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Knowledge Co-creation and Sustainable Education in the Labor Market-Driven University–Business Environment

Cristina Bianca Pocol[1], *Liana Stanca*[2], *Dan-Cristian Dabija*[3]*, *Ioana Delia Pop*[4] *and Sergiu Mișcoiu*[5]

[1]Department of Animal Production and Food Safety, Faculty of Veterinary Medicine, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania, [2]Department of Business Information Systems, Faculty of Economics and Business Administration, Babeș-Bolyai University Cluj-Napoca, Cluj-Napoca, Romania, [3]Department of Marketing, Faculty of Economics and Business Administration, Babeș-Bolyai University Cluj-Napoca, Cluj-Napoca, Romania, [4]Department of Exact Sciences, Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania, [5]Department of International Relations and German Studies, Faculty of European Studies, Babeș-Bolyai University Cluj-Napoca, Cluj-Napoca, Romania

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***Correspondence:**
Dan-Cristian Dabija
dan.dabija@ubbcluj.ro

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Objective: The university-business partnership plays a particularly important role in society, allowing a symbiosis between socio-economic stakeholders and the university. This symbiosis is based on co-creating and sharing knowledge, creating collaborative projects, valorizing research, implementing SD principles, and on good governance. The aim of this research is to identify groups of francophone socio-economic organizations willing to engage in co-creating knowledge with universities to adapt the academic curriculum to the dynamic requirements of the labor market, supporting entrepreneurship, whilst implementing SDG principles, and ensuring sustainable education. We base our approach on the two-step cluster analysis, data being collected *via* questionnaires among representatives of francophone organizations in an emerging market. This allows the identification of two clusters of francophone organizations according to the extent to which they contribute to strengthening their relationship with the university by co-creating knowledge, implementing SDG principles, and supporting sustainable education.

Findings: The first cluster is represented by francophone organizations reluctant to co-create knowledge and innovate with universities. These organizations have a rather unclear long-term vision and are not actively involved in supporting SDG education or understanding the universities' training needs. The second cluster is represented by francophone organizations willing to strengthen the relationship with universities and to co-create value, developing students' entrepreneurial skills and cooperating on the adaptation of the academic curriculum to labor market requirements.

Originality/Implications: The originality of this paper consists in conducting exhaustive research among francophone organizations in Romania, with significant practical and social implications for strengthening the strategic university-business environment

partnership and identifying solutions to improve knowledge co-creation and sustainable education within a proper university governance.

Keywords: Cooperative/collaborative learning, Data science applications in education, Teaching/Learning strategies, Education, Environmental studies and sciences, Sustainable development goals, sustainable education, Stakeholders

HIGHLIGHTS

- Through knowledge co-creation the university-business relation is strengthen
- Modern universities tend to adapt their curriculum according to requirements of the labor market
- The two-step cluster analysis allows the identification of relevant clusters of organizations involved in knowledge co-creation
- The first cluster consists of francophone organizations reluctant to collaborate with universities
- The second cluster consists of francophone organizations willing to strengthen the relationship with universities and to co-create value

INTRODUCTION

In a society based on sustainable development goals, knowledge, entrepreneurship, innovation, and digitization (Avila et al., 2017; Mubarak et al., 2021), collaboration of universities with the business environment has become increasingly stringent and relevant, co-creating knowledge, developing new student skills and abilities, and supporting sustainable education (Coatney and Poliak, 2020; Throne and Lăzăroiu, 2020; Cunningham, 2021). When adapting the academic curriculum to labor market requirements (Grant, 2021; Suler et al., 2021; Valaskova et al., 2021), it is vital to support sustainable education, implementing sustainable development principles within all didactic, research and administrative processes of the university (Barnett et al., 2001; Dabija et al., 2014; Dabija et al., 2017; Pop et al., 2020). Internal and external stakeholders and their role in raising awareness and implementing subsequent strategies should also be involved. Internal stakeholders might be teaching and administrative staff, management, or students (Pocol et al., 2018), while external stakeholders consist of social and economic partners, and public local, regional, or national authorities, companies, organizations, etc. (Aleixo et al., 2018; Novo-Corti et al., 2018; Veiga et al., 2019; Maiorescu et al., 2020).

In the landscape of sustainable development goals (SDG) and within the framework of sustainable education (Trencher et al., 2017; Kunkel and Tyfield, 2021), universities are unique providers of scientific knowledge, skills and abilities concerning contemporary political, cultural, economic, technological, and societal changes. They must continually provide new and updated examples of the best social, technological, and entrepreneurial practices, relying on up-to-date information from stakeholders. The co-creation of knowledge in conjunction with socio-economic organizations is a main SDG and sustainable education desideratum, requiring universities to redefine their mission from generating knowledge as a means per se to identifying and/or developing appropriate solutions to contemporary societal issues and challenges. It also involves triggering sustainable societal transformations through permanent information exchange with relevant stakeholders (Van Veen et al., 2013; McCormick et al., 2016; Trencher et al., 2017). The development of a strategic partnership with socio-economic stakeholders becomes increasingly stringent for universities. Through the lectures delivered by representatives of these organizations, workshops and practiced communities, knowledge can be co-created (Kolb, 1984; Rinkus and O'Rourke, 2020; Stanca et al., 2021), and students can develop entrepreneurial dexterity, expanding their knowledge and learning new skills by interacting with brand specialists.

By cooperating with private and public organizations, universities enter a two-way partnership. The academic partner benefits in many ways, such as enhanced impact of applied research, enhanced education opportunities for students, and easy insertion on the labor market for students. The business partner similarly benefits in various ways, from accessing world-leading innovation and research to growing and developing internal capabilities. Involving company representatives in teaching and/or researching might increase the attraction of the university amongst prospective students, and enable the development of collaborative research, support innovation in SMEs, and consultancy and advice, supporting internships and placements for students, easing graduate employment and providing Continuing Professional Development (Chankseliani et al., 2021). As the main role of universities lies in teaching, and also research and development, higher education institutions are unique providers of scientific knowledge, skills, and abilities concerning contemporary political, cultural, economic, technological, and societal changes. They also provide knowledge concerning the evolution of different organizations.

Higher education offers a powerful prospective for societal development (Oketch et al., 2014; McCowan, 2016; Owens, 2017). From their original inception, higher education institutions played an essential role in society, educating the elite, and generating knowledge in natural sciences and humanities. The first Western-style universities emerged in Medieval Europe, and, despite their exclusivity, they sustained the progress of knowledge. With the broadening of university attendance outside the elite, higher education gained greater potential to contribute to the development of society. Universities now educate individuals from all social categories, simultaneously contributing to the development of each knowledge area and supporting the development of a peaceful, inclusive, and just

society. They conduct fundamental research and apply it for our better understanding of life and to develop practical applications on scientific knowledge.

The consolidation of the strategic business environment-university partnership thus acquires strategic importance, as it allows adequate adaptation of the academic curriculum to SDGs (Waris et al., 2021), and sustainable requirements of the labor market, students having access to sustainable education. Starting from the stakeholder theory (Miles, 2017) and examining the skills sought by organizations, this research aims, through the two-step cluster analysis method, to highlight groups of socio-economic organizations willing to engage in knowledge co-creation with universities, to support sustainable education and to adapt the academic curriculum to the dynamic, constantly changing requirements of the business environment. Knowledge co-creation is a developing field of increased relevance in contemporary society, as universities must continuously adapt to the ever changing and dynamic reality and societal trends (Brătianu and Bejinaru, 2020a; Brătianu and Bejinaru, 2020b). Strengthening the relationship between companies and universities is beneficial both for the development of students' entrepreneurship skills and sustainable behavior, and for strengthening the innovative capacity and performance of companies (Secundo et al., 2017b). From a theoretical perspective, the paper extends studies focusing on the stakeholder theory to the educational field (Dabija et al., 2017), highlighting the contribution of francophone socio-economic organizations to strengthening the strategic partnership with universities. This is necessary to co-create knowledge, develop student entrepreneurship, and support sustainable education, adapting the academic curriculum to the current requirements of the labor market and to the SDGs (Mathisen and Jørgensen, 2021). The originality of this study lies in carrying out exhaustive research among the francophone organizations and members of the most representative francophone business clubs in an emerging market (Romania).

The paper is structured as follows: **Section 1** provides a literature review on the coordinates of education for sustainability, highlighting its relevance in consolidating and developing universities, and the ways in which socio-economic organizations choose to cooperate with universities to co-create knowledge, support sustainable education, and develop students' entrepreneurial skills. *Literature Review* contains the research methodology, and *Research Methodology* covers the research results. After a description of the sample's socio-demographic features, we proceed to the implementation of the two-step cluster analysis and to cluster definition/lay-out. *Results* consists of the results discussion. The paper ends with conclusions derived from the theoretical contributions and managerial implications, along with the research limitations and perspectives.

LITERATURE REVIEW

The United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992 (ESD, 2020) stressed the importance of higher education and teaching on the implementation of the principles of sustainability according to SDGs, the UN declaring the period 2005–2014 as a Decade of Education for Sustainable Development (Piroșcă et al., 2020). The terms "sustainable education", "education for sustainable development", and "education for sustainability" (Lukman and Glavič, 2007) represent the learning process in which decisions are made on the long-term future of communities' economy, ecology, and equity (Șerban et al., 2020). Education for Sustainable Development (Neamțu et al., 2020) is now an emerging but dynamic concept, providing a holistic vision of education, aimed at convincing citizens of all ages to become more responsible, and to take an active role in creating a sustainable future (UNESCO, 2020) according to SDGs. This type of education is considered crucial for the implementation of sustainable development principles, enabling participants to make informed decisions, being fully aware of their impact and huge responsibility on the future development of society (ESD, 2020). At the same time, sustainable development education encourages participants to act responsibly for environmental integrity, economic viability and to create a safe society for present and future generations (UNESCO, 2014). The relevance of sustainable higher education in strengthening the efforts for a better future is also emphasized by Ramos (2016).

The importance of higher education and teaching in supporting sustainable development and in identifying its formative role in societal progress was first identified in 1972 at the Stockholm Conference on the human environment (Imbrișcă and Toma, 2020; Piroșcă et al., 2020), the Belgrade Charter (1975) pointing out the importance of higher education and teaching on attaining sustainability (Belgrado, 2020). In 1990, 40 representatives of different world universities signed the Talloires Declaration (Talloires, 2020; Șerban et al., 2020), which set out the educational role of universities and their immense task in raising awareness, knowledge of technologies and development tools necessary for creating a sustainable future, characterized by sustainable entrepreneurship, digitization, and innovation (Avila et al., 2017; Pan et al., 2021). In this sense, universities have multiple roles, raising awareness of the need for social sustainable development; creating a sustainability culture within organizations; educating the masses in the spirit of responsibility towards the environment and society; promoting mass literacy, regardless of students' background; involving stakeholders and socio-economic partners in specific actions based on sustainability; collaboration with the business environment on interdisciplinary approaches; promoting information to the national and international public regarding the latest sustainability initiatives, etc. (Piroșcă et al., 2020; Șerban et al., 2020).

Compared with education in the Twentieth Century, which was mainly aimed at transmitting skills and consolidating knowledge, education in the Twenty-First Century focuses on developing creativity, supporting student collaboration within the teaching-learning process and, especially, generating "soft skills", key features necessary to improving students' knowledge (Burnard, 2006; Hamidi et al., 2008; Sanina et al., 2020). University courses must facilitate students' professional

experience through pedagogical tools based on digital simulations, creating practice communities, or supporting team-teaching courses and/or lectures between specialists and teaching staff (Stanca et al., 2021). These allow knowledge co-creation and a quick and easy anchoring of entrepreneurial skills among students. Co-creation of business environment-university knowledge facilitates the development of an educational product that students can easily use in the learning and practice process (Wenger, 1988; Han, 2020; Stanca et al., 2021). Resorting to a strategy of knowledge co-creation in the learning process generates a deeper understanding, knowledge, and awareness of a subject, increasing participants' motivation and enthusiasm (Bovill et al., 2011; Bovill, 2014). It also leads to the improvement of learning and collaboration skills (De Jans et al., 2017; Sanina et al., 2020). The development of entrepreneurial skills as a result of knowledge co-creation can transform students into agents of change (Dunne and Zandstra, 2011) who run or become more involved in research projects, obtain scholarships (Werder and Otis 2010), and enjoy various university collaborations, improving the teaching-learning process (Buckley, 2014). They are more likely to participate in course reviews (Rock et al., 2015) and get involved in consulting (Huxham et al., 2017), developing their own businesses (Cook-Sather et al., 2014) and searching for ways to improve the teaching-learning environment of the university (Howson and Weller, 1996; Bovill, 2014).

Knowledge co-creation has multiple benefits for students. They participate more easily and with greater motivation in the educational process, thus improving their own self-awareness (Elsharnouby, 2015; Lubicz-Nawrocka, 2018). They develop personal creativity, communication, and talent, are better able to cope with the positive dynamics of groups (Brandt et al., 2008), and actively learn taught content. Knowledge co-creation thus overlaps with the concept of active learning, involving students in active participation in teaching-learning, encouraging them to interact and contribute to a smooth teaching-learning process, identifying best solutions to existing problems, and strengthening relationships with teaching staff and business environment representatives (Bovill, 2020). Thus, education is perceived as a common effort in which teaching and learning are done *with* students and not *for* students (Cook-Sather et al., 2014), a transition towards a sustainable education. Supporting an education focused on sustainable development goals and principles must aim to define an institutional strategy which includes all stakeholders' efforts oriented towards generating knowledge and intellectual capital through continuous collaboration between universities and the business environment (Elena-Pérez et al., 2011; Shi and Lai, 2013; Pop et al., 2020).

In support of entrepreneurial education based on sustainable development principles, an important role is played by the existence of financial resources, universities being largely dependent on the financial support of governments and socio-economic organizations (Owens, 2017; Ávila et al., 2017; Aleixo et al., 2018). Research budget justification before socio-economic partners has become increasingly difficult because the adaptation of the academic curriculum to sustainable development requirements is a broad and long-term process (Godemann, 2006; Şerban et al., 2020). The transposition of sustainability principles to budget requirements may be considered a theoretical approach without any practical relevance (Aleixo et al., 2018; Veiga et al., 2019; Maiorescu et al., 2020).

The literature (Grecu and Ipina, 2015; Argento et al., 2020) reveals that a sustainable university is based on the synergistic action of three vectors: the internal approach which focuses on the university campus and all those who gravitate around it; the external approach which focuses on the community and relationships which develop with socio-economic partners, namely students and their knowledge, skills, competences; and the value of sustainability principles transmitted to them (Şerban et al., 2020). Sustainable education revolves around knowledge co-creation, improving the essential skills of collaborative work (Bovill et al., 2011; Blau and Shamir-Inbal, 2017; De Jans et al., 2017). Students who have acquired such co-created knowledge through business environment-university cooperation tend to identify opportunities in the labor market faster and more efficiently (Magni et al., 2020), have better understanding of what they are working on, and are more aware of the importance of their efforts (Salas Velasco, 2014; Blau and Shamir-Inbal, 2017; Pandey et al., 2017; Stanca et al., 2021).

Education for Sustainable Development (ESD) is based on creating an institutional "ecosystem", designed to provide support services which can quickly and efficiently respond to students' and employers' needs on the issues and challenges of applying sustainability principles to all current fields and activities (Nookhong and Nilsook, 2017; Jakob, 2020). The challenge of implementing Education for Sustainability consists in the need for a pedagogical and didactic base which allows this type of student training and transmission of appropriate skills (Disterheft et al., 2015; Maiorescu et al., 2020). In this sense, universities need to rethink their academic curricula, better adapting them to the requirements of the labor market in accordance with the training needs expressed and expected by employers (Plăiaș et al., 2011). They need to introduce aspects which both allow the sustainable consolidation of taught content (Jora et al., 2020), and which support and increase public awareness on the concept of sustainable development, its dimensions, and principles, enhancing a mentality in favor of the concept. There should also be adequate training of academic staff on the correct understanding of sustainable education and transposition of its principles in taught subjects (Maiorescu et al., 2020), namely its harmonious integration within the curricula (Jora et al., 2020). A mentality favoring the concept of sustainable development will allow students not only a better understanding of the sustainability concept and how to apply and put it into practice, but also of the responsible training/formation, which will allow them to become true promoters of sustainable change in both their personal and professional life (Mulà et al., 2017; Piroșcă et al., 2020). It would also enable students to make responsible decisions and to engage in concrete actions within the context of social, economic, and environmental challenges (Annan-Diab and Molinari, 2017; Maiorescu et al., 2020). Knowledge co-creation simulates involvement in the teaching-

learning process, increasing the attraction of learning, and developing motivation and enthusiasm, students being increasingly passionate about digital solutions applied to education (Blau and Shamir-Inbal, 2017). Co-creation establishes a lasting dialogue between students and instructors (Bovill, 2014), making them responsible through learning and letting them realize that they are taken seriously by others. As a result, students and teaching staff tend to appreciate collaborative pedagogical planning processes more than the products of learning (Bovill et al., 2011; Pandey et al., 2017).

RESEARCH METHODOLOGY

Starting from evaluation of the need to train and adapt the academic curriculum to the requirements of the labor market, we implemented research based on the survey technique, using the questionnaire as a working tool. The aim was to carry out a study oriented towards identifying groups of francophone organizations with homogeneous practices concerning collaboration with universities, development of student entrepreneurship and consolidation of strategic partnerships, to support sustainable education and to adapt the academic curriculum to the needs of the labor market (Johnson and Nica, 2021; Lăzăroiu and Harrison, 2021; Novak et al., 2021), by using appropriate statistical techniques to obtain stable and solid conclusions. The exhaustive study, conducted in 2020, was aimed at all 45 companies included in the Annuary of the Francophone Companies from Transylvania, Romania, and was the first of its kind. Data sampling followed prescribed steps (Dillman, 2000). The survey was disseminated to all 45 enterprises during May-July 2020. A total of 45 questionnaires were collected, having promoted the study as follows: firstly, a one-page notification presenting the research objectives was sent. The companies agreeing to partake in the study received a letter of intent and credentials for the online questionnaire. Forty-five questionnaires were valid, which means that all items were evaluated. To test non-response errors, we compared the first third (early respondents; $n = 15$) to the last third ($n = 15$) in terms of all latent and control elements: business turnover, type of activity (family firm or not, listed on the market or not, subsidiary or headquarters). The results of the tests indicated no significant differences between the two groups ($p > 0,1$), suggesting that non-response bias is not a significant concern in this study. The control elements employed were recommended by the literature (Nekhili et al., 2017): business turnover, type of business (family-owned firm or not, listed on the market or not, subsidiary or headquarters).

The obtained results aimed to identify hidden models/patterns in the form of clusters/typologies of francophone organizations according to the extent to which they adopted and implemented sustainable development practices which contributed to strengthening the relationship with universities and supported long-term sustainable development, along with knowledge co-creation in accordance with the specialty literature recommendations (Hambrick, 1983; Ketchen and Shook, 1996; Munn, 2018). All statistical analyses were performed using SPSS version 13.0 for Windows, while the tests were two-tailed and statistical significance was defined as a value of $p \leq 0.05$. The data were collected using a questionnaire and dichotomous scale to measure whether the three economic, social, and environmental dimensions influenced the involvement of francophone organizations in the process of reorganizing the academic curriculum.

The statistical analysis scenario was as follows: descriptive analysis, verification of collected data validity and advancement of reliability tests to concentrate data in precise factors by purifying measurement scales. These analyses involved performing the nonparametric Chi-Square Test for Independence/association, the Kruskal-Wallis, and the Marginal Homogeneity Tests.

The stage of verifying the validity of the questionnaire required the use of reliability tests to concentrate the data collected in precise factors by purifying the measurement scales and identifying the main dimensions created by analyzing the factors using Varimax rotation. According to the literature (Drugan et al., 2005; Brown, 2006), factor analysis assumes that a small number of latent constructs are responsible for the correlations between many observed variables. Thus, factor analysis was used to identify latent constructs that could not be directly observed in the studied variables. According to Drugan et al. (2005) and Brown (2006), to select the components of specific factors, a measurement model with a value greater than 0.6 is considered reliable. Internal consistency analysis has as its calculation step the alpha coefficient which is a measure of the correlation square between the observed score and the actual score, according to Robinson et al. (1999); if its alpha value is higher than 0.7, there is high reliability. If the alpha value is lower than 0.3, there is low reliability. The interpretation of the results was performed according to the literature (Popa, 2008; Opariuc, 2012). The analysis proceeded with "Principal Component Analysis (PCA)" to select the number of key components or to identify the final factors and tested the multicollinearity of our dataset without loss of information. This analysis was used to transform the variable space into an optimal space (Brown, 2006). The analysis began with the determination of the Kaiser-Meyer-Olkin test, which establishes whether a questionnaire has a medium degree of confidence or consistency, so that its results are the same over time and can be used in scenarios like those discussed in this article.

The exploratory factorial analysis was applied to identify the latent dimensions/constructs in which the observed items were grouped using the Varimax rotation (Drugan et al., 2005; Brown, 2006). To select the number of main components or to identify the final factors, the multicollinearity of our dataset was tested without loss of information (Brown, 2006). The last step was dedicated to cluster analysis. Cluster analysis is an exploratory technique of data systematization, used in various fields due to its very good partitioning capacity (Auyero, 2000; Johnson and LeBreton, 2004; Okazaki, 2006; Wilks, 2011), facilitating the identification of latent structures (sustainable development practices) among the observed variables. This analysis also allows inherent homogeneity between groups (Okazaki, 2006; Nijman, 2010; Wu et al., 2016). For the automatic determination

of the number of existent clusters in a mixed dataset (dichotomous, ordinal, and nominal data, which may be more informative for the studied topic -see Kent et al., 2014), the two-step cluster analysis method was used, according to the literature specifications (Ichino and Yaguchi, 1994; Bacher et al., 2004; Enachescu, 2009). The two-step cluster analysis is more efficient for continuous variables when the sample is large (>200) and for dichotomous variables when the sample is smaller than 200 (Garson, 2020). Model adjustment was evaluated by the Bayesian Information Criterion (BIC) of Schwarz and evaluated by the silhouette coefficient which evaluates cluster cohesion and separation measures. BIC is a criterion for selecting the model from a finite set of models; the model with the lowest BIC is preferred (Gideon, 1978). The Silhouette coefficient is an internal validity index which usually varies from 0 to 1: the closer it is to 1, the better the model. The lowest BIC value accompanied by the highest values of the BIC change (i.e., the ratio between the changes in the BIC values and the distance ratio) and an average of the silhouette coefficient equal to or above 0.50 indicate a good adjustment model (Kaufman and Rousseeuw, 1990; Dinh et al., 2019). Due to the data dichotomous character, the two-step cluster analysis method was used, being considered suitable for identifying/determining the optimal number of clusters (Mooi and Sarstedt, 2011). The application of this method allowed for the identification of two profiles/clusters of francophone organizations. Then, we proceeded to an investigation of derived groups concerning the social dimension (Working language in francophone organizations; Situations of French language use; French as a recruitment criterion; Francophone organization interacts with the university), socio-economic-cultural dimension (Green campus management; Active/passive involvement in the university; Identification of training needs), and economic dimension (Type of employment contract; Action market), namely social (Participation in innovation fairs). Following Okazaki (2006), Nijman (2010), and Wu et al. (2016), we decided that cluster analysis was appropriate for our study to determine the degree of heterogeneity of sustainable development practices adopted by the various categories of francophone organizations in the sample. Thus, this research extends the numerous approaches available in the specialty literature which resorts to the use of the two-step cluster analysis (Chiu et al., 2001; Bacher et al., 2004).

Amongst the many available approaches in the literature, the two-step cluster analysis (Chiu et al., 2001; Bacher et al., 2004) is indicated, because it can manage dichotomous, ordinal, and nominal data, which can be better systemized (Kent et al., 2014). The dichotomously measured data facilitated the classification of practices used by organizations, illustrating the way in which questionnaire items measured the sustainability dimensions (economic, social, and environmental), their presence determining the degree of involvement of organizations examined in the process of restructuring the academic curriculum. The most frequently used methods of grouping organization profiles are the hierarchical ones (Cotrena et al., 2017; Crouse et al., 2018; Lewandowski et al., 2018) or the k-means (Lee et al., 2015). Because such methods present different limitations (exclusive applicability to continuous variables, assuming distribution normality and arbitrary choice of cluster number - see Bacher et al., 2004; Mooi and Sarstedt, 2011), the two-step cluster analysis was used. This allowed the disclosure of natural groupings from the examined dataset, also favoring the examination of categorical and continuous data, thus enabling the automatic determination of cluster numbers from an existent dataset (Mooi and Sarstedt, 2011).

RESULTS

Socio-Demographic Characteristics of the Sample

The research was attended by representatives of 45 companies activating in various fields (agri-food; architecture, real estate, interior design; trade; consulting; energy, water, and the environment; industry, construction, and public works; logistics, transport and related activities; recruitment and professional training; general services; banking and established insurance; communication and public relations; and information and communications technology). The training needs of these companies were accomplished either by analyzing the external environment of the francophone organization (political-legal, socio-economic, technological, natural), or by their own medium and long-term strategy, depending on the investments afforded by francophone companies/organizations, necessity of human resources, investment opportunities, targeted trade policy, etc. The sought-out profile of potential employees (**Table 1**) largely depended on the field's specificity, but most companies preferred economic graduates.

Applying the Two-step Cluster Analysis

The first step in applying the two-step cluster analysis aimed at the descriptive analysis of data obtained from the 45 companies. The result of the reality-validity analysis highlighted an alpha Cronbach of 0.710 (>0.7), Mean = 15.40; Std.Dv. = 4.202, which denotes a sufficient fidelity of the items used to measure the degree to which the collaboration between companies and universities contributed to knowledge co-creation, development of students' entrepreneurship and consolidation of the strategic business environment-university partnership to support sustainable education and adaptation of the academic curriculum to the sustainable requirements of the labor market. It was found that 31.1% (14) of the examined companies did not use French in their activities, while for 68.9% (31), French was one of the usual working languages. Companies requested the use of French in communication with business partners (62.2%–28 entities), for advertising job offers, and for the initial or continuous training of employees (37.8%–17 francophone organizations). The recruitment of new employees was done in French by 42.2% of companies (19 entities).

The second step of the cluster analysis aimed to test the association between francophone organizations which were actively involved in strengthening the relationship with universities to co-create knowledge, develop students' entrepreneurship, and strengthen the strategic university-socio-

TABLE 1 | Profile of companies.

Companies: Field of activity and processed markets	Employees: Number, period, spoken languages	Employees profile according to previous educational path
Agri-food (4.44% of the sample), active since 2006 on national level, since 2009 on regional level and since 2016 on international level	LTD: 1–9; employees on determinate period according to needs and on indeterminate period; French speakers	• EBA.
Architecture, real estate, interior design (6.67% of the sample), active since 2009 on national level, since 2011 on regional level and since 2015 on international level	LTD: 1–9; LC: 250–999; employees on indeterminate period; speakers of French, English, but also other languages	• EBA; P; S and T
Trade (11.11% of the sample), active since 2006 on national level, since 2008–2010 on regional level and since 2017 on international level	LTD: 1–9; LTD: 10–49; LC: 1,250–9,999; employees on determinate and indeterminate period according to necessities; speakers of French, but also other languages	• EBA; LS; S and T • No university experience
Consulting (20.00% of the sample), active since 1994 on national level, since 2003 on regional level and since 2011 international level	AP; LTD: 1–9; 10–49; LC: 1,250–9,999; employees on determinate and indeterminate period depending on necessities; speakers of French, but also other languages	• EBA; HSS; P; S and T
Energy, water, and environment (4.44% of the sample), active since 1856 on national level and since 1991 on regional level, international market.	LC: 50–249; over 1,000 employees; employees on indeterminate period; speakers of French, but also other languages	• EBA; LS; S and T
Industry, construction, and public works (28.89% of the sample), active since 1977 on national level, since 2000 on regional level and since 2013 on international level	LTD: 10–49; LC: 50–249; branch of multinational companies with over 1,000 employees; employees on determinate and indeterminate period depending on necessities; speakers of French, but also other languages	• Any type of previous education, companies organize their own training, qualifying employees according to their organizational needs
Logistics, transport, and related activities (6.67% of the sample), active since 2010 on national level and since 2014 on international level	LTD: 1–9; employees on indeterminate level; speakers of different languages	• EBA; Engineering; S and T
Recruitment and training (6.67% of the sample), active since 2001 on national level, since 2007 on regional level and since 2010 on international level	LTD: 10–49; employees on indeterminate period; speakers of different languages	• EBA; P
General services (2.22% of the sample), active since 2015 on national level, since 2016 on regional level and targeting the international market.	LTD: 250–999; employees on indeterminate period; speakers of different languages	• EBA; HSS; P
Banking and insurance (2.22% of the sample) active since 1999 on the national market.	LTD: 10–49; employees on indeterminate period; speakers of different languages	• EBA; S and T
Communication and public relations (2.22% of the sample), active since 2015 on national level	LTD: 10–49; employees on determinate and indeterminate period depending on necessities; French speakers	• EBA; HSS; LS.
Information and communications technology (4.44% of the sample), active since 2015 on national level, since 2016 on regional level and targeting the international market.	LTD: 10–49. employees on determinate and indeterminate period depending on necessities; speakers of French, but also other languages.	• EBA; P; S and T

AP = authorized person; LG = large corporation; LTD = limited liability company; EBA: = Economics and business administration (economics, accounting, management, marketing, human resources); HSS = Humanities and social sciences (psychology, sociology, political sciences); LS = legal sciences; P = Philology (letters, languages, art); S and T = Science and technologies (mathematics, computer science, biology, chemistry).

economic organizations partnership, to support sustainable education and to adapt the academic curriculum to the sustainable requirements of the labor market. The analysis revealed that they used French for recruitment (Chi-Square = 9.308; p-value = 0.002), and as an official working language within the francophone organization (Chi-Square = 6.231; p-value = 0.013), which reveals the existence of an association between the two variables, as they are not independent. At the same time, the behavior of francophone organizations was tested according to their degree of involvement (active/passive) in relation to the university, a decisive aspect in strengthening the relationship between the two entities to support entrepreneurial education, sustainable education, and curriculum adaptation to the sustainable requirements of the labor market. Thus, the Chi-Square Test for Independence/association was applied between them (Chi-Square = 32.2915; p = 0.000), the result revealing that

TABLE 2 | The Kurskal-Wallis test result for francophone organizations.

Variable/Dimension	Chi-square	*p*-value
The working language within the francophone organization	3.964	0.860
The degree of French use within the francophone organization	7.079	0.528
French as a recruitment criterion	13.479	0.096
Knowledge co-creation between the francophone organization and the university	19.229	0.014
Green management of the university campus	6.275	0.616
University active/passive involvement in developing students' entrepreneurship	16.419	0.037
Identifying training needs within the francophone organization	8.984	0.344
Employees' contract type (on determinate/indeterminate period)	12.547	0.128
Economic (action market)	11.584	0.171
Participation in innovation fairs	16.336	0.038

TABLE 3 | The Marginal Homogeneity test for francophone organizations.

	Mean (MH) statistic	Std. Deviation of MH statistic	*p*-value
Involvement and activity sector	168	25.436	0.000
Enterprise interacts with university and activity sector	175.500	24.233	0.000
Activity sector and innovation fair	171.500	24.794	0.000
Action market and activity sector	212	18.166	0.000
Employee contract type and activity sector	190.500	22.400	0.000
Identifying training needs and activity sector	178	24.073	0.000
Campus management and activity sector	163.500	26.005	0.000
Work language in the organization and activity sector	176	24.228	0.000
Status of French language use and activity sector	170	25.150	0.000
French as a recruitment criterion and activity sector	171	25.060	0.000

MH—Marginal Homogeneity.

knowledge co-creation took place through various forms of knowledge/skills transmission to university courses, workshops with practice specialists, innovation fairs, etc.

In *the third step*, the null statistical hypothesis (H_0) was verified, according to which francophone organizations did not involve themselves differently, depending on the activity field, when supporting knowledge co-creation with the academic environment, development of students' entrepreneurship and consolidation of strategic business environment-university partnership in order to support sustainable education and to adapt the academic curriculum to the sustainable requirements of the labor market. The alternative hypothesis (H_1) shows that francophone organizations highlighted different involvement behavior depending on the activity field and perception of collaboration with the university as an important constituent of developing entrepreneurial academic education and of strengthening the strategic business environment–university partnership, to support sustainable education. To verify this hypothesis, the Kurskal-Wallis test was applied for independent and unequal samples, the result being summarized in **Table 2**.

Table 2 shows that francophone organizations participating in this research highlighted a different involvement in perception of the relationship with the university, in knowledge co-creation with the academic environment (Chi-Square = 19.229; *p*-value = 0.014), in development of students' entrepreneurship (Chi-Square = 16.419; *p*-value = 0.037), and in consolidating the strategic business environment-university partnership to support sustainable education and to adapt the academic curriculum to the sustainable requirements of the labor market by participating in joint workshops and innovation fairs (Chi-Square = 16.336; *p*-value = 0.014).

In *the third step*, the null statistical hypothesis (H_0) was tested, according to which the francophone organizations included in this research did not highlight, depending on their activity field, a homogeneous behavior concerning the examined items (**Table 3**). The alternative hypothesis (H_1) specifies that the examined francophone organizations highlighted, depending on the activity field, a homogeneous behavior on the studied items. The result of the Marginal Homogeneity test requires the rejection of H_0 and the acceptance of the alternative (H_1).

The results from **Table 3** highlight the fact that the francophone organizations included in the sample were relatively homogeneously involved in co-creating knowledge with the academic environment, respectively, in consolidating and enhancing the partnership with the examined university. In fact, depending on the industry in which they activated, these francophone organizations made considerable efforts to support interaction with the university, always seeking to innovate and positively contribute to co-creating knowledge, values, and relevant projects for the sustainable development of the higher education institution, to consolidate the transmitted knowledge to the participants and to support cooperation endurance.

In *the fifth step*, experts resorted to testing the hypothesis of the Anova Friedman test concerning the study's unilateral dimension. According to the null hypothesis H_0, we assume that there were no differences generated by the vision of the

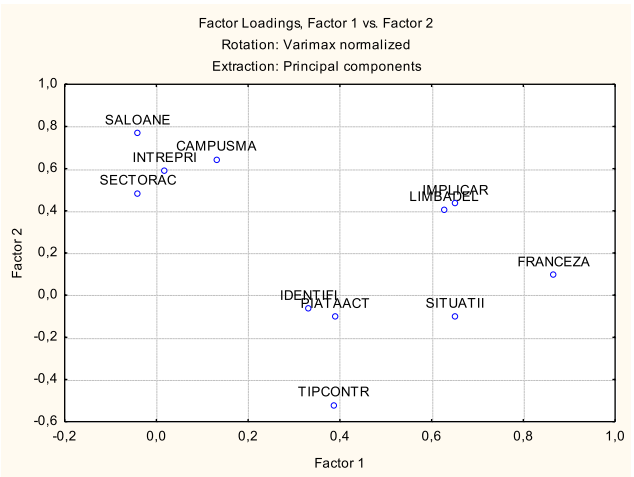

FIGURE 1 | Result of principal component analysis.

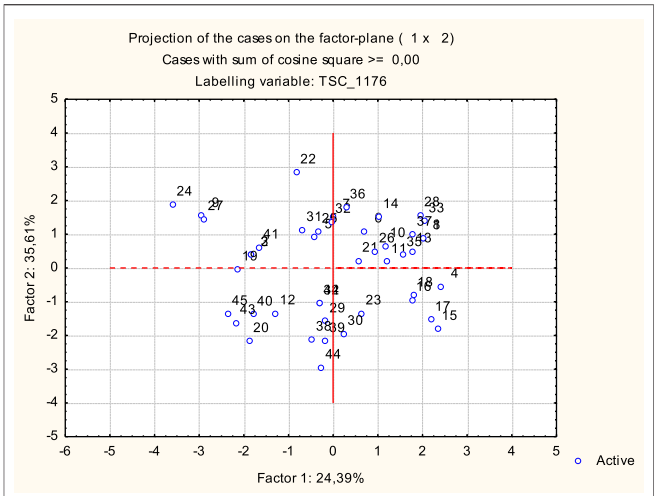

FIGURE 3 | Distribution of francophone organizations studied in clusters.

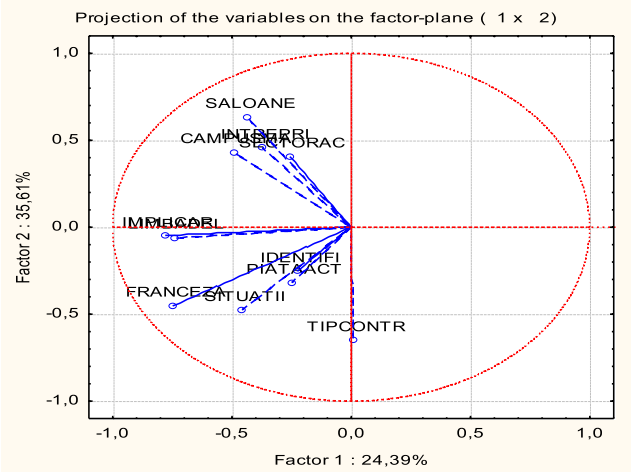

FIGURE 2 | Projection of the variables on the factor-plane coordinates and the variation explained by each factor resulted from the PCA—correlation circle.

francophone organizations' representatives as to the role of their interaction with the university to co-create knowledge. In other words, the questionnaire items did not allow the identification of different views of the francophone organizations' representatives concerning the role of their interaction with the university to co-create knowledge. On the other hand, according to the alternative hypothesis H_1, we assume that there were differences generated by the vision of the francophone organization representatives concerning the role of their interaction with the university to co-create knowledge. Thus, the questionnaire allowed the identification of different views of the francophone organization representatives as to the role of their interaction with the university to co-create knowledge. According to the ANOVA Friedman test result (Popa, 2008) (Chi-Square = 355.283; p-value = 0.000) H1 is accepted, so the research tool (questionnaire) was suitable to identify differences in vision of the francophone organization representatives concerning the role of their interaction with the university to co-create knowledge, to develop students' entrepreneurship and to strengthen the strategic business environment-university partnership in order to support sustainable education and to adapt the academic curriculum to the sustainable requirements of the labor market. Therefore, *the sixth step* was possible, for the application of factor analysis on the collected data. Elements whose correlation was lower than 0.3 were eliminated from the factorial analysis, an inexistent aspect of this study. The value of the Kaiser-Meyer-Olkin test of 0.466 confirms that the factor analysis was suitable for the examined model, and that data variability was due to the data collection tool, the factorial analysis being implementable. The result of the Bartlett test p = 0.000 indicates the fact that the factor analysis was useful for the given data. According to Kaiser's criterion (in communities, values must be over 0.4) the latent root was made up of variables such as: construct type degree, action market, activity sector, presence in innovation fairs.

The seventh step of the research aimed at testing the null statistical hypothesis (H_0) according to which it was assumed that there was no set of restricted variables/items. The rejection of this hypothesis allows us to accept the alternative one (H_1), which means that there was a small set of elements determining the validity of the research tool in proportion of 60.296% (items in the research were moderately correlated with each other in the studied scenario). The analysis continued by determining the degree to which the indicators' dispersion was explained by the extracted factors: most of the variables are well represented by the used factorial model, the result being plotted in **Figures 1**, **2**. These figures contain the relations between the examined indicators, including the items which jointly contributed to generating similar information, i.e., those which were positively or negatively correlated. It was thus determined that the examined francophone organizations highlighted different

involvement behavior in perceiving their relationship with the university as a component of developing an entrepreneurial education oriented towards sustainable education, having different interactions with the university.

We went on to identify the behavioral typologies (hidden models) of francophone organizations by using clustering methods. The optimal result of the two-steps cluster analysis was of two clusters. The quality of the two-cluster model was good: average silhouette coefficient, taking the value of 0.50, which indicates a reasonable cluster structure (Gideon, 1978). The connection between the two clusters and the answers of the francophone organizations' representatives was evaluated by applying the Chi-Square test, the examined statistical significance being for $p < 0.05$. The obtained clusters are characterized by the fact that the value of interclass inertia significantly exceeds the values of the intraclass inertia. The set of representative attributes for cluster formation are as follows: French as a working language (Chi-square = 14.852; p-value = 0.0001); the degree of French language use in francophone organizations (Chi-square = 3.087; p-value = 0.079); knowledge of the French language as a recruitment criteria (Chi-square = 5.908; p-value = 0.0151); consolidation of the strategic business environment-university partnership to adapt the academic curriculum to the sustainable requirements of the labor market (chi-square = 16.442; p-value = 0.001); green management of university campus (Chi-square = 6.008; p-value = 0.014); active/passive university involvement in students' development of entrepreneurship (Chi-Square = 18.799; p-value = 0.002); participation in innovation fairs (Chi-Square = 15.855; p-value = 0.001) (**Figure 3**). Based on this set of attributes, the following two profiles of francophone organizations resulted.

Cluster 1: Francophone Organizations Reluctant to Form Academic Relationships

This cluster included 26 organizations from the pro-French business environment in Romania (57.78%), which did not consider that the idea of collaboration with a university could lead to innovation and knowledge co-creation, namely, to deepening and developing the university-entrepreneurial environment partnership. Although these francophone organizations were active nationally and regionally in the represented industries, they were not actively involved in holding workshops and professional fairs, but nonetheless wished to increase their student recruitment efforts and activities for practice stages and internships within their own companies. These francophone organizations mainly developed business relationships with partners willing to accept their operation mode, being somewhat reluctant to cooperate with higher education institutions to co-create knowledge (as the literature also suggests, see Galan and Plewa, 2016), understand the exact training needs, or carry out study programs with entrepreneurial components, thus supporting universities in their mission to train future entrepreneurs according to sustainable development goals and principles (Adams et al., 2021; Wallace and Lăzăroiu, 2021). Although they stated that they identified their training needs by analyzing the company's external environment, resorting to relevant and in-depth analysis of political, legal, economic, social, technological, and environmental aspects, etc., they still had no clear long-term vision of turning the academic partnership into a synergistic and holistic one.

Cluster 2: Francophone Organizations Willing to Consolidate the Relationship With the University and Co-Create Entrepreneurial Value for Students.

This cluster consisted of 19 francophone organizations active on the national, regional, and international market (42.22%), which used the French language when conducting organizational processes and in recruitment, their expectations from the relationship with universities revolving around the idea of consolidating the student-companies relationship. The francophone organizations in this cluster were willing to cooperate, to contribute to the development of students' entrepreneurial skills and to consolidate the strategic business environment-university partnership to adapt the academic curriculum to the sustainable requirements of the labor market.

These francophone organizations actively participated in professional innovation fairs, professional projects, job interview simulations, presentations of company members' professional success, etc., as well as contributing to organizing workshops, entrepreneurial courses, and other forms of knowledge/competence transmission, being always prone to strengthen the relationship between universities and francophone organizations. Through the positive valorization of training within universities, these companies acknowledged and supported the university's educational mission. Their long-term vision was aimed at adequately identifying training needs and students' skills development concerning trade policy, investments, company organization, human resources, and other organizational processes.

DISCUSSIONS

The analyses carried out revealed that the francophone organizations showed homogeneous behavior in their activity field; nevertheless, they had a different degree of involvement in the development of entrepreneurial education capable of orienting the academic curriculum to the sustainable requirements of the labor market (Kovacova and Lăzăroiu, 2021; Nica, 2021; Woodward and Kliestik, 2021). On the one hand, it was found that some of the companies participating in the research were constantly involved in consolidating and enhancing their relationship with universities, making consistent efforts in support of the development of entrepreneurial education and contributing to the organization of joint activities through which students could have access to contact with the business environment representatives. The importance of synergistic collaboration between the economic environment and universities has also been emphasized by Secundo et al. (2017a), who highlighted the multiple practical

implications which could be obtained by companies, students, and educators who jointly project innovative learning initiatives to support entrepreneurial education. Strengthening the relationship between companies and universities is beneficial both for the development of students' entrepreneurship and for training their sustainable behavior, as well as for strengthening companies' innovative capacity and performance (Choi and Markham, 2019). These results are compatible with previous research highlighting the role of workshops and courses organized in conjunction with the business environment to develop students' skills and abilities and facilitate their access to the labor market (Stanca et al., 2021). However, there were also companies which did not fully perceive the relevance of involvement in supporting entrepreneurial education. In this case, there is a need for greater awareness, on behalf of the academic environment, on the importance held by francophone organizations in facilitating graduate students' access to the labor market. The development of collaboration and value co-creation between francophone organizations and universities in an organized framework is a catalyst for consolidating an entrepreneurial education oriented towards sustainable education, innovation, and economic development (Ahlstrom, 2010; Hockerts and Wüstenhagen, 2010; Rafique et al., 2021). This is the only way we can contribute to the adequate training of human capital on entrepreneurial values principles (Purser et al., 1995; Gagan et al., 2021). Therefore, we consider that the entrepreneurial approach of higher education oriented towards sustainable development is one of the ways to support the promotion of such ideas within the conventional curriculum limits and the dominant institutional logic.

Although knowledge co-creation, along with active learning, contributes to better knowledge anchoring among students, only a relatively small number have access to such a learning form (Freeman et al., 2014). Higher education institutions should introduce active learning and knowledge co-creation within a strategic partnership with the business environment in more and more scientific fields, especially those with obvious entrepreneurial values (Kuh, 2009). Based on active learning, a sustainable education can be obtained, and training provided to students open to change, capable of acting cooperatively, thinking independently, making decisions adapted to new learning contexts, discussing, analyzing critically and creatively, and reaching the most pertinent conclusions for each existent problem, based on theoretical and practical experience assimilated from specialists (O'Donoghue and Cusack, 2008; Stanca et al., 2021).

Higher education must resort to active learning and knowledge co-creation based on a strategic and durable partnership with the business environment (Kuh, 2009). Based on active learning to engage students and make them adaptable to change, universities, in cooperation with the entrepreneurial environment, may convey to their students the knowledge and skills that empower them to act cooperatively, to think, to discuss, and to reach pertinent solutions for everyday issues and challenges in a holistic, critical, and creative manner (O'Donoghue and Cusack, 2008). The solution of sustainable education supported by this article is based on the identification of stakeholders' particular role within higher education, facilitating the co-creation of knowledge and active learning. Students and/or course attendees of the higher education institution gain a solid foundation in core disciplines, thus developing creative, critical, and collaborative skills, through practical training sprinkled with interactions with representatives from the business environment within specialized workshops, conferences, etc. At the same time, these attendees have the unique opportunity to build character traits, such as attention, curiosity, courage, and resistance (Maguire et al., 2013), which will enable them to use these opportunities to support their creative ideas and entrepreneurial endeavors in the future. Sustainable knowledge co-creation is considered possible (Freeman et al., 2014; Rubio et al., 2020) especially 1) as a superficial change: a co-creation project in which a small group of students' re-design a course previously studied that might not have been updated much in recent years, or 2) as a seismic change: teaching staff modify the entire teaching-learning experience by re-designing the course for each new class of students. The difficulty of implementing this endeavor resides in the fact that knowledge co-creation for a whole class requires the professor to meet the needs of every new group of students, to engage profoundly with each group at every step of their career, and to negotiate with them based on new learning situations (Doyle et al., 2021). This change is shown in the response behavior of the francophone business environment included within this research.

The solution for sustainable education based on sustainable development goals thus rests on identifying the stakeholders' features which facilitate their knowledge and active learning co-creation, students having the chance to acquire, within their academic studies, a solid knowledge base in key subjects, developing creative, critical thinking, collaboration skills, shaping their character and developing their attention, curiosity, courage, resilience, and tenacity (Maguire et al., 2013; Stanca et al., 2021). Sustainable knowledge co-creation could take place as a superficial change (Bovill, 2020), the co-creation project being intended for a small group of selected students, who re-design a previously studied course; or it could be based on systemic change, in which the student group actively and creatively contributes to knowledge co-creation, gaining learning, teaching, negotiation and course re-design experience, along with teaching staff and practice specialists. Knowledge co-creation at university course level requires the teaching staff to be capable of replying, with the help of intern specialists engaged in restructuring course contents and topics, to the training needs of the student group. This partnership with business stakeholders allows universities to achieve appropriate governance (Brătianu and Bejinariu, 2020a; Brătianu and Bejinariu, 2020b; Brătianu et al., 2021) focused on implementing a better convergence between business training needs and students' expectations and developing networks of business incubators in universities. The results could in time lead to identifying new entrepreneurial solutions, to establishing start-ups, thus having a positive impact on society, and to building common pedagogical modules among universities and enterprises.

CONCLUSION

From a theoretical perspective, the paper contributes to extending studies focused on the stakeholder theory, highlighting their role in supporting and enhancing the partnership and cooperation

between the academic and business environments. Only through continuous cooperation with socio-economic partners, can universities adapt their curricula to the latest technical, technological, and entrepreneurial discoveries, thus providing sustainable education. An academic governance would enable the transformation of the higher education institution into a center for creation and generation of knowledge within the local community, allowing the coagulation and observation of current labor market trends and developing directions for future trades. Such an academic governance, based on the principles of sustainable development, should allow the generation of know-how for the proper implementation of sustainability principles in society, creation of expertise for integrating new student generations into the labor market, and the development of social responsibility in universities.

The involvement of any type of companies and organizations in the academic environment, and the consolidation of this relationship to co-create knowledge, to organize workshops, lectures, practice communities, contributing to the development of a curriculum adapted to long-term market requirements represents the Cartesian points on which the business environment-university relationship can be sustainably developed. The involvement of different organizations in developing, maintaining, or strengthening such relationships differs, depending on countless factors. The will and motivation of organizations to implement such approaches is relatively low when devoid of the existence of an adequate external stimulus on behalf of policy makers, namely the full understanding by the educational institution leaders of the crucial importance of facilitating these relationships to increase the employability of their graduates.

The limitations of this research include the fact that only francophone companies/organizations have been examined, but the aim was to implement exhaustive research addressing all the francophone organizations in the examined region, an unprecedented aspect in specialty literature. Another limitation relates to the number of companies taking part in the study, which might be considered rather low. But this limitation is mitigated by the fact that the entire range of francophone companies operating in Romania is limited and by the diversity of profiles among the companies retained for our investigation. Future research could be extended by broadening the focus to companies whose main language is English or German. A comparison between the methods in which companies/organizations develop and strengthen their relationship with universities to co-create knowledge and sustainable development of the academic curriculum on entrepreneurial principles could also become the object of comparative studies between these developments in mature markets, with a stable market economy versus emerging or developing economies. Future studies may also consider a clustering of companies depending on their size (turnover, number of employees), or on their foundation time, namely the number of processed markets.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

CP: Conceptualization, Methodology, Formal analysis, Resources, Writing—Original Draft, Writing—Review andEditing, Supervision LS: Methodology, Software, Formal analysis, Resources, Writing—Original Draft, Writing—Review andEditing D-CD: Conceptualization, Investigation, Resources, Writing—Review andamp; Editing, Visualization, Supervision IP: Software, Validation, Resources S M: Formal analysis, Investigation, Resources.

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