It is noticeable that the added values of this methodology are the action and improvement diagrams. By using these diagrams, the management board of the tourism SMEs could assist the strategic planning of digital transformation for improving the organisational performance.

Keywords:

Digital transformation, digital technologies, organizational transformation, digital innovation, Multicriteria Satisfaction Analysis (MUSA), tourism industry

1. Introduction

During the last decade, digital transformation has become known as a critical phenomenon in strategic information systems literature, both for practitioners

and researchers (Bharadwaj et al. 2013; Piccinini et al. 2015). This phenomenon has forced tourism firms to be more customer-centric and responsive, at each one of the customer journey stages (Lam & Law 2019). To meet changing customer expectations, grow market share and retain growth, tourism firms' decision-makers owe to defend their digital competitiveness, positioning their business against other competitors in the tourism industry. From a strategic viewpoint, digital transformation is a roadmap for achieving deep changes which take place in the society and the industries, using new digital technologies (Bharadwaj et al. 2013; Chanas, 2016; Chanas et al. 2018; Henriette et al., 2016; Matt et al. 2015; Mitroulis Kitsios 2019b). For organisations, it has been proposed that they should focus on new ways to innovate utilizing these digital technologies by formulating strategies that utilize digital transformation and lead to higher organisational performance (Hess et al., 2016). They need to adopt new information and communication technologies (ICT), referred to as digital technologies. Digital transformation is characterized by the changes that are enabled by new digital technologies. In terms of organisations, digital transformation is characterized by the organizational shift to big data and analytics, cloud computing, mobile platforms and social networking. Adopting a range of digital innovations such as analytics, big data, cloud computing, artificial intelligence, internet of things, machine learning, social media and mobile platforms, organisations aim to foster a competitive digital business strategy. The implementation of new digital technologies increases the opportunities for growth, by improving ICT systems with virtualization, analytical systems, machine learning etc. This kind of initiatives provides a more holistic view of the digital business and it is referred to as digital transformation. The current business environment is affected by the radical changes of the business landscape which are caused by the appearance of digital innovations and opportunities. Enhancing business performance is considered as one of the major and critical purposes for organisations. The area of information technology is increasingly the centre of attention, examining its impact on organisational performance.

Recent research has contributed to the increase of understanding of specific aspects of the digital transformation phenomenon. The literature on digital transformation highlights the organisation's ability to change its business model and the enhancement of organisational performance (Chen et al. 2016; Kitsios et al. 2019; Mitroulis & Kitsios 2019a; Vial 2019; Yeow et al. 2017). This fact shows the consistency of digital transformation literature with the majority of strategic information systems literature (Vial 2019). Even though research questioning the sustaining of organisational performance is not discussed in this literature. The context of strategic research on digital transformation, is of high importance, due to the increasing firm's adoption of digital technologies, used by multiple stakeholders in order to accomplish their goals. As a result, the firm's ability to sustain organisational performance faces many challenges. The purpose of this research is to explore the impact of digital transformation on organisational performance. In the attempt to advance the understanding of the impact of digital transformation on

organisational performance this research measures the satisfaction of chief information officers (CIOs), chief executive officers (CEOs) and other senior executives based on certain dimensions. In this study the methodology employed to gather data was based on the principles of multicriteria analysis.

This article is structured in four sections. Section 1 includes a brief introduction to previous researches. Section 2 presents the satisfaction criteria and the methodology of the research. Section 3 presents the results which were exported from the implemented methodology. Finally, Section 4 discusses the results and concludes the paper.

2. Materials and Method

Digital transformation is defined as the changes and transformations which are enabled by new digital technologies. In organisational terms, it is defined as an organisational alteration to social media platforms, analytics and big data, cloud computing, internet of things (IoT), artificial intelligence (AI), machine learning etc. All these digital technologies focus on reshaping business models, enhance customer experience, improve business operations and processes, digitalise products/services and improve value creation and organisational performance (Chen et al., 2016; Kitsios et al. 2019; Mitroulis & Kitsios, 2019a). Taking advantage of digital innovations firms are capable of integrating digital technologies in many aspects of their operations and moreover, engage customers. Organisations that possess digital capabilities are more capable of achieving a successful transition to emerging digital transformation (Angelopoulos et al., 2008; Lam and Law, 2019; Kitsios et al., 2013; Kitsios and Skiadas, 2001; Kitsios and Sindakis, 2014; Mitroulis and Kitsios, 2019;). As a result, these firms have better chances of generating revenue with existing resources. Thus, they are able to take advantage of their upgraded and digitalised relationships among their partners in their value chain.

Organisational performance refers to the measurement of a firm's ability to meet its aims and objectives in comparison to its competitors (Mitroulis & Kitsios 2017). In most cases, superior organisational performance dimensions are profitability, growth and market value (Vial 2019). Many previous researches have measured organisational performance, implementing the dimensions: profitability, sales growth, innovation, product/service quality improvement, cost reduction, revenue growth, operational efficiency, improved customer satisfaction and retention, improved ROI, market share growth, improved sales revenue and ROA (Kamariotou et al. 2018). The latter have presented the criteria in order to measure IT executives' satisfaction from IS performance.

The literature on digital transformation highlights the organisation's ability to change its business model and the enhancement of organisational performance (Karimi & Walter 2015; Yeow et al. 2017). This fact shows the consistency of digital transformation literature with the majority of strategic information systems literature (Vial 2019). Organisations should be able to increase

customer engagement and offer tailored service founded on their preferences which are revealed through the analysis of data collected by digital technologies. The impacts of digital transformation in the organisational context have been questioned intensively, in the last decade (Vial 2019). To begin with, operational efficiency is positively influenced by digital transformation. As mentioned in the previous section, digital technologies have a high potential to change an organisation. The key benefits of digital transformation on operational efficiency embrace a) the enhancement of business processes (Gust et al. 2017), b) automations (Vial 2019), and c) cost reductions and savings increase (Pagani 2013). For example, the implementation of big data and analytics lead to faster decision-making processes and responsiveness to the market (Bharadwaj et al. 2013). Besides, the combination of artificial intelligence and data enables algorithmic decision-making and automations (Vial 2019). Organisational performance is also related with digital transformation. Vial 2019 argues that digital transformation boosts several dimensions of organisational performance, such as financial performance (Karimi & Walter 2015), firm growth (Tumbas et al. 2015), innovativeness, reputation and competitive advantage. For instance, new business models (i.e. freemium, product as a service etc.) could take advantage of online communities or social media and e-word-of-mouth to advance co-creation, engage users or customers and enhance their customer experience (Nadeem et al. 2018; Sebastian et al. 2017). In the same direction, Setia et al. (2013) suggested that successful implementation of digital technologies could lead to higher customer engagement and participation, and further foster increased business profits. Last but not least, digital transformation could raise the organisational ability to forecast and respond more effectively to the changes and complexity of the firm's environment (Vial 2019). This fact assists to the maximization of its possibilities to survive through the adaptation and the reengineering of its core activities (Tanriverdi & Lim 2017).

The increase of digital transformation has improved the firms' ability to achieve added value for its customers by increased customisation, reduction of selling costs and increase of customer satisfaction (Chen et al. 2016; Mitroulis & Kitsios 2019b; Nwankpa & Roumani 2016). Prior researches on the implications of new digital technologies propose that digitalisation could positively affect organisational performance. The more firms implement digital business processes, the better organisational performance is obtained. In addition, the integration of new digital technologies in the value chain of partners and suppliers enables the reduction of transaction costs, agent costs and coordination costs by increasing monitoring, transparency and communication. Hence, by leveraging digital transformation, firms improve their performance by transforming customers-side business operations and being data-driven. Table 1 shows the criteria used by previous researchers in order to measure IT executives' satisfaction organisational performance after the implementation of digital transformation.

(Insert Table 1)

Executives in the tourism industry need to be aware of the organisational performance in order to evaluate the management of digital transformation. The analysis of their satisfaction is very important in order to make decisions. They aim to improve customers' satisfaction and retention, because these dimensions reveal customers' interaction with their products or services. In addition, the organisation's ability to improve products or services based on data and market orientation is another dimension of measuring decision-makers' satisfaction. Offering premium quality of products or services is a major competitive advantage in the tourism industry. This assumption leads to the involvement of customers in the business processes, adding value to the organisations' outcomes. Moreover, the research framework includes employee's performance, innovation and increase of operational efficiency, because these dimensions could be improved due to the integration of new digital technologies. Finally, the improvement of financial indexes such as return on investment (ROI), sales revenue, profitability, market share and reduction of costs and expenses reveals organisational growth. The measurement of both financial and non-financial indexes of performance leads to useful results related to the impact of digital transformation on business performance. Each of the 11 criteria above appears in the satisfaction criteria hierarchy (Figure 1).

(Insert Figure 1)

2.3 MUSA Method

The MUSA method is a multicriteria approach that has been developed in order to measure and analyze customer satisfaction (Grigoroudis and Siskos 2002). This method is used for the evaluation of a set of marginal satisfaction functions in such a way that the global satisfaction criterion becomes as consistent as possible with customer's judgments. As a result, the major objective of this method is the aggregation of individual judgments into a collective value function.

The MUSA method assesses global and partial satisfaction functions Y^* and Xi^* respectively, given customers' ordinal judgments Y and Xi (for the i -th criterion). The assumption of an additive utility model is the main principal of the method, and it is represented by the following ordinal regression analysis equation:

$$(1)$$

Where \tilde{Y}^* is the estimation of the global value function Y^* , n is the number of criteria, b_i is a positive weight of the i -th criterion, s^+ and s^- are the

overestimation and the underestimation errors, respectively, and the value functions Y^* and X_i^* are normalized in the interval $[0, 100]$.

In this context, the customer satisfaction measurement problem may be formulated as an optimization problem using goal programming techniques, and thus, the estimation model can be written in an LP formulation, as follows:

$$\left\{ \begin{array}{l} [\min] F = \sum_{j=1}^M \sigma_j^+ + \sigma_j^- \\ \text{subject to} \\ \sum_{i=1}^n \sum_{k=1}^{x_i^j-1} w_{ik} - \sum_{m=1}^{y^j-1} z_m - \sigma_j^+ + \sigma_j^- = 0 \quad \text{for } j=1,2,\dots,M \\ \sum_{m=1}^{\alpha-1} z_m = 100 \\ \sum_{i=1}^n \sum_{k=1}^{\alpha_i-1} w_{ik} = 100 \\ z_m, w_{ik}, \sigma_j^+, \sigma_j^- \quad \forall m,i,j,k \end{array} \right. \quad (2)$$

Where M is the size of the customer sample, while y_j and x_{ij} are the j -th level on which variables Y and X_i are estimated (i.e., global and partial satisfaction judgments of the j -th customer). Furthermore, the following transformation equations are used for the decision variables of LP (2):

$$\left\{ \begin{array}{l} z_m = y^{*m+1} - y^{*m} \quad \text{for } m=1,2,\dots,\alpha-1 \\ w_{ik} = b_i x_i^{*k+1} - b_i x_i^{*k} \quad \text{for } k=1,2,\dots,\alpha_i-1 \text{ and } i=1,2,\dots,n \end{array} \right. \quad (3)$$

Where y^{*m} is the value of the y_m satisfaction level, x_i^{*k} is the value of the x_{ik} satisfaction level, and a and a_i are the number global and partial satisfaction levels.

The MUSA method incorporates also a post-optimality analysis stage in order to overcome the problem of model stability. The final solution is obtained as the average of the near optimal solutions of linear programming, which maximize the weights of the n satisfaction criteria (Grigoroudis and Siskos 2002).

An analytical development of the method is given by Grigoroudis and Siskos (2002), while the presentation of the MUSA, decision support system (DSS) and several real-world applications can be found in many publications.

The MUSA methodology produces many types of results. An important result refers to the criteria weights b_i , which represent the relative importance of the assessed satisfaction criteria (value trade-offs among the criteria). The MUSA methodology provides also a series of normalized indices that may help the in-depth analysis of the satisfaction measurement problem. These indices include (Grigoroudis and Siskos 2002):

Satisfaction indices: These average indices show, in the range 0–1, the level of customer global or criteria satisfaction; they may be considered as the basic average performance indicators (globally or per criteria) for the business organization.

Demanding indices: These indices are normalized in the interval $[-1, 1]$ and calculated based on the set of estimated added value curves; these indices show customers' demanding level (globally and per criteria) and may be considered as an indicator for the extent of company's improvement efforts.

Improvement indices: The average improvement indices are normalized in the interval $[0, 1]$ and show the improvement margins on a specific criterion; the output of improvement efforts depends on the importance of the satisfaction dimensions and their contribution to dissatisfaction as well.

Additionally, in the context of the MUSA methodology, a series of additional diagrams may be developed, based on the aforementioned results.

Action diagrams: These 'Performance/Importance' diagrams are developed through the combinations of criteria weights and satisfaction indices (Figure 2). They are similar to SWOT analysis and may represent the strong and weak points of the business organization, indicating which satisfaction dimensions should be improved.

(Insert Figure 2)

Each of these diagrams is divided into quadrants, according to performance and importance that may be used to classify actions:

- i. Status quo (low performance and low importance): Generally, no action is required, these satisfaction dimensions are not considered as important by the customers.
- ii. Leverage opportunity (high performance/high importance): This area can be used as an advantage against competition. In several cases, these satisfaction dimensions are the most important reasons why customers have purchased the product/service under study.
- iii. Transfer resources (high performance/low importance): Regarding the particular satisfaction dimension, company's resources may be better used elsewhere (i.e., improvement of the satisfaction dimensions located in the action opportunity quadrant).
- iv. Action opportunity (low performance/high importance): These are the criteria that need attention; improvement efforts should be focused on these, in order to increase the global customer satisfaction level.

Improvement diagrams: Combining improvement and demanding indices, a series of improvement diagrams may be developed (Figure 3) which may be used to rank improvement priorities; since the action diagrams can only

indicate which satisfaction dimensions should be improved, these diagrams can determine the output or the extent of improvement efforts.

(Insert Figure 3)

As shown in Figure 3, each of these maps is divided into quadrants according to demanding (high/low) and effectiveness (high/low), that may be used to rank improvement priorities:

1st priority: This area indicates direct improvement actions, since these dimensions are highly effective, and customers are not demanding.

2nd priority: It includes satisfaction dimensions that have either a low demanding index or a high improvement index.

3rd priority: It refers to satisfaction dimensions that have small improvement margin and need substantial effort.

It should be noted that these diagrams are rather dynamic, since they are able to illustrate only the current situation of customer behavior.

2.4 Data Collection

This research was conducted among tourism SMEs in Thessaloniki, Greece during October and November 2018. The satisfaction level of all criteria is measured on a 5-point ordinal Likert scale with the following format: completely dissatisfied, dissatisfied, neither satisfied nor dissatisfied, satisfied, completely satisfied. The questionnaire contained 12 questions and it was sent to 150 chief information officers (CIOs), chief executive officers (CEOs) and other senior executives of tourism firms in Thessaloniki, Greece. A total of 53 questionnaires were collected. A total of 73 per cent of the respondents consisted of men and 27 per cent were women. Analyzing the age level of the sample, it is clear that the majority of the sample was over 40. Furthermore, 5 per cent of the responders were 18–25, 28 per cent of them were 26–35, 38 per cent were 36–45 and finally 29 per cent of the samples were 46–55 years old.

3. Results

3.1 Criteria Weights and Satisfaction Indices

As presented in the previous sections of the article, the MUSA method was implemented for data analysis. The results of this method reveal the level of satisfaction of tourism firms' decision-makers. In details, in a scale of 0–100 per cent the MUSA method illustrates to the user the score that the decision-makers elements for the measurement of their overall satisfaction. Analysing the overall satisfaction, it is noticeable that the average satisfaction index is high (81%) pointing out that the decision-makers are rather satisfied with the effects of digital transformation on tourism firms' performance.

According to Figure 4, “Increase of sales revenue” (11,231%), “Increase of ROI” (10,298%) and “Customer retention” (12,03%) are the three most important criteria. Therefore, global satisfaction is mostly influenced by these three criteria.

(Insert Figure 4)

In Figure 5, the decision-makers are very satisfied from the "Reduction of expenses and cost" (97%) criterion followed by the criteria of "Customer satisfaction" (96,26%) and "Increase of profitability" (94,44%).

(Insert Figure 5)

Figure 6 illustrates that most of the criteria have a negative average demanding index, apart from the "Improvement in products/services" criterion (11,92%). More specifically, decision-makers seem not demanding considering the criteria "Customer satisfaction" (-83,81%) and "Reduction of expenses and cost" (-83,24%).

(Insert Figure 6)

3.2 Action diagram

As presented in the previous section of this paper, MUSA method could lead to action and improvement diagrams. The previously presented data were used in order to a) develop these diagrams, b) further analyse the chief information officers (CIOs), chief executive officers (CEOs) and other senior executives of tourism firms' satisfaction and c) prioritize those action and make improvements. As a result, the action diagram illustrates that the strong dimensions of tourism SMEs performance are "Customer retention", "Increase of sales revenue", "Increase of ROI" and "Customer satisfaction". These criteria were considered as very important and satisfying for the managers. Additionally, these are the major basis for managers' decision-making related to the digital transformation of the organisations and focus their efforts toward the maintenance of this high performance. Decision-makers believe that "Market share growth" is very important, however, the level of their satisfaction is low. The main dimension of their dissatisfaction lays on "Employees performance". This result lead to the need for improving the employee's engagement and performance in order to improve their results through digital transformation. In the same manner, the "Increase of profitability" and the "Improvement in products/services", need to be planned in a different way, in order to perform better and increase their importance. In this area of the action diagram, managers reveal a low level of satisfaction and importance. Finally, criteria such as "Reduction of expenses and costs" and "Increase of operational efficiency" belong to the quarter of resources transfer (Figure 7).

(Insert Figure 7)

3.3 Improvement diagram

Action diagrams are not the only diagrams produced by the MUSA method. Improvement diagrams are also generated, based on the method results. Through the latter diagrams, decision-makers of tourism SMEs in Thessaloniki, have the chance to see illustrated, which dimensions of satisfaction should be improved, and thus enhance their decisions. As mentioned in the previous section of this paper, the improvement diagrams were created combining the improvement and demanding indices. The first priority of the tourism SMEs in Thessaloniki should be the dimension of improving their products or services. Therefore, decision-makers need to improve the organisational capabilities and processes related to their products or services improvements. Taking advantage of digital technologies, they must redesign some processes and based on customer-data, enhance the added value of their offering. Secondly, they should focus on increasing the profitability, customer retention and the reduction of expenses and costs. These criteria show a low demanding index and have low improvement limits. The third priority actions are related to "Customer satisfaction", "Increase of sales revenue", "Increase of ROI", "Innovation", "Employees performance", "Market share growth" and "Increase of operational efficiency" (Figure 8).

(Insert Figure 8)

4. Conclusions

The purpose of this study was to evaluate the level of CEOs, CIOs and other senior executives' satisfaction, and to propose solutions on how to increase the level of satisfaction by using the MUSA method, in Greek tourism SMEs, in Thessaloniki. An analysis of the findings illustrates that the criteria of "Customer retention", "Customer satisfaction", "Increase of sale revenue" and "Increase in ROI" are the key dimensions of organisational performance. Evaluating CEOs, CIOs and other senior executives' satisfaction related to tourism SMEs performance while the organisation faces digital transformation, might be a reliable way to question the effects of digital transformation on organisational performance. This kind of surveys could lead to useful implications due to questioning how decision makers that drive digital transformation initiatives rate the firm's performance and which dimensions of satisfaction need to be improved. The employment of the MUSA method revealed the weak and strong aspects of satisfaction. By developing the action and improvement diagrams, this study offers to the tourism SMEs management a useful tool for enhancing their decisions related to the improvement of their organisational performance.

Future research could measure if there are different results, taking into consideration differences among the tourism SMEs, such as the type of organisation. The MUSA method could also be used in order to assess a cross-case scenario of different type of organisations and different stakeholders. Additionally, future research could include the examination of the organisational performance in accordance to different digital transformation

strategies leading to the combination of the action and the efforts that should be done for managers satisfaction improvement.

References

- Angelopoulos S, Kitsios F & Babulac E 2008, 'From e to u: Towards an innovative digital era', In: Kotsopoulos S & Ioannou K (Eds.), *Heterogeneous Next Generation Networking: Innovations and Platform*, IGI Global Publishing, pp. 427-444.
- Bharadwaj A, Sawy OA El, Pavlou PA & Venkatrama N 2013, 'Digital Business Strategy : Toward a Next Generation of Insights', *MIS Quarterly Executive*, vol. 37, no. 2, pp. 471–482.
- Chanas S & Hess T 2016, 'Understanding digital transformation formation: insights from Europe's automotive industry', *PACIS 2016 Proceedings*, pp. 296.
- Chanas S 2017, 'Mastering Digital Transformation: The Path of a Financial Services Provider Towards a Digital Transformation Strategy', *Proceedings of the 25th European Conference on Information Systems (ECIS)*, Guimarães, Portugal, pp. 16–31.
- Chanas S, Myers MD, & Hess T 2018, 'Digital transformation strategy making in pre-digital organizations: The case of a financial services provider', *The Journal of Strategic Information Systems*, vol. 28, no. 1, pp. 1–17.
- Chen YY K., Jaw YL, & Wu YH 2016, 'Effect of Digital Transformation on Organisational Performance of SMEs: Evidence from the Taiwanese Textile Industry's Web Portal', *Internet Research*, vol. 26, no. 1, pp. 186-212.
- Grigoroudis E, & Siskos Y 2002, 'Preference disaggregation for measuring and analysing customer satisfaction: The MUSA method', *European Journal of Operational Research*, vol. 143, no. 1, pp. 148–70.
- Gust G, Flath CM, Brandt T, Ströhle P & Neumann D 2017, 'How a traditional company seeded new analytics capabilities', *MIS Quarterly Exec*, vol. 16, no. 3, pp. 215–230.
- Henriette E, Feki M & Boughzala I 2016, 'The Shape of Digital Transformation: a Systematic Literature Review', *Information Systems in a Changing Economy and Society: MCIS2015 Proceedings*, pp. 431–443.
- Hess T, Benlian A, Matt C & Wiesböck F 2016, 'Options for Formulating a Digital Transformation Strategy', *MIS Quarterly Executive*, vol. 15, no. 2, pp. 123–139.

- Kamariotou M, Kitsios F & Grigoroudis E 2018, 'Strategic Decision Making using Multicriteria Analysis: Information Systems Performance Evaluation in Greek SMEs', *Proceedings of the 7th International Symposium and 29th National Conference on Operational Research*, Chania, Greece, pp. 184-188.
- Kitsios F & Grigoroudis E 2014, 'Evaluating new service development effectiveness in tourism: An ordinal regression analysis approach', *Proceedings of 3rd International Symposium & 25th National Conference on Operational Research*, Volos, Greece, pp. 138-145
- Kitsios F & Grigoroudis E 2016, 'Comparing hospitality innovation strategies: New service development using multicriteria analysis', *Proceedings of the 5th International Symposium and 27th National Conference on Operation Research*, Athens, Greece, pp. 127-132
- Kitsios F & Sindakis S 2014, 'Analysis of innovation strategies in hospitality industry: Developing a framework for the evaluation of new hotel services in Thailand', *Proceedings of 2nd International Conference on Innovation and Entrepreneurship (ICIE 2014)*, Bangkok, pp. 136-141.
- Kitsios F & Skiadas C 2001, 'Some Critical Issues Concerning Technological Change', *Proceedings of 1st International Conference in Management of Change*, Iasi, Romania, pp. 37-43.
- Kitsios F, Doumpos M, Grigoroudis E, Zopounidis C 2009, 'Evaluation of new services development strategies using multicriteria analysis: Predicting the success of innovative hospitality services', *Operational Research: An International Journal (ORIJ)*, vol. 9, no. 1, pp. 17-33
- Kitsios F, Grigoroudis E, Giannikopoulos K, Doumpos M & Zopounidis C 2015, 'Strategic decision making using multicriteria analysis: New service development in Greek hotels', *International Journal of Data Analysis Techniques and Strategies*, vol. 7, no. 2, pp. 187-202
- Kitsios F, Moschidis O & Livanis E 2013, 'Service innovation strategies in Greek hotel sector: an exploratory study using the statistical method of multidimensional analysis', *International Journal of Data Analysis Techniques and Strategies*, vol. 10, no. 5, pp. 49-62.
- Kitsios F, Stefanakakis S, Kamariotou M & Dermentzoglou L 2019, 'E-service Evaluation: User Satisfaction Measurement and Implications in Health Sector', *Computer Standards & Interfaces Journal*, vol. 63, pp. 16-26.
- Lam C & Law R 2019, 'Readiness of upscale and luxury-branded hotels for digital transformation', *International Journal of Hospitality Management*, vol. 79, pp. 60– 69.
- Mithas S, Tafti A & Mitchell W 2013, 'How a Firm's Competitive Environment and Digital Strategic Posture Influence Digital Business Strategy', *MIS Quarterly*, vol. 37, no. 2, pp. 511–536.
- Mitroulis D & Kitsios F 2017, 'Fostering a Competitive Differentiation Strategy for Sustainable Organizational Performance, In: Grigoroudis E.,

This is the pre-print version. The final version is available at: Mitroulis, D. and Kitsios, F. (2019). Using multicriteria decision analysis to evaluate the effect of digital transformation on organizational performance: evidence from Greek tourism SMEs, *International Journal of Decision Support Systems*, 4(2), pp. 143-158. [see: <https://www.inderscienceonline.com/doi/abs/10.1504/IJDSS.2019.104569>]

- Doumpos M. (eds) *Operational Research in Business and Economics. Springer Proceedings in Business and Economics*. Springer, Cham
- Mitroulis D & Kitsios F 2019a, 'Digital Transformation Strategy: a literature review', *Paper presented at the 6th National Student Conference of HELORS*, Xanthi, Greece.
- Mitroulis D & Kitsios F 2019b, 'Measuring the success of digital transformation strategies in tourism firms: an MCDA approach', *Paper presented at the 17th Special Conference of HEL.O.R.S. & 13th Meeting of Multicriteria Decision Analysis*, Serres, Greece.
- Nadeem A, Abedin B, Cerpa N & Chew E 2018, 'Editorial: Digital transformation & digital business strategy in electronic commerce - The role of organizational capabilities', *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 13, no. 2, pp. i–viii.
- Nwankpa JK & Roumani Y 2016, 'IT capability and digital transformation: a firm performance perspective', *Proceedings of the Thirty-Seventh International Conference on Information Systems (ICIS)*, Dublin, Ireland, pp. 16.
- Pagani M 2013, 'Digital business strategy and value creation: framing the dynamic cycle of control points', *MIS Quarterly*, vol. 37, no. 2, pp.617–632.
- Piccinini E, Hanelt A, Gregory R & Kolbe L 2015, 'Transforming industrial business: the impact of digital transformation on automotive organizations', In: *International Conference of Information Systems*, Forth Worth, TX.
- Sebastian IM, Ross J W, Beath C, Mocker M, Moloney KG & Fonstad NO 2017, 'How Big Old Companies Navigate Digital Transformation', *MIS Quarterly Executive*, vol. 16, no. 3, pp. 197–213.
- Setia P, Venkatesh V & Joglekar S 2013, 'Leveraging digital technologies: how information quality leads to localized capabilities and customer service performance', *MIS Quarterly*, vol. 37, no. 2, pp. 565–590.
- Sia KS, Soh C & Weill P 2016, 'How DBS Bank Pursued a Digital Business Strategy', *MIS Quarterly Executive*, vol. 15, no. 2, pp. 105–122.
- Tanriverdi H & Lim SY 2017, 'How to survive and thrive in complex, hypercompetitive, and disruptive ecosystems? The roles of IS-enabled capabilities', In: *International Conference of Information Systems*, Seoul, South Korea.
- Tumbas S, Berente N, Seidel S & vom Brocke J 2015, 'The 'digital façade' of rapidly growing entrepreneurial organizations', In: *International Conference of Information Systems*, Forth Worth, TX.

This is the pre-print version. The final version is available at: Mitroulis, D. and Kitsios, F. (2019). Using multicriteria decision analysis to evaluate the effect of digital transformation on organizational performance: evidence from Greek tourism SMEs, *International Journal of Decision Support Systems*, 4(2), pp. 143-158. [see: <https://www.inderscienceonline.com/doi/abs/10.1504/IJDSS.2019.104569>]

Vial G 2019, 'Understanding digital transformation: A review and a research agenda', *Journal of Strategic Information Systems*. In press.

Yeow A, Soh C & Hansen R 2017, 'Aligning with new digital strategy: a dynamic capabilities approach', *Journal of Strategic Information Systems*, vol. 27, no. 1, pp. 43–58.

Table 1. Satisfaction Criteria

Criteria	Definitions	References
Customer retention	Measures the companies' activities that aim to reduce the number of customer defections. The goal of customer retention activities is to keep as many customers as possible, mainly through customer loyalty and brand loyalty initiatives.	Chen et al. (2016); Lam & Law (2019); Mitroulis and Kitsios (2019b)
Customer satisfaction	Measures how products and services meet or surpass customer expectations.	Chen et al. (2016); Lam & Law (2019); Mitroulis and Kitsios (2019b)
Employees performance	Measures the working-related activities expected of employees and how well those activities were executed.	Chen et al. (2016); Mitrouli and Kitsios (2019b)
Improvement in products/services	Measures the process of making meaningful product or service changes which lead to new customers or increased benefits for existing customers.	Chanas et al., (2018); Cher et al. (2016); Hess et al., (2016); Matt et al., (2015); Mitroulis and Kitsios (2019b); Nadeem et al., (2018); Nwankpa & Roumani, (2016); Sebastian et al., (2017)
Increase of operational efficiency	Measures the capability to offer products or services to its customers in the most cost-effective manner possible, while ensuring the high quality of its products or service and support.	Chanas et al., (2018); Cher et al. (2016); Hess et al., (2016); Matt et al., (2015); Mitroulis and Kitsios (2019b); Nadeem et al., (2018); Nwankpa & Roumani, (2016); Sebastian et al., (2017)
Innovation	Measures how firms update, change, and improve internal processes manufacturing techniques and management methods	Chanas et al., (2018); Cher et al. (2016); Hess et al., (2016); Matt et al., (2015); Mitroulis and Kitsios (2019b); Nadeem et al., (2018); Nwankpa & Roumani, (2016); Sebastian et al., (2017)

		et al., (2017)
Increase of ROI	Measures the efficiency of an investment.	Chen et al. (2016); Mitrouli and Kitsios (2019b); Nwankpa and Roumani (2016)
Increase of profitability	Measures the ability of an organisation to earn profit	Chen et al. (2016); Mitrouli and Kitsios (2019b); Nwankpa and Roumani (2016)
Increase of sales revenue	Measures the amount realized from selling products or services in the firm's normal operations, in a specified period.	Chen et al. (2016); Mitrouli and Kitsios (2019b); Nwankpa and Roumani (2016)
Market share growth	Measures the percentage of the industry or market's total sales that is generated by a particular organisation.	Chen et al. (2016); Mitrouli and Kitsios (2019b); Nwankpa and Roumani (2016)
Reduction of expense and cost	Measures the process used by firms to reduce their costs and increase their profits.	Chen et al. (2016); Mitrouli and Kitsios (2019b); Nwankpa and Roumani (2016)

Figure 1. Satisfaction criteria hierarchy structure



Figure 2. Action Diagram (Manolitzas et al., 2014)

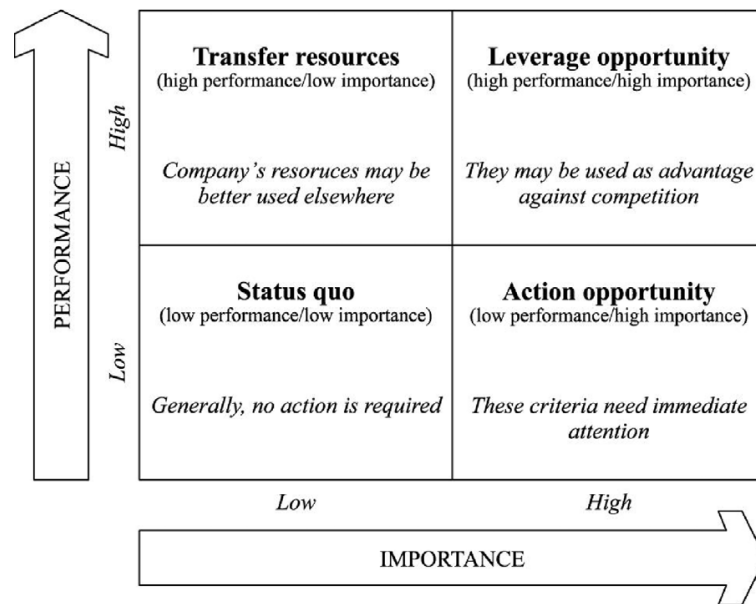


Figure 3. Improvement Diagram (Manolitzas et al., 2014)

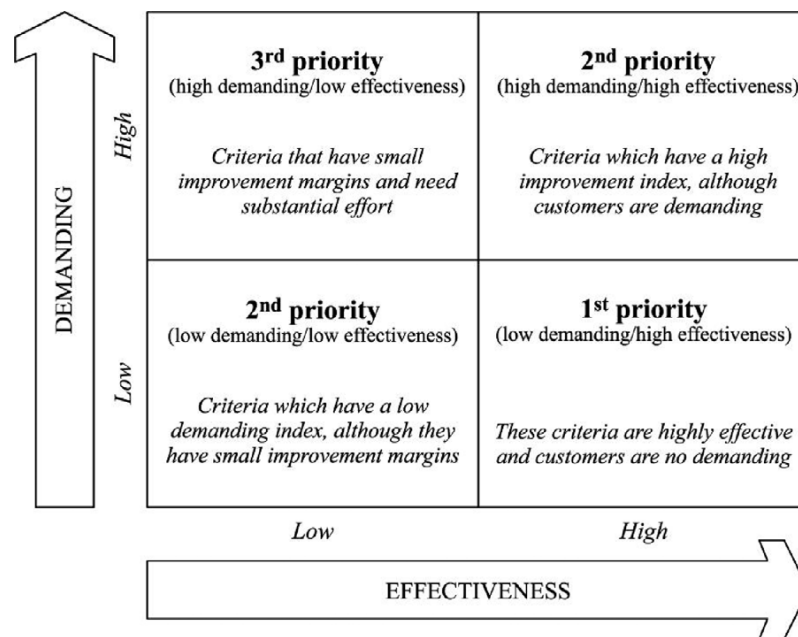


Figure 4. Weights of global satisfaction criteria

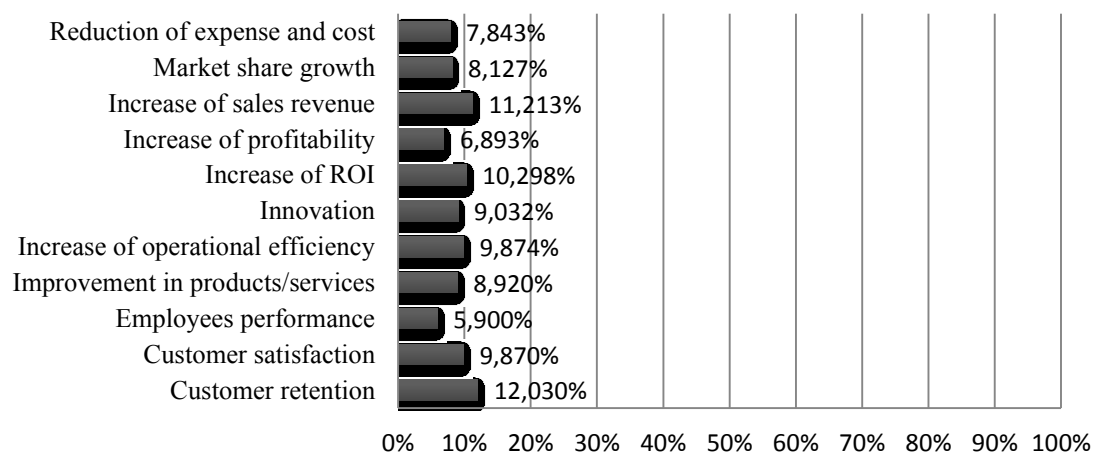
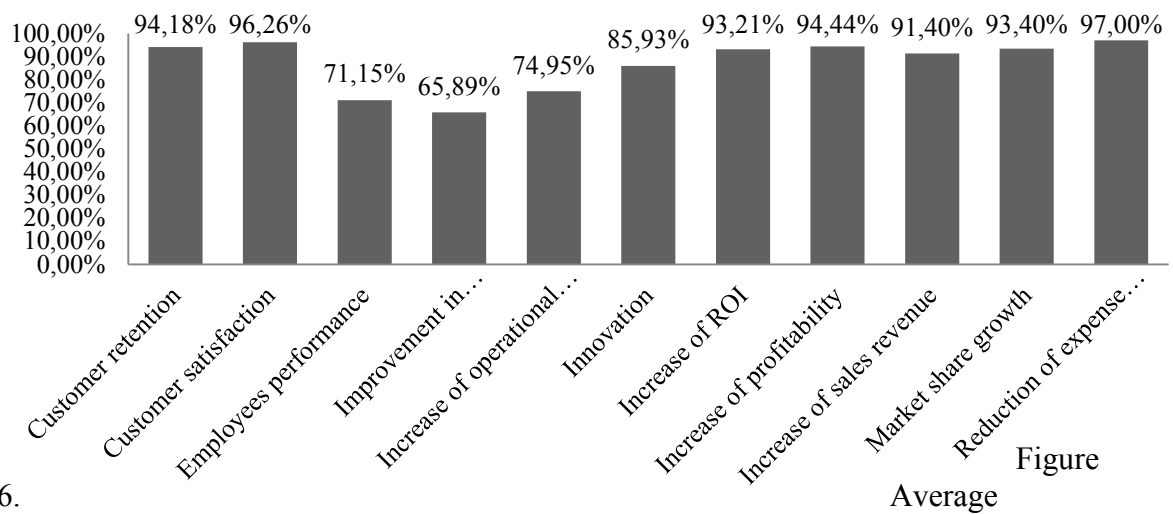


Figure 5. Average satisfaction indices of the criteria



6. demanding indices of the criteria

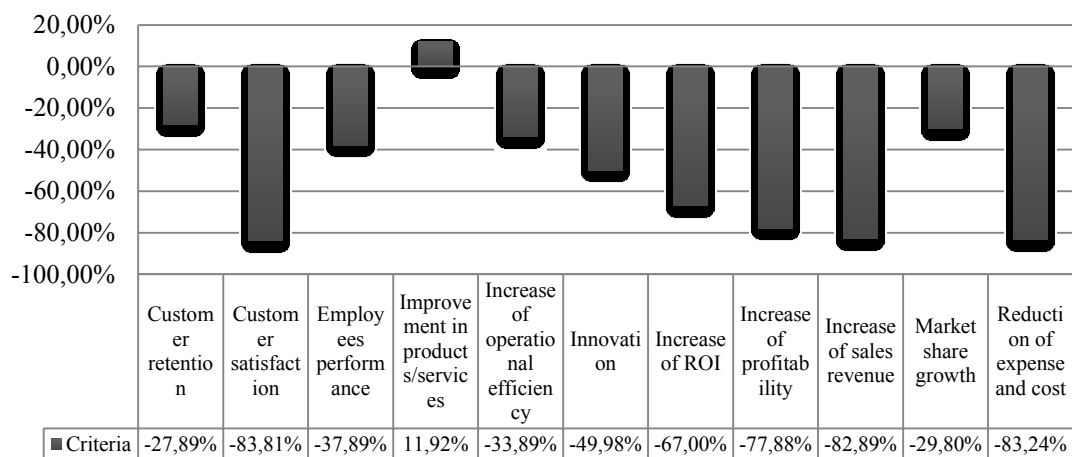


Figure 7. Action diagram

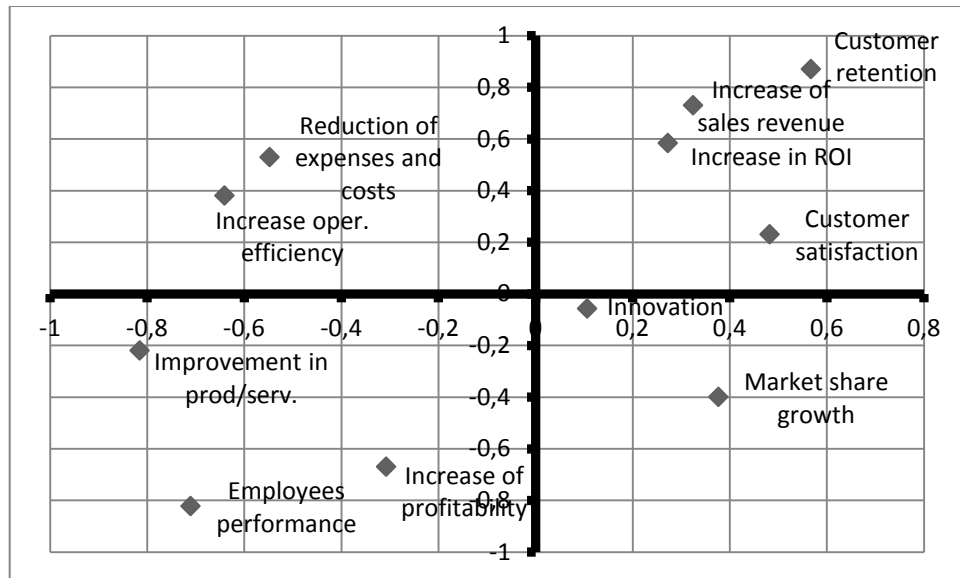


Figure 8. Improvement diagram

