



Environmental dynamism and sustainability: The mediating role of innovation, strategic flexibility and HR development

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6 sustainability, taking into consideration the mediating role of the innovation process, strategic
7 flexibility and human resource development in this relationship.
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10 modeling using the survey data from 513 Greek firms.
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13 of innovation process, strategic flexibility and human resource development fully mediate the effect
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17 explore other topics that affect sustainability. Moreover, it might be useful for researchers to
18 examine firms' digital capability and ambidextrous sustainability.
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21 and human resource development are critical factors in achieving sustainability.
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23 CUST_SOCIAL_IMPLICATIONS_(LIMIT_100_WORDS) :No data available.
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25 This empirical study determines the contribution of environmental dynamism to sustainability taking
26 into consideration the role of three critical organizational factors as mediators in this relationship.
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Environmental dynamism and sustainability: The mediating role of innovation, strategic flexibility and HR development

Abstract

Purpose – The purpose of this paper is to examine whether environmental dynamism can drive firms to adopt sustainability, taking into consideration the mediating role of the innovation process, strategic flexibility and human resource development in this relationship.

Design/methodology/approach – The proposed framework is tested by confirmatory factor analysis and finally structural equation modeling using the survey data from 513 Greek firms.

Findings – The results show that environmental dynamism drives firms to sustainability, but the introduction of innovation process, strategic flexibility and human resource development fully mediate the effect of this relationship.

Research limitations/implications – This study explores three organizational factors. In future research it would be very interesting to explore other topics that affect sustainability. Moreover, it might be useful for researchers to examine firms' digital capability and ambidextrous sustainability.

Practical implications – This study offers clear implications for managers, proving that innovation process, strategic flexibility and human resource development are critical factors in achieving sustainability.

Originality/value – This empirical study determines the contribution of environmental dynamism to sustainability taking into consideration the role of three critical organizational factors as mediators in this relationship.

Keywords: Environmental dynamism, Innovation process, Strategic flexibility, Human resource development, Sustainability.

Paper type Research paper.

1. Introduction

Nowadays, sustainability has received increased attention among both academicians and professionals (Silvestre and Tîrca, 2019). It is a major force that affects and shapes our life and behavior (Gasser and Schweigler, 2017) and its impact is not just on companies but also on our whole society (Tidd and Bessant, 2014). Prior research has identified multiple reasons why companies adopt sustainability programs, including generating cost savings, improving brand image, enhancing competitive advantage, creating legitimacy, and increasing employee satisfaction (Zhua and Mazaheri, 2020).

Nevertheless, the literature is lacking in the understanding of the key factors for sustainability, and there is an absence of clear practical guidance regarding the implementation of specific activities, plans and strategies (Pantouvakis and Vlachos, 2020; Klettner et al., 2014). Previous research has shown that sustainability can be predicted and affected by individual differences in management (Pantouvakis and Vlachos, 2020). However, how to achieve sustainability in practice and which factors drive effective implementation of sustainability still requires further research (Sharma et al., 2021; Klettner et al., 2014). **In particular**, further research is needed on how the governance mechanism can make the supply chain more sustainable and enhance social sustainability (Awan et al., 2018a) and how a firm's production procedure can be transformed in order to reduce resource consumption, prevent pollution, and adopt environmental management systems in the field of business operations. Linking environmental and socially responsible practices in firms to the human aspects has become even more important over the past few decades for sustainable performance in the field of supply chain management (Awan et al., 2017).

Firms can be influenced by many conditions; in this context, they take actions and adopt distinct strategies in response to both external as well as organizational factors (Powell, 1992). With regard to the external factors, the implementation of firms' strategies can be influenced by changes in market dynamism, customer demands, new product development, new technology adaptation, etc. (Kumar and Bhatia, 2021; Jansen et al., 2006). However, it is unknown if environmental dynamism (ED) does indeed influence the tension of sustainability and, more specifically, if it influences that tension in a special way, for example, by means of organizational or managerial changes. Thus, ED needs to be studied systematically as an antecedent to sustainability with a holistic and integrated perspective. In this regard, the first objective of this paper is to examine the effect of ED on sustainability.

The success of sustainability is also shaped by various organizational factors that are required to be recognized by managers (Grimm et al., 2014). Researchers include as

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2 organizational factors the rate of innovation process, the strategic flexibility or the development
3 of a firm's human resources (Groza et al., 2021; Nwachukwu and Vu, 2020; Li et al., 2020;
4 Mousa and Ayoubim, 2019). Therefore, the second objective of this paper is to analyze the
5 mediating effect of the above three critical factors between ED and sustainability.
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9 Taking into consideration the need for a more comprehensive investigation of the factors
10 of success in sustainability (Coelho et al., 2017; Engert and Baumgartner, 2016; Routroy and
11 Pradhan, 2013), this study uses a framework that was partially used in previous research (Groza
12 et al., 2021; Nwachukwu and Vu, 2020; Herrera and de las Heras-Rosas, 2020; Silvestre and
13 Tírca, 2019; Silvestre, 2015; Cao et al., 2012). However, no study investigated a complete
14 model of the four critical factors for successful sustainability. The proposed framework
15 postulates that the higher the fit among environmental and organizational capabilities, the better
16 the potential of sustainability in use is. The environmental factors include changes in markets,
17 products or services, whereas the organizational factors include a firm's capability in innovation
18 process, strategic flexibility and human capital. The human factor identifies the development
19 needs and adequate opportunities for employees of a firm as well as ensuring skills utilization.
20 This study attempts to extend the stream of literature proposing that in a dynamic market
21 environment, firms need to focus on certain critical organizational factors that may have a
22 significant effect on companies' adoption of sustainability programs (Kumar and Bhatia, 2021).
23 In a nutshell, this study answers the following questions:
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- 34 *1. Does ED influence firms towards the transition to sustainability?*
- 35 *2. What is the role of innovation process, strategic flexibility and human resource*
36 *development in the relationship between ED and sustainability?*
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40 The findings of this study will be beneficial to all organizations willing to improve their
41 sustainable performance, whether they have recently initiated the transformation towards
42 sustainability or **whether they** are still in the planning phase of this transition. The
43 transformation towards sustainability has begun, and it is important that firms respond to the
44 ED and focus on certain organizational factors for this successful transition. The proposed
45 framework is tested using data collected from Greek firms, as Greece is a country that in recent
46 years has begun to finance and support sustainable practices.
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52 The remaining part of the paper is organized as follows. In section 2 we present the
53 background literature and subsequently develop hypotheses. Section 3 illustrates the research
54 methodology adopted in this study and in section 4 the findings are provided. Section 5
55 discusses the implications, highlights conclusions and suggests future directions.
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60 **2. Theoretical background and hypothesis development**

2.1. *Environmental dynamism*

ED generally refers to the rate of change in the external environment regarding uncertainty, volatility and instability, competition, customer preferences and technology (Wilhelm et al., 2015; Jansen et al., 2009). The higher the rate of change in the environment, the more dynamic the environment becomes. The external environment interacts with firms' survival, while their success has become more dynamic in the context of the Fourth Industrial Revolution. Therefore, firms tend to experience more unpredictable, unstable, and uncertain conditions (Seo et al., 2020). Many researchers claim that ED plays an important moderating role between organizational capabilities and competitive advantage while others believe that ED is an important driving force of organizational capabilities (Teece, 2007). However, in the ever-changing environment, with quick changes in demand and frequent shifting in technology, the acquirement and maintenance of competitive advantage is quite difficult (Li and Liu, 2014). Therefore, rather than sustainable advantage, some scholars propose **taking** a series of short-term actions (D'Aveni et al., 2010). This study holds that sustainability **is a state in which** organizations **can** cope with ED and continuously provide satisfying products or services for customers in a sustainable manner. Moreover, there is a need for innovative sense-making, flexible decision-making and dynamic implementation to reshape the sustainability and competitive advantage of firms.

2.2 *Innovation process*

The importance of innovation in seizing new opportunities and enhancing competitiveness within firms is a widely accepted hypothesis (Kafetzopoulos et al., 2020). It represents one of the most important and sustainable strategies which leads to increased performance and economic success (Le Bas et al., 2015). Firms are usually required to modify their organizational structures to initiate innovation processes. Tidd et al. (2005) define innovation process as turning opportunity into new ideas and putting these into widely used practice. Innovation process is the movement of a novelty from an innovation concept to a market product. According to this view, the stages of the innovation process consist of design and legal documentation, a prototype, an industrial design and a market product stage. It is commonly understood that the innovation process involves the coordinated efforts of many organizational members to develop, implement and promote innovative ideas to improve work practices (Bessant and Tidd, 2015). The innovation process is a multi-level approach with a high level of uncertainty and market risk. It comprises a complex system with lags and feedback loops that leads to the evolution of innovation in positive economic cycles (Guarascio et al.,

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2 2015). Therefore, to understand the innovation process over time, it is necessary to consider
3 positive and negative feedback loops between internal variables, external variables and
4 different stakeholders (Kazakov and Kunc, 2016).
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7 2.3 *Strategic flexibility*

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10 Strategic flexibility is defined as a set of abilities that enable firms to respond to
11 environmental changes (Fernandez-Perez et al., 2016; Sanchez, 1995) and it also enables them
12 to drive change when operating in current fast-moving hypercompetitive markets (Saini and
13 Johnson, 2005). According to Shimizu and Hitt (2004), strategic flexibility is a firm's capability
14 to identify changes in the environment, to quickly commit resources in response to changes,
15 and to act promptly when it is time to halt or reverse such resource commitments. Strategic
16 flexibility depends jointly on resource flexibility and the company's flexibilities in applying
17 those resources to alternative courses of action (Li et al., 2011). Many researchers have
18 classified strategic flexibility into observable dimensions; for example, Roberts and Stockport
19 (2009) have classified it into external and internal flexibility, while MacKinnon et al. (2008)
20 suggested five constructs which comprise strategic flexibility; namely, operational, human
21 capital, information, supply chain and financial flexibility. Thus, we can conclude that
22 maintaining strategic flexibility is one of the most important tasks of managers and
23 organizations in a dynamic environment that involves the creation, maintenance and realization
24 of options for a firm's future (Singh et al., 2013).
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36 2.4 *Human resource development*

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38 Human resources play a major role in any organization as they are essential in decision
39 making and the growth of the organizations. This study focused on human resource
40 development as a goal of companies wishing to increase the capabilities of human capital within
41 organizations, which cannot be easily imitated by competitors and can enable organizations to
42 grow (Kumar and Bhatia, 2021). Organizational training and development activities of human
43 resources can optimize their knowledge and skills contributing to knowledge creation (Cabello-
44 Medina et al., 2011). Such employees will be distinguishable from other employees by the
45 capital they possess, which enables them to make a difference and add value to their
46 organizations. Specifically, there is significant research interest in employees that are
47 simultaneously unique, valuable, rare, and inimitable (Lewis and Heckman, 2006). Continuous
48 training of the employees on new tools and technology is a major challenge for any organization
49 and its successful adoption depends on the external environment, which includes the
50 competitors and business partners of an organization (Shet et al., 2021). In short, human
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2 resource development involves regularly developing the depth and breadth of employees'
3 knowledge and expertise, personalizing training to fit particular needs and, finally, ensuring
4 continuous employee development (Kianto et al., 2017).
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7 2.5 *Sustainability*

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10 Sustainability concerns the creation of current and future profits for a firm. It represents
11 the long-lasting competitive advantage in economic returns that firms obtain by considering the
12 impact on the natural environment and human society - the so-called “triple bottom line”
13 (Tomšič et al., 2015) - and by not sacrificing investors’ and other stakeholders’ needs.
14 Economic, social and environmental sustainability are treated equally and are mutually
15 supportive. Economic sustainability concerns the return on assets, competitive efficient
16 markets, organizational cost reduction and wealth for all stakeholders (Green et al., 2012). The
17 social dimension of sustainability focuses on the impact of a company’s activities on society
18 (e.g. community relations) and ensures that a company **behaves** responsibly to its stakeholders
19 and approaches social issues ethically (Bansal, 2005). Lastly, environmental sustainability
20 concerns the operation of any company that leads to the reduction of various harmful materials
21 such as the emissions created by its production process, waste removal, water treatments, and
22 daily use of consumables in its offices (Zhu and Mazaheri, 2020). The literature shows that
23 sustainability requires deep and systemic change in organizations, responding to the new levels
24 of risk and ambiguity of today. Sustainability itself **comprises several** different frameworks of
25 values and mental models that compete to define what it is, why it is important, and how it may
26 be realized (Scully-Russ, 2012).
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40 2.2. *Hypotheses development*

41 2.2.1. *Environmental dynamism - sustainability and critical factors*

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43 The contingency theory supports the view that firms implement specific strategies in
44 order to respond to the internal as well as the external environment (Donaldson, 2001). The use
45 of the contingency theory offers a new and useful perspective on the implementation of
46 sustainability practices. However, there is **considerable diversity in the** organizations as well as
47 **in the** different types of approaches to corporate sustainability that can be identified (Hahn and
48 Scheermesser, 2006). In this regard, there is a need to adopt a contingency theory to broaden
49 the understanding of the implementation of sustainability practices. In recent years the world
50 has been facing environmental challenges which prevents us as a society from pursuing a
51 sustainable development trajectory. These challenges include, for example, air and water
52 pollution (Greenstone and Hanna, 2014), waste disposal and management ozone layer depletion
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1 and as a result, perhaps most importantly, climate change (Huang et al., 2016). Previous studies
2 have discussed whether or not environmental dynamics is a crucial factor in firms posing their
3 sustainability orientation (Cao et al., 2012). Thus, it is generally recognized that ED is often
4 associated with the way we live and consume, and the impact we have on all the three
5 dimensions of sustainability (i.e., the natural environment dimension is impacted by and
6 impacts both the economic and social dimensions) (Silvestre and Tîrca, 2019). Therefore, we
7 posit that ED can drive firms to adopt strategies to achieve desired sustainability outcomes, and
8 we hypothesise:
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16 *H1: Environmental dynamism is positively related to firms' sustainability.*
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19 A highly dynamic environment means unpredictable changes in an organization's
20 external environment, which **restrict** a firm's ability to recognize opportunities and threats in
21 order to respond to market demands (Wilhelm et al. 2015; Jansen et al. 2009). When a business
22 environment is dynamic and uncertain, "the firm finds it hard to respond with the necessary
23 changes, and it will experience considerable levels of volatility in firm" (Chen et al. 2017). In
24 that circumstance, firms will be faced with the threat of their existing products/processes and
25 markets becoming obsolete (Ferrerias-Méndez et al., 2015). Therefore, faced with the threat,
26 firms cope with adverse environmental conditions by innovating and displaying proactive
27 behavior. The operation of organizations in a dynamic environment is likely to focus on the
28 innovation process of developing new products/processes, markets and technologies
29 (Naqshbandi et al., 2015) through which to improve their innovation performance. More recent
30 studies emphasize improving innovation process through environmental practices (Awan et al.,
31 2018b). A review of the literature on existing studies of this issue reveals a significantly positive
32 direct effect of ED on innovation process (Turulja and Bajgoric, 2019; Martinez-Conesa et al.,
33 2017; Pervan et al., 2015), **while attempts are made** to understand the mechanisms of that
34 relationship.
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36 Furthermore, several studies have emphasized the effectiveness of strategic flexibility in
37 the context of ED and the uncertainties we are currently facing with the COVID-19 pandemic.
38 Strategic flexibility is a concept that is associated with ED. For example, Yawson (2020) argues
39 that strategic flexibility of firms can be enhanced by their competitiveness in dynamic
40 environments by applying alternative courses of action or strategic options. Cingoz and
41 Akdocan (2013) point out that one of the most important factors that affects strategic flexibility
42 is ED. Firms that want to achieve strategic flexibility should consider all the factors that are
43 related to organizational environment. In this context, firms that operate in a dynamic and
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1 rapidly changing environment create strategic flexibility to obtain sustainable competitive
2 advantage. In a constantly changing environment around sustainability, companies become
3 more flexible and adaptive by learning, improving and developing (Arend, 2014). Thus, a
4 dynamic environment is crucial in allowing firms to achieve such adaptive flexibility and make
5 constant adjustments.
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10 Top leaders in today's globally dynamic environment must continually realign and
11 develop their organizations to achieve sustainability. To drive these changes, top leaders need
12 to know if their employees are capable of attaining such innovation (Mayfield et al., 2016).
13 External environmental forces have forced all the companies' stakeholders to consider
14 restructuring and develop human capital to meet the challenges (Higgins and Coffey, 2016).
15 When employees are in a highly dynamic work situation where changes in consumer demand,
16 competitors and technology are rapid and discontinuous, the information provided to employees
17 is often inaccurate, unavailable, or obsolete (Deng et al., 2019). Then, they lack the accurate
18 information required to make correct decisions and are often prone to negative emotions like
19 anxiety. Therefore, for an organization to be successful, the efficient and effective deployment
20 of human capital development would help in this direction (Yong et al., 2019). Hence, the
21 following hypothesis is proposed:
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31 *H2. Environmental dynamism has a positive effect on (a) innovation process (b) strategic*
32 *flexibility and (c) human resource development.*
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35 36 37 2.2.2. Innovation process and sustainability

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39 The effect of innovation process on sustainability is an interesting phenomenon. The
40 literature acknowledges that innovation process is necessary for embracing sustainability and
41 often demands the transformation of the entire method of operation (Eccles and Serafeim,
42 2013). In fact, sustainability should be tackled based on innovation-centered approaches, as
43 enhanced sustainability cannot be achieved without innovations (Silvestre, 2015). Achieving
44 enhanced sustainability requires changes in processes, products, marketing or management
45 approaches. Improving aspects of innovation processes such as product and process design and
46 flexibility means that more tacit, and organization-specific information has to be shared
47 between buyers and suppliers, which requires trust (Awan et al., 2018b). Therefore, change is
48 a fundamental element for organizations, supply chains, and communities as they evolve on
49 their sustainability trajectory (Silvestre and Tîrca, 2019). Dangelico et al. (2017) also found a
50 positive relationship between innovation process and sustainability. Similarly, Groza et al.
51 (2021) and Chang and Chen (2012) asserted that green innovation is an essential strategic
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predecessor to achieving sustainability. In companies following innovation processes, innovative behaviors become the norm and employees are more likely to adopt and integrate such innovations in their sustainable development processes (Hogan and Coote, 2014). Firms with high levels of innovation processes, develop new products and services that lead to cost reduction and increased sales and we anticipate high levels of sustainable economic growth (Groza et al., 2021). Furthermore, product and process innovation reduce the negative environmental impact of the business and they also increase the firm's social performance through waste reduction (Weng et al., 2015). Thus, we hypothesize:

H3: Innovation process has a positive effect on sustainability

2.2.3. Strategic flexibility and sustainability

Empirical findings have shown that flexibility can act as a driver of all three pillars of sustainability (Sushil, 2015; Aragon-Correa et al., 2008). A company's strategic flexibility is one of the ways in which a company's performance can be promoted. Besides, failure in companies' sustainability may harm the strategic flexibility and performance of the company (Arshad et al., 2018). Through enabling the flexible allocation of resources, and by adequately adapting structures and processes at the operational level, companies initiate organizational change faster than their rivals, design more sustainable offerings and require less energy or avoid toxic by-products leading to sustainability (Gelhard and von Delft, 2016). Firms with a strong focus on strategic flexibility are more likely to use sustainability to develop and nurture dynamic core competencies that are of great importance to achieving performance in a rapidly changing environment. Nwachukwu and Vu (2020) show that strategic flexibility has a significant influence on business sustainability and also significantly affects business sustainability indicators of economic, social, environmental and innovation performance. Gelhard and von Delft (2016) point out that the dynamic capability of strategic flexibility, indirectly contributes to sustainability through its impact on a series of operational capabilities, namely value chain flexibility and customer integration. Based upon the prior reasoning, we propose the following hypothesis:

H4. Strategic flexibility has a positive effect on sustainability

2.2.4. Human resource development and sustainability

Researchers suggest that human resource development represents a basic pillar for the implementation and effectiveness of sustainability (Awan et al., 2022). It could be considered as a firm's investment that will improve the competence of their employees (Gannon et al.,

2015). This implies that any organization that aims at achieving sustainability needs to invest in its employees to ensure that they have all the requisite knowledge and skills that are required in order to be effective and efficient in the discharge of their duties (Nico et al., 2017). Human resource development promotes organizational performance, since it connects the concepts of development and learning with the organization's strategy and culture (Longenecker and Fink, 2013). The employee will become an active agent for sustainable development, and their behavioral change **will be reflected in** attitudes that will boost sustainability (Ardichvili, 2012). All employees need to understand how changes in work processes help the company reach sustainability goals and how their **work** activities can facilitate obtaining those goals (DuBois and DuBois, 2012). Being allowed to gain practical experience in implementing new job processes, employees gain knowledge and commitment to sustainable efforts (Mandip, 2012). Therefore, the following hypothesis is proposed:

H5. Human resource development has a positive effect on sustainability

3. Methodology

3.1. Research design

The survey was designed in four steps. First, the literature on ED, innovation process, strategic flexibility and sustainability was reviewed to identify established measures and items. Second, a questionnaire was developed and evaluated by experts in the field and then it was pilot-tested on 17 firms through interviews with owners/managers. This step helped in the final designing of the survey and measurements, in validating the core concepts studied in this paper and in ensuring the questionnaire's content validity. Third, following recommendations on survey design by Eikelenboom and Jong (2019), the syntax was simple, the scale clear and relevant and the questions in an appropriate order. Fourth, the questionnaire was translated using forward-backward protocols and tested again on six managers of Greek firms.

3.2. Sample and participants

The population of this study included 2500 Greek private firms employing more than 10 employees. A structured questionnaire was used as the data collection method. For each of the targeted companies, the director or senior manager who was identified was expected to be well-informed about innovation, strategy, and the sustainability of the firm. Then, the questionnaire was sent **by e-mail**, while some personal interviews were also conducted. Data were collected between October and December 2020. From the 514 questionnaires that were received, 34 were deleted because they were incomplete or defined as cases with a threshold value of a standard

score up to 3 (Hair et al., 2006), leaving 480 observations for the analysis. All measured variables in this study exhibited univariate normality and did not suffer from skew and kurtosis ($< \pm 1$), indicating, but not guaranteeing, multivariate normality (Hair et al., 2006). The firms represented a range of sectors: manufacturing 26.2%; services 42.9% and trade 30.9%. The gender of most respondents was male (328 male, 152 female). The education level of the respondents was: **high school 23.7%; university 63%** and Msc 13.3%, while the number of years of their organizational experience was $5 < 26.6%$; $5-10 25.4%$ and $10 > 48%$. The number of employees in the firms was **11-49 (70%); 50-250 (20.8%); 251-500 (6.2%) and 500 > (3%)**.

3.3 *Non-response bias and common method bias*

Given that for the dependent variables and the independent variables respondents were asked for subjective impressions, it is very likely that the results are biased¹. Thus, non-response bias and common method bias were also checked in this study. To detect non-response bias, the Mann–Whitney test is used to determine if there are differences between the early, middle, and late respondents in terms of the questionnaire items. However, no statistically significant differences were found for any variables used in the study at $\alpha=0.05$. Additionally, we examined possible differences between respondents and non-respondents, based on the number of employees. The corresponding T-tests showed that there was no significant difference.

Since the questionnaire was completed by a single respondent from each participating company, the common method variance had to be checked. To reduce this risk, we ensured anonymity, we carefully evaluated all **the** survey items, distancing dependent and independent variables from each other in the survey, and the respondents completed the survey instrument individually and independently within a six-week period. Consequently, the independence of each predictor variable was not violated. The companies are heterogeneous in terms of sub-sectors and product/process complexity. To measure the equality of variances for a single variable or pair of variables, the Levene test is used showing that the p-value for the test is > 0.05 significance level, indicating variation in homogeneity (Feng et al., 2008). Additionally, we conducted Harman's one-factor test using the items included in our measurement instrument. If common method variance was a serious problem in this study, we would expect a single factor to emerge from a factor analysis or one general factor to account for most of the covariance in the independent and dependent variables (Podsakoff et al., 2003). Following our analysis, we did not obtain such a single factor. Thus, the respective results indicated that they were not a substantive problem in this study.

*The author is grateful to an anonymous reviewer for this remark

3.4 Measures

All measurement instruments used in this study have been previously tested and verified in the relevant literature. The scale for ED ($\alpha=0.80$) was adopted because it shows it tapped into the rate of change and the instability of the external environment. This instrument was developed by Jansen et al. (2006). The scale to measure innovation process ($\alpha=0.90$) was adopted from Tomšič et al. (2015). Innovation has complex features and most of the firms are not certain about the benefits. Thus, we have chosen the items intended to measure the “level of implementation” of innovation processes in firms, rather than measuring the level of success (Kamble et al., 2020). Strategic flexibility captures “the ability to adjust available means to better achieve current and expected future ends, in accordance with an encountered situation”. As such, measures of strategic flexibility mirror the proactive and reactive abilities of firms reacting to environmental changes. We adapted six items ($\alpha=0.92$) from previous research measuring the proactive and reactive ability to meet changing environmental conditions (Miroshnychenko et al., 2020; Liu et al., 2013). Based on the pre-tests to measure **human resource development**, we used an adapted version of the El Dahshan et al. (2018) and Alkerdawy (2016) six-item scale ($\alpha=0.90$). Human **resource** development is measured by looking for development needs of talented employees, planning to ensure skills utilization and introduction opportunities for development. The owner/manager perception of sustainability was measured by the instrument used by Iqbal et al. (2020), Pantouvakis and Vlachos (2020) and Iqbal et al. (2018). The items were adapted to include economic ($\alpha=0.91$), environmental ($\alpha=0.80$), and social ($\alpha=0.81$) performances. A 7-item Likert scale was used to record responses for all scales, ranging from (1) totally disagree to (7) totally agree.

3.5 Data analyses

The statistical analysis software SPSS 24 (Statistical Package for Social Sciences) and AMOS 6.0 (Analysis of MOment Structures) were used for the statistical processing of the data. The descriptive and correlation statistics for the variables are shown in Table 1. The correlation coefficients (r) were all above 0.3 and below the cut-off of 0.90 at $p<0.01$, indicating the interdependence of all factors; hence, collinearity and multicollinearity do not represent data problems in this research (Hair et al., 2006). The model and the hypotheses are tested using structural equation modeling (SEM) via path analysis, as it is a multivariate analytic methodology that gives insights into the causal ordering of variables in a system of relationships (Hair et al., 2006).

Take table 1 about here

4. Measurement analysis and results

4.1 Measurement model

According to Kafetzopoulos and Psomas (2015), when there is a latent factor with several correlated dimensions and also the structural relationships between the dimensions and the latent factor are strongly supported by the literature, then a second-order factor model is applicable. So, in the case of the present study, a measurement second-order factor is constructed using “economic sustainability,” “social sustainability” and “environmental sustainability” as second-order factors that explain the first-order factor “sustainability”.

In order to determine whether all latent factors show acceptable fit to the empirical data, the confirmatory factor analysis (CFA) was applied. The results of CFA provided a good fit to the data (with $\chi^2/df = 1.869$, CFI=0.962, RMSEA=0.043, NFI=0.923, GFI=0.901, TLI = 0.958 and RMR=0.08). To ensure reliability of items, we examined: (a) Cronbach’s alpha, (b) the loadings between the items and the intended constructs and (c) the composite reliability (CR). The results show that each construct had an acceptable level of Cronbach’s alpha and CR (see Table 2). Furthermore, based on the results of CFA, the average variance extracted (AVE) for each construct was calculated. The AVE values for all the constructs were above the 0.50 threshold, factor loadings of all items were >0.5 , significant at p-values 0.001 and the signs were all positive, proving adequate convergent validity (Hair et al., 2006). Discriminant validity is analyzed by comparing the AVE with the shared variance (i.e. square of the correlation) between any pair of latent constructs (Fornell and Larcker, 1981). In each case, the AVE was greater confirming the discriminant validity (Hair et al., 2006). Face validity is about whether a test appears to measure what it’s supposed to measure. The constructs revealed and their associated items possess a sufficient level of face validity, as the survey instrument was mainly adopted from the existing literature, reviewed by experts in the field and **pilot-tested** in firms (Hair et al., 2006). Thus, the results provided strong evidence that all of the study constructs were reasonably reliable and valid.

Take table 2 about here

4.2 Hypotheses testing

After CFA, the SEM technique was applied (maximum likelihood method) to test the hypotheses of the study, using the model illustrated in figure 1 as the base model, The structural model provided a good fit to the data (with $\chi^2/df = 2.141$, CFI=0.955, RMSEA=0.049,

NFI=0.911, GFI=0.886, TLI = 0.945 and RMR=0.081). Figure 1 and table 3 indicate the associated hypotheses, as well as the estimated path coefficients, and squares multiple correlations (R^2) for the dependent construct.

Take figure 1 about here

The analytical results reveal no significant direct effect of ED on sustainability (-0.209) at $p < 0.01$. Nevertheless, ED directly affects the innovation process (0.879), strategic flexibility (0.752) and human resource development (0.737) at $p < 0.001$. In addition, sustainability is affected directly by innovation process (0.421), strategic flexibility (0.367) and human resource development (0.513). **These findings indicate that ED promotes specific organization factors of a firm, while these enhanced organization factors also enhance sustainability.** The above results support H2a, H2b, H2c, H3, H4, H5 and reject the H1 hypothesis.

Take table 3 about here

4.3 Mediation analysis

A mediation analysis exists in the structural model (Figure 1) regarding the mediating effect of the three critical factors (innovation process, strategic flexibility and human resource development) on sustainability. Full mediation arises when an independent variable (in this case ED) no longer affects a dependent variable (in this case sustainability) after another variable has been controlled. Partial mediation arises when the relationship between an independent variable and a dependent variable is reduced in absolute size but is still different from zero when the mediator is introduced (Kafetzopoulos et al., 2019).

In this study, using the method proposed by Kumar and Bhatia (2021) and Kafetzopoulos et al. (2019), we tested two models: Mod1 includes only the direct relationship between ED and sustainability, and Mod2 includes the direct relationship between ED and sustainability and the mediation link of three critical factors on the relationship between ED and sustainability. The results reveal that in Mod1, ED, without the mediator variables, has a significant direct effect on sustainability (0.510; $p < 0.001$). However, introducing the three critical factors as mediator variables (Mod2), the path between ED and sustainability is not found to be statistically significant (-0.209; $p < 0.01$). The effect of ED on sustainability via innovation process (indirect effect) achieves a point estimate of 0.370 (0.879×0.421); $p < 0.001$, which is higher compared to the estimated direct effect. Further, the effect of ED on sustainability via strategic flexibility (indirect effect) achieves a point estimate of 0.276 (0.752×0.367); $p < 0.01$, and via human resource development it achieves a point estimate of 0.378 (0.737×0.513); $p < 0.001$. We further

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2 tested the mediation effect of the critical factors by using the Sobel (1982) test. The results
3 (Table 4) confirm that innovation process, strategic flexibility and human resource development
4 factors fully mediate between ED and sustainability.
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9 **Take table 4 about here**
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11 **5. Discussion**

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14 This study has several theoretical and managerial implications for firms. The findings
15 show that external environmental changes force firms to cultivate critical organizational factors.
16 They corroborate the studies of Higgins and Coffey (2016), Naqshbandi et al. (2015) and
17 Cingoz and Akdocan (2013) who observed ED as an important external antecedent for
18 innovation process, strategic flexibility and employees' development. The main reason may be
19 that, as the environment becomes more dynamic, with changes in markets, competence and
20 technology, firms may be more sensitive and cultivate a higher level of internal factors in order
21 to take advantage of new opportunities or face environmental threats (Rosenbusch et al., 2011).
22 Therefore, enterprises must enhance the perception of change and make some necessary
23 adjustments to match them. Given the above significant impact, managers should take into
24 consideration the decisive role of ED, and confidently invest in the development of capabilities
25 to address environmental changes, avoiding core rigidities and capability traps. Nevertheless,
26 we have to learn more about what exactly the mechanism that ED exerts on critical
27 organizational factors is. Future studies have to investigate in depth different ED dimensions
28 and their effect on different capabilities of a business. Thus, we will be able to make predictions,
29 better manage threats or identify opportunities. Bhatia (2021) points out that by taking a
30 proactive approach toward ED management through the implementation of green process
31 innovation practices, a firm can develop capabilities necessary for enhanced sustainable
32 performance.
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47 This study also provides empirical evidence on certain critical organizational factors for
48 adopting sustainability. These organizational factors (innovation process, strategic flexibility
49 and human resource development) enable firms to seize possible chances, implement change
50 as necessary and ultimately, to smoothly transition towards sustainability (Doving and
51 Gooderham, 2008). Human resource development is the most decisive organizational factor in
52 the results obtained. This finding is similar to Luthra et al. (2020) who reported that employee
53 training and expertise is one of the important factors for sustainability. Sustainability requires
54 a committed, well-trained and developed workforce that fully participates in economic, social
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2 and environmental activities. Lack of knowledge and experience of sustainability practices, lack
3 of non-monetary motivation mechanisms and tedious paperwork are major obstacles to
4 successful sustainability. Specific training and development programs could assist employees
5 to improve the skills that would enable them to better exhibit sustainability behaviors
6 (Kafetzopoulos and Gotzamani, 2022). Furthermore, leaders have to create an environment
7 which is **conducive** to sustainability by encouraging employees to share their ideas, information
8 and risk taking, fostering sustainable development (Iqbal et al., 2020).

14 Innovation process is another critical organizational factor in a dynamic environment that
15 can play an important role in firms' sustainable performance. It drives organizations towards
16 sustainable performance through innovative changes creating long-lasting advantages ensuring
17 thus a company's long-term success (Jimenez-Jimenez et al., 2008). Similarly, Tomšič et al.
18 (2015) indicated that innovation process has a significant positive influence on corporate
19 sustainability. However, the collective innovation journey towards a sustainable economic
20 system crucially depends on the active participation of numerous actors in different sectors.
21 People require a lot of innovation in areas such as energy as well as in business models, in the
22 organization and activities of the public sector and in their way of life more generally
23 (Fagerberg, 2018). Strategic flexibility and sustainability is another interesting positive
24 relationship. Strategic flexibility is a special organizational ability that an enterprise achieves
25 to respond to changes in the external environment by re-allocating organizational resources,
26 processes, and management activities (Liu and Zhang, 2022). Businesses with the ability to
27 navigate ED and changes, can develop different strategies and policies, thus achieving
28 sustainability. However, the research on strategic flexibility and sustainability still faces
29 challenges and obstacles. Some scholars believe that the size of an enterprise, large enterprises
30 compared with startups, affects the relationship between strategic flexibility and sustainability.
31 **Therefore**, this balance needs to be explored urgently (Liu and Zhang, 2022).

45 The next significant contribution of this paper is the focus on the role of ED as an external
46 factor that directly affects firms and leads them to adopt economic, social and environmental
47 sustainability equally. The findings are similar to Cao et al. (2012) who observed that ED has
48 a tangible impact on strategic choices, **and that it** enhances the ability of firms to achieve the
49 desired sustainability. **They further noted** that managers need to pay close attention to their
50 environment when making strategic and operational decisions. Moreover, Kafetzopoulos and
51 Gotzamani (2022) point out that in a highly volatile environment with fleeting opportunities
52 and ever-present threats from competitors, environmental turbulence reduces the competitive
53 position and affects sustainable performance. Moreover, this study tested the mediating role of
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2 internal organizational factors between ED and sustainability. Firms cannot successfully adopt
3 sustainability solely due to the influence of ED; organizational factors can also have a crucial
4 role in this relationship. Introducing the critical factors of innovation process, strategic
5 flexibility and human resource development into the framework, we obtain their mediating role,
6 as the influence of ED on sustainability is in a negative direction and not statistically significant.
7 This full mediation relationship may be explained by the fact that firms with a higher
8 commitment to innovation processes, focus on strategic flexibility and properly develop their
9 human resources, they acquire the appropriate organizational capabilities and are not influenced
10 by the dynamism of the external environment to achieve sustainability. Hence, managers must
11 understand the dynamic environment in which they are operating and frame the appropriate
12 strategies accordingly. In a rapidly changing environment, policymakers should choose the
13 right strategic solutions (Zavadskas et al., 2013).

24 6. Conclusions

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27 Most of the earlier studies have analysed the adoption of drivers of sustainability more
28 comprehensively under the utility maximization and legitimacy theories (Li et al., 2017; Tan et
29 al., 2017). The present study is the first to empirically validate the effect of ED and three specific
30 critical internal factors on sustainability, providing novel insights into the advancement of
31 theory. It provides a better understanding of the key factors for sustainability, helping to fill the
32 gap that exists in the literature, as required by several authors (Sharma et al., 2021; Pantouvakis
33 and Vlachos, 2020; Coelho et al., 2017; Engert and Baumgartner, 2016; Klettner et al., 2014).

41 *Practical implications*

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44 The findings will help managers of organizations to identify and exploit the most effective
45 ways of managing the adoption of sustainability. With this paper, we show that when firms are
46 faced with dynamic environments, managers should direct their strategy towards human
47 resource development, innovation and strategic flexibility to realize the true potential of
48 sustainability. These organizational factors are critical and acquire a complementary character,
49 which induces firms to adopt sustainability to compete in highly dynamic contexts. Managers
50 have to be aware and proactive, motivating and guiding employees to overcome the challenges
51 of working in the sustainability era. They have the responsibility of inculcating an innovative
52 culture of change in an organization through vision (Sony and Naik, 2020), as sustainability in
53 many cases involves radical changes. Furthermore, we stress the importance of ED that

1 encourages managers to continuously **develop innovative and flexible behavior in their human**
2 **resources**. According to Teece (2007) who extends the resource-based view to the context of
3 the dynamic environment, managers should constantly adapt, reconfigure and renew their
4 resources, strategies and capabilities to address environmental change.
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8 *Limitations and future research suggestions*

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11 The research is not without limitations and assumes that additional research is needed.
12 First, this study merely explores three **specific** organizational factors, but many other topics that
13 affect the adoption of sustainability remain unexplored. Further researches should explore in
14 depth other factors too, such as different leadership styles, learning capability, manufacturing
15 efficiency and competition strategy which may explain sustainability performance. Second, our
16 findings are based on a sample of Greek firms, and other industrialized or emerging market
17 countries with different cultural and institutional environments are needed to test our theoretical
18 framework and generalize our results. Moreover, the digital capability of a firm is also a
19 promising field for research: for example, the role of the internet, the utilization of e-commerce
20 for launching products in international markets or the use of information systems technologies
21 in achieving sustainability. Finally, an increasing number of researchers believe that
22 ambidexterity is of central importance to the competitive advantage. Future research is
23 encouraged to examine the simultaneous pursuit of explorative and exploitative orientations in
24 the sustainability domain.
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Table 1. Descriptive statistics

Constructs	1	2	3	4	5	6	7
1. Environmental dynamism	-				-		
2. Innovation process	0.505	-					
3. Strategic flexibility	0.400	0.641	-				
4. Human resource development	0.357	0.619	0.561	-			
5. Economic sustainability	0.400	0.641	0.487	0.561	-		
6. Social sustainability	0.308	0.525	0.440	0.517	0.440	-	
7. Environmental sustainability	0.312	0.463	0.438	0.416	0.438	0.674	-
Mean	5.24	5.00	5.47	5.55	5.40	5.55	5.73
S.D	1.52	1.62	1.11	1.26	1.30	1.26	1.26

Remarks: S.D. = standard deviation; Correlation is significant at the 0.01 level (two-tailed)

Table 2. Measurement model (N=480).

Constructs /Indicators	Loadings	AVE	CR	Cronbach's a
Environmental dynamism		0.503	0.793	0.800
Environmental changes in our local market are intense.	0.645			
Our clients regularly ask for new products and services	0.771			
In our local market, changes are taking place continuously.	0.727			
In a year, many have changed in our market.	0.690			
Strategic Flexibility.		0.663	0.921	0.928
If circumstances change, our organization.....				
can easily change its current plans.	0.783			
is prepared to react in a modified and viable manner.	0.854			
can control a shift in strategy.	0.877			
has the necessary practical knowledge to make shifts in daily routines and practices.	0.811			
can pro-actively develop a new project.	0.753			
can shift projects with a high probability of success.	0.804			
Innovation process		0.593	0.796	0.902
Innovation is defined as a commitment of the entire enterprise, not just as the domain of R&D.	0.750			
We offer employees various trainings in the field of innovation and creative thinking	0.735			
We have established a reward system for employees' innovation activity.	0.726			
We use the concept of open innovation.	0.784			
We always protect intellectual property, which arises from the innovation process.	0.811			
We have established a system for monitoring innovation performance.	0.812			
Human resource development		0.624	0.892	0.900
Our firm				
identifies development needs for employees.	0.705			
introduces enough opportunities to develop employees.	0.823			
keeps with employees through suitable workplace conditions.	0.872			
Establishes employees resource planning to ensure skills utilization.	0.804			
develops employees pool consisting of a skilled, engaged and committed workforce.	0.737			
Economic sustainability		0.724	0.913	0.913
Our firm's economic performance is at an acceptable level in terms of				
sales growth.	0.862			
income stability.	0.874			
return on investment.	0.862			
Profitability.	0.805			
Social sustainability		0.536	0.811	0.815
Our firm.....				
protects claims and rights of local people or local community.	0.749			
communicates the firm's environmental impacts and risks to the general public.	0.800			
recognizes and acts on the need to fund local community initiatives.	0.619			

1				
2	shows concern for the visual aspects of the firm’s facilities and operations.	0.730		
3	Environmental sustainability		0.643	0.878
4	Our firm.....			0.803
5	uses utilities (e.g., Energy and water) in an environmental friendly manner.	0.773		
6	produces few wastes and emissions.	0.783		
7	is concerned about waste management.	0.798		
8	is concerned about hygienic factors.	0.853		

Table 3. Analysis results of the structural model

Hypothesis	Standardized regression weights	Support?
H1: Environmental dynamism → Sustainability	-0.209**	No
H2a: Environmental dynamism → Innovation process	0.879*	Yes
H2b: Environmental dynamism → Strategic flexibility	0.752*	Yes
H2c: Environmental dynamism → Human resource development	0.737*	Yes
H3: Innovation process → Sustainability	0.421*	Yes
H4: Strategic flexibility → Sustainability	0.367*	Yes
H5: Human resource development → Sustainability	0.513*	Yes

Note: *p<0.001; **p<0.1

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Table 4. Mediation analysis

Path	Mod1	Mod2	Std. error	Sobel test	Results
ED → Sustainability	0.510*	-0.209**	0.23	2.42*	Full mediation
ED → Innovation process	-	0.879*	0.16		
Innovation process → Sustainability	-	0.421*	0.08		
ED → Sustainability via Strategic flexibility (Indirect effect)	-	0.370*			
ED → Sustainability	0.510*	-0.209**	0.23	3.70*	Full mediation
ED → Strategic flexibility	-	0.752*	0.10		
Strategic flexibility → Sustainability	-	0.367*	0.06		
ED → Sustainability via Strategic flexibility (Indirect effect)		0.276**			
ED → Sustainability	0.510*	-0.209**	0.23	4.53*	Full mediation
ED → Human resource development		0.737*	0.11		
Human resource development → Sustainability		0.513*	0.06		
ED → Sustainability via Human resource development (Indirect effect)		0.378*			

Note: *p<0.001; **p<0.01

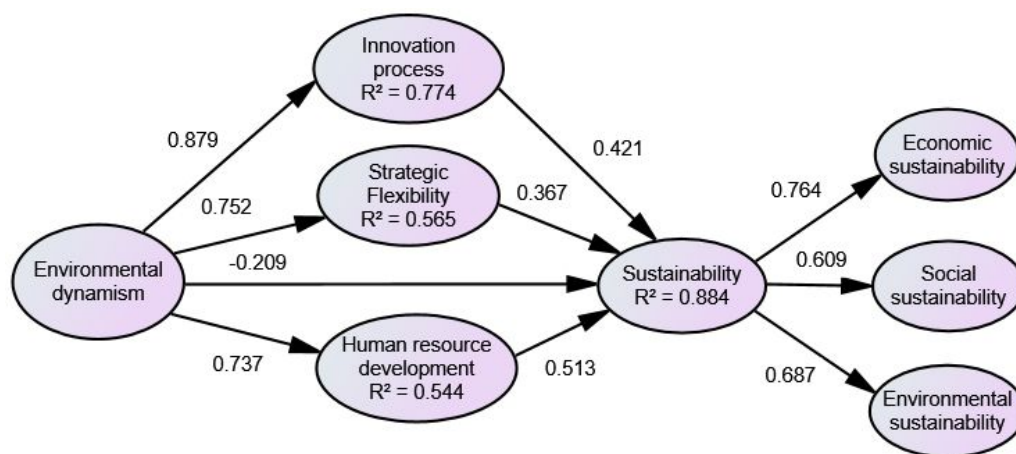


Figure 1. Structural equation modeling results

Management Decision

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