


Article

# Entrepreneurial University: Catalyst for Regional Sustainable Development

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**Abstract:** The purpose of this paper was to identify collaboration opportunities between one of the most important universities in Romania and companies with production activity within the development region in which this university operates. In order to attain this goal, a survey was conducted to identify the needs of consultancy, expertise, and services for companies that operate in the Centru Development Region of Romania (RO12) and to evaluate the extent to which they are interested in cooperation with Transilvania University of Brasov. In this respect, 3506 companies were included in a panel and their managers were invited to take part in the survey. Finally, a sample of 457 companies was obtained. According to the survey results, the most used consulting services by these companies were the economic and financial ones, but the percentage of companies that have benefited from these services is low. The percentage of interviewed companies that have benefited so far from the consultancy offered by Transilvania University of Brasov is much lower (3.9%). Starting from the research results we proposed an entrepreneurial pilot model for online data analysis, based on the Tableau Public v. 2019.3 software, meant to help companies to do better promotion in order to develop their markets.

**Keywords:** entrepreneurial university; entrepreneurial model for online data analysis; sustainable regional development; stakeholder organisations; quantitative marketing research

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## 1. Introduction

Education, research, and society must combine their efforts to address sustainability issues [1]. While the important role that universities must play in sustainable development is recognised, researchers argue that it is still not very clear what universities should do. However, concerns about sustainable approaches to higher education processes are increasingly present in university development strategies [2]. A sustainable university must have efficient management, address issues of the environment and sustainable resources, have a policy of social responsibility, and apply the principles of sustainability in both research and education. Sustainability principles can be more easily integrated into a higher education institution if they are evaluated by the same system as academic performance [3]. Such principles should address managing relations with stakeholders to achieve common economic, social, and environmental objectives [4]. Universities have an important role in regional development [5–10] and a sustainable partnership between universities and business environment brings benefits to all partners [11].

Having in mind the increasingly entrepreneurial role of universities, we started our investigation from a case study about Transilvania University of Brasov, the biggest university in one of the most

important development regions of Romania. Among the strategic objectives of this university, providing services and expertise for the academic community and society plays an important role. Therefore, the research question was: “to what extent the companies from Centru Region are available to cooperate with Transilvania University of Brasov in order to increase their business activity, especially in foreign markets?”. In this respect, marketing research was carried out with the purpose of determining the companies’ needs of consultancy and the best ways in which Transilvania University of Brasov could help these to develop their businesses. The research results revealed that the percentage of interviewed companies from Centru Region that have generally benefited from consulting services is low (20.1%) and only 3.9% have collaborations with Transilvania University of Brasov. The most frequently used consulting services are economic and financial. Nevertheless, the representatives of the firms have shown openness and interest in future collaboration, which is the prerequisite for a sustainable development of the entrepreneurial university.

Based on the research results regarding the companies’ needs, an entrepreneurial pilot model was designed using the OLAP technology and Tableau Public v. 2019.3 software. This model allows users to select from a database certain companies according to various indicators such as turnover, number of employees, profit (or loss), activity code according to the Statistical classification of economic activities in the European Community (NACE) etc. Such a promotion tool could be administered by Transilvania University of Brasov and the companies could be included in the database in order to increase their likelihood to be found by potential investors or collaborators.

This paper is structured into four sections. After reviewing the scientific papers published on the topic of entrepreneurial universities, the methodology of the research conducted is described. Further, the results of the empirical investigation, the related discussions, and the pilot entrepreneurial model for online data analysis are presented. The paper finishes with conclusions, proposals, limitations, and future research directions.

## 2. Literature Review

### 2.1. Sustainable Development of Universities

Sustainable development of universities can be achieved if the barriers that arise in the fulfilment of their mission (research, teaching, and connecting research with sustainable development) are overcome by innovation [12]. A management model for a sustainable university should include four phases: developing a sustainable vision of the university, creating a mission as the basis for future university actions, establishing the policies and resources necessary to carry out the mission undertaken, and establishing a strategy for sustainability [13]. Besides the obvious advantages of a sustainable orientation for universities, i.e., a better position in the educational market and increased attractiveness for drawing new students, there is also the opportunity to become opinion-formers in society [14]. Universities can, and must, therefore, play a well-defined role in regional development [5–10] by promoting sustainable actions, since stakeholders expect them to be sustainable organisations themselves. This implies conceptual and organisational changes such as updated curricula; new study programmes in accordance with the needs identified in the labour market; newly identified financial resources; more flexible forms of organisation; internationalisation; and new strategies in human resources management [15].

The growing needs of a knowledge-based society have led to the transformation of higher education. Universities must have an entrepreneurial role in economic and social development [16] because they are drivers for innovation [17]. Entrepreneurship is considered to be a third function of universities, complementary to the other two functions (research and teaching) and involves generating, using, applying, and exploiting research results with companies and with society. The accomplishment of this mission can be achieved by assessing three interrelated areas: (1) research through technology and innovation transfer, (2) teaching, and (3) social involvement for regional and national development [18]. The entrepreneurial university is a concept that is seen as a way of development and innovation [19].

A sustainable partnership between universities and companies should lead to the progress of the partners [11] and the need to transform higher education institutions into entrepreneurial universities [20]. The concept must be integrated into the university development strategy either by providing entrepreneurial education or by implementing and promoting its entrepreneurial activities [21]. A functional market mechanism for the research activity of the universities will lead to the increase of scientific productivity and to the increase of quality in scientific research [22].

## 2.2. *The Increasingly Entrepreneurial Role of Universities*

The entrepreneurial university is an academic ideal that involves three goals: technology transfer, set up of companies, and involvement in regional development [23] through knowledge production and dissemination [24]. The creation of an entrepreneurial university requires several years of cultural and infrastructural changes and the implementation of flexible innovation policies [25]. Three levels of entrepreneurship implementation in universities have been identified in the literature: university entrepreneurship, academic entrepreneurship, and technology transfer [8]. In the triad of universities, industry, and governance, universities have the role of intermediaries, university entrepreneurship being a step forward towards a knowledge-based economy [26]. The role of the entrepreneurial university must not be reduced to profit. The university must have an appropriate management culture to survive changing economic environments and markets characterized by increasingly fierce competition [6,27]. Besides economic and social benefits, universities also face several challenges related to changing expectations, both of the academic and business community [9].

The strategy of entrepreneurial universities includes the development of internal capital for technology transfer, commercialisation of research results, and expansion of collaboration between different stakeholders for sustainable regional development [7,28]. Entrepreneurial universities represent the answer to technology transfer and start-ups, and their role in an entrepreneurial society is growing to facilitate the improvement of entrepreneurial capital and to generate a certain type of behaviour [29]. In designing the strategy for academic entrepreneurship, universities must also take into account that the most important predictors of academic entrepreneurship are individual-level attributes, experience, and the social environment [30]. The university's entrepreneurial orientation can lead to the emergence of innovative and sustainable products and the mobilisation of research resources to address regional and national economic problems [31].

An entrepreneurial university assumes the existence of internal factors, which determine advanced research activity; the existence of practices for the transfer of technology; and entrepreneurial skills, and external factors such as government support, the existence of capital for investments, and the willingness of companies to cooperate [32].

Thus, the need for closer cooperation with industry and other stakeholders appears as an identifying element of an entrepreneurial university in addition to the necessary changes in university culture, commercialisation of know-how, technology transfer, and pressure on universities to respond to regional development needs [33]. Regarding the relationship between universities and the economic environment, it has been found that firms oriented towards identifying external and innovation-oriented development strategies are more open to attaining knowledge from universities. Firms that have high technology and high absorption capacity also appreciate the links with universities [34].

In trying to achieve the third mission, universities with distinctive characteristics have different views on entrepreneurship and specific ways of interacting with the business environment [35]. Thanks to this mission, through the commercialisation of research and fostering of regional economic growth, universities play a central role in innovation in sustainable regional development [36]. Entrepreneurial universities are actively involved in innovation, generating changes in their organisation, and taking on entrepreneurial roles to gain a competitive advantage [8,27]. The concept of the entrepreneurial university has been adopted by all kinds of universities, both by traditional universities and by newer universities [33]. Universities are not uniform in terms of integrating the third mission, they are not homogeneous, and they do not have similar capacities to contribute to regional development, so their

missions are different. Thus, some specialists [37–39] argue that the difference between European and American universities in the approach of entrepreneurship is that European entrepreneurial universities rely more on the teaching mission, compared to American ones that rely more on research. However, the specialists predicted that in the future, both European and American universities would adopt reciprocal procedures to help achieve sustainable, regional development. Although several elite universities have been very successful in developing and exploiting entrepreneurial capital, most have achieved relatively modest results, even though they have made efforts to do so through the development of strategies, systems to stimulate entrepreneurial activity, and by changing the organizational structure [6].

### *2.3. Entrepreneurial Universities: Evidence from Romania*

In Romania, the initiatives to transform higher education institutions into entrepreneurial universities are still in the early stages and most of these initiatives have aimed at developing students' entrepreneurial skills. Some of these initiatives came from outside universities, for example, the International Junior Achievement Organization launched a project in 2016 to support universities in developing entrepreneurial approaches in relation to the business community and also developing entrepreneurial education for students [40]. Other initiatives started from some universities, but they were focused mainly on creating Student Entrepreneurial Societies, financed from university funds or by accessing European funds through the Operational Programme Human Capital [41,42]. Such societies aim at developing student's entrepreneurial spirit [43,44]. In 2018 the Ministry of Education decided that Romania should participate in the HEInnovate Exercise that involves the use of a guide developed by the Organisation for Economic Co-operation and Development (OECD) and the European Commission for self-assessment of entrepreneurial and innovative potential of universities [45].

Transilvania University of Brasov is also involved in initiatives that support the development of students' entrepreneurship through the Student Entrepreneurial Society [44] and the Technological and Business Incubator (it aims to transfer the results of scientific research to the business environment) [46]. A new initiative for involvement in regional development consists in creating future collaborations with companies from the Centru Region by offering an innovative entrepreneurial model useful for their promotion.

## **3. Research Methodology**

### *3.1. Background*

According to the Nomenclature of Territorial Units for Statistics (NUTS) designed by European Union (EU) [47], Centru Development Region (RO12) is one of the eight NUTS 2 development regions of Romania. This region covers 34,100 square kilometres, which represent about 14.3% of the Romania's territory. In terms of economic development, it is very dynamic, being placed third out of eight regions in Romania according to the Gross Domestic Product GDP per inhabitant in 2017. Nevertheless, this indicator represents only 60% of the EU-28 average recorded in 2017, so that Centru Region was placed in 255th position out of 323 EU regions [48]. In regard to the entrepreneurial ecosystem, Centru Region is also very dynamic and again placed in the third position out of Romanian regions in terms of new birth enterprises [49]. In this context, there is a strong need for proper strategy and collaborative models meant to stimulate local companies and to generate a sustainable economic growth.

Transilvania University of Braşov is the biggest university in the Centru Region and one of the biggest comprehensive universities in Romania, with 18 faculties and over 19,200 students. Its strategy is based on 3 pillars: (1) Education and research; (2) Collaboration and services for the academic community and society; (3) Internationalisation. Aiming toward the second strategic objective, the university seeks to become more involved in collaboration with companies from the Centru

Region in order to enhance its entrepreneurial role and to contribute to a durable development of the entire region.

As proof of its determination to play an important role in the regional entrepreneurial ecosystem, Transilvania University of Brasov has built a multidisciplinary research institute (ICDT), to enhance the university's competitiveness in national and international research. ICDT aims at effective collaboration with firms in the Centru Region, ensuring technological transfer and developing applied research, according to the regional research-development-innovation needs. ICDT was a strategic decision of the university aimed at creating an optimal environment for study, research, testing, and experimentation; concentrating a lot of technological equipment close to the study premises; ensuring the perspective of interdisciplinary collaboration by including several research centres in different fields; and providing a research space to encourage collaboration with regional companies. All eleven buildings of the ICDT have high energy autonomy and focus on modern and complex research infrastructure, consisting of integrated lines of high-tech advanced research equipment [50].

### 3.2. Methodology

In order to find answers to the research question proposed in our research, we needed to identify collaboration opportunities between ICDT as the representative of Transilvania University of Brasov and companies with production activity within the Centru Development Region. The research started from a case study that was based on a single case method [51]. After a thorough documentation of the universities from the Centru Region, Transilvania University of Brasov was selected as it is the biggest university in the region. Additionally, it has a research institute (ICDT), which can be involved actively in relationships with the business environment. Moreover, the marketing strategy of ICDT states the aim of becoming an important player in the sustainable development of the Centru Region. This single-case study was selected based on the rationale that this university is an unusual (extreme) case [51]. The documentation consisted in collecting statistical, financial, and accounting data, interviews with key persons, and direct observations. The results were validated by triangulation using alternative sources of evidence: data collected from companies that are active in the Centru Region by using a survey and a review of relevant literature regarding entrepreneurial universities.

In conducting the mentioned survey, the first step was to create a panel with companies from the Centru Region that produce goods or services and have a turnover higher than 100,000 Euro, because they are supposed to be the most interested in developing their businesses, especially in foreign markets. This panel was selected from a database with all companies that are active in the analysed region. The panel contains only companies that met the above mentioned conditions regarding the sector of activity and the value of turnover. To reduce errors that may interfere in the process of total marketing research [52,53], the information was cross-checked by using official data reported to public authorities. The final panel included 3506 companies that were contacted, and managers were invited to participate to a survey. The main objectives of this survey were: (O1) Identification of the main consultancy needs of firms and their attitudes about the importance of consulting services for the companies' development; (O2) Obtaining information on the main external markets in which the analysed companies operate; and (O3) Identification of interest in future collaboration with ICDT and the university in promoting the companies in different markets.

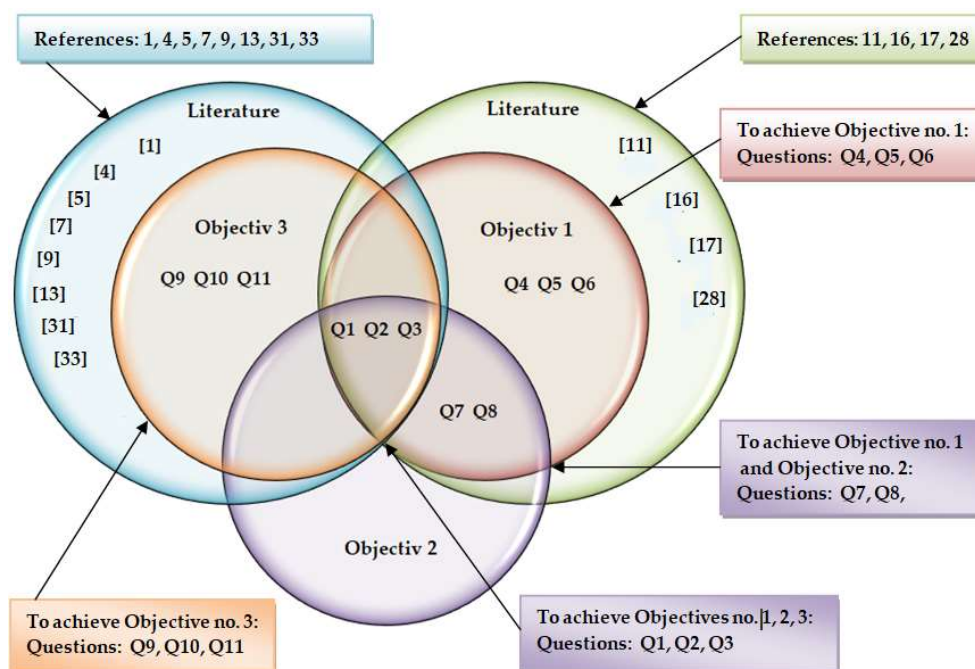
In order to achieve these objectives, data were collected by using a questionnaire that consisted of 33 questions grouped into three sections. In this paper only a few questions of the questionnaire were used. The first questions (Q1–Q3) had the aim of identifying the main characteristics of the interviewed companies from market, economic, and legal points of view. The other questions were aimed at reaching the above research objectives. The questions in connection with the objective they aim to fulfil are presented in Table 1.

The results obtained through these items were aimed at a comparison with other research in the literature that explore the implementation of entrepreneurial strategies [1,4,5,7,9,13,31,33].

The workflow and the ways in which the items of the questionnaire interact with the analysed literature are illustrated by means of the Venn diagram in Figure 1.

**Table 1.** The list of questions and the objectives they aim to fulfil.

Questions		Objective
Q1	Turnover	Identification questions
Q2	Field of activity	
Q3	Share capital provenience	
Q4	Do you currently benefit from the services of consulting companies?	O1
Q5	Mention the type of advice you receive?	O1
Q6	In your opinion, to what extent can consulting services contribute to the development of your company?	O1
Q7	Do you export the products made within the company you represent?	O1, O2
Q8	Please specify the countries to which you export?	O1, O2
Q9	Have you heard about the Research and Development Institute of Transilvania University of Brasov?	O3
Q10	Have you collaborated so far with the Research and Development Institute of Transilvania University Brasov?	O3
Q11	Would you like to be contacted by the representatives of Transilvania University for details regarding the services offered by the Research and Development Institute?	O3



**Figure 1.** Venn diagram of the workflow.

Data collection was carried out employing an electronic questionnaire adapted to the two methods used: CATI (computer-assisted telephone interviewing) [54] and CAWI (computer-assisted web interviewing) [55] for self-administration by the respondent. The CAWI method was only used for managers who requested the transmission of the questionnaire via the Internet and required that the online questionnaire be loaded and completed directly in a browser, without the need to install an

application or a program. The questionnaire link was distributed through the official emails of the panel companies, which were contacted in advance by telephone. All companies that did not respond to the initial request were re-contacted, and the questionnaire was sent by email. The telephone interview covered all the companies included in the panel and was carried out over three weeks in May–June 2019 by the 46 pre-trained interview operators, students of the Transilvania University of Brasov. Interviews took place from Monday to Friday between 10.00 and 18.00, the working hours for most firms, to increase the chances of interviewing managers. The acceptance rate of the interview was 10%, which falls within the average level in the CATI survey [54]. The final sample consisted of 457 companies that satisfied the basic characteristics (production activity and turnover over 100,000 Euro). Other characteristics of the sampled companies are presented in Table 2.

**Table 2.** The samples' characteristics.

Characteristics	Frequency	%
Field of activity		
Industry	238	52%
Construction	81	18%
Services	138	30%
Share capital provenience		
Entirely domestic	361	79%
Entirely foreign	51	11%
Mixed capital	45	10%

The data obtained were processed using the SPSS program by using various data analysis methods. The authors fully organized and supervised the research process, from the development and implementation of the questionnaire data analysis.

#### 4. Results and Discussions

This chapter is structured in two closely related parts. The first part contains the results of the survey on the needs of companies in the Centru Region and the possibilities of collaboration with ICDT to develop their own businesses. Starting from those results, the second part proposes an entrepreneurial pilot model of online data analysis, which can be used in the creation of an electronic catalogue to promote the products and services of firms from the Centru Region in foreign markets.

##### 4.1. Results of the Survey on the Needs of Companies

The results are grouped by the objectives of the research, and the analyses carried out are presented in a logical sequence, which allows relevant results to be obtained.

##### 4.1.1. Identification of the Main Needs for Consultancy Services

The results of the research reveal a rather small collaboration of the sampled companies with consulting service providers. Of the 457 companies analysed, a rather low number (92 companies), representing 20.1% of the total, have benefited from consulting services so far. Most of these companies (30%) mentioned using economic and financial services, while other types of consultancy recorded quite small numbers: 19 companies (20.1%) used consultancy to access and attract European funds (20.1%), while 13 companies (14.1%) benefited from legal advice. Regarding marketing consultancy, only 13% of firms collaborated with companies offering such services. A small number indicated using consulting services in personnel training, management, IT services, and logistics. Given that the number of firms that have used consulting services so far is quite low, the need for consulting is high. This conclusion is based on the responses received regarding the level to which consulting services can contribute to business development. Thus, the managers' evaluations on a 5-level interval scale focused on the positive levels of the scale, which express a strong or very strong influence of consultancy

on the company's development. There were also many responses indicating the neutral level of the scale. On average, the extent to which managers believe that consulting services could contribute to the company's development was 3.34 points on a scale from 1 to 5 points (5 = very large extent).

Taking into account the need of companies for sustainable development and the importance given to consulting services, but also the low level of usage of such services, it can be assumed that the involvement of the University in meeting these needs is critical, since it can use the resources it has, as well as the results of the research carried out in different areas, to support these businesses. These results support the findings in the literature regarding the increasingly entrepreneurial role of universities and are in line with the results of previous research, which highlighted the role that universities can play in sustainable regional development [11,16,17,28]. This implies a wise vision, starting from the establishment of a clear strategy of involvement in sustainable entrepreneurial activities up to the effective allocation of the resources needed to work with companies to stimulate sustainable regional development [7,13,31,33].

#### 4.1.2. Identification of the Main External Markets

Approximately half of the respondents claimed that they export their own products (48.8%), most of the sales markets being in Europe. The markets covered by the 223 export companies are Germany, to which 94 of the companies export (42%), 50 companies to Italy (22.4%), 41 to France (18.4%), 34 to Hungary (15.25%), 27 to the Netherlands (12.1%), 21 to Spain (9.4%), 19 to Austria (8.5%), 18 to Belgium (8.1%), 15 to the Republic of Moldova (6.7%), and 12 to Sweden (5.4%). However, exports are also made throughout the world. There are companies that export to only one market to countries such as Australia, Croatia, Indonesia, Kazakhstan, Morocco, Peru, Qatar, Slovenia, Taiwan, Vietnam, Indonesia, the United Arab Emirates, and China. Given the broad spectrum of external markets to which the products of the firms from the Centru Region are exported, the idea of involving ICDT in the creation of an electronic catalogue to promote the offers of firms becomes an objective of interest to both the academic and the business environments. Such an electronic catalogue could be accessed from any country in the world and could be used as a strong promotion tool.

#### 4.1.3. Interest in Cooperating with ICDT

Based on the above presented results, another research objective was to identify whether the interviewed companies are available to collaborate with ICDT to implement future projects.

Regarding the familiarity with ICDT among the analysed companies, the answers highlight a rather low percentage who knew of the Institute (28.4% of the total sample). Collaboration with ICDT was even lower, with only 3.9% of respondents (18 companies) mentioning they had benefited from the services provided by ICDT. However, more than 57% of firms showed interest in receiving details of the services that the institute can offer for identifying both technical and economic solutions. This low familiarity confirms the results of research presented in specialty literature, according to which many universities did not achieve the expected results in implementing entrepreneurial strategies [6]. Efforts will have to continue because innovative firms are typically oriented towards the support of universities [34]. This opening is also reflected in the intention of the companies surveyed.

A possible involvement of ICDT for sustainable regional development is to design an electronic catalogue to promote the offers of companies from the Centru Region in different markets. Thus, one of the aims of our research was to identify the opportunity to create such a catalogue. The responses showed that 63.5% of companies were available to cooperate with ICDT in order to design an online catalogue, which could promote their offers in various markets. The usefulness of this catalogue for increasing the companies' presence in foreign markets was appreciated with an average score of 3.76 points on a scale from 1 to 5 points (5 = very useful).

The openness of both companies and Transilvania University of Brasov towards future collaboration creates incentives for a sustainable development of the university and the entire region. The need for such cooperation for sustainable development is also highlighted in the literature [5–10,14–21].

Considering these results and the companies' openness to collaboration, we designed an entrepreneurial pilot model for data analysis using the on-line analytical processing (OLAP) technology in order to assure the background function of the proposed electronic catalogue.

#### 4.2. Proposal for an Entrepreneurial Pilot Model for Online Data Analysis

Based on the results of the market research, modern techniques of processing historical data were used to analyse online data. The validation of data involves the transformation of data into information and, subsequently, into knowledge that can be gained through synthesis and analysis of data followed by their interpretation. The synthesis of data implies their consolidation using various criteria. The synthesis process uses specific or dedicated programs, queries that provide the possibility of obtaining results by grouping data according to well-established criteria, sometimes using totalizing functions [56]. Since lately the volume of data requiring processing has greatly increased, classical methods of analysis are sometimes ineffective. To cover these shortcomings, new technologies are available such as:

- Data warehousing and
- OLAP (on-line analytical processing).

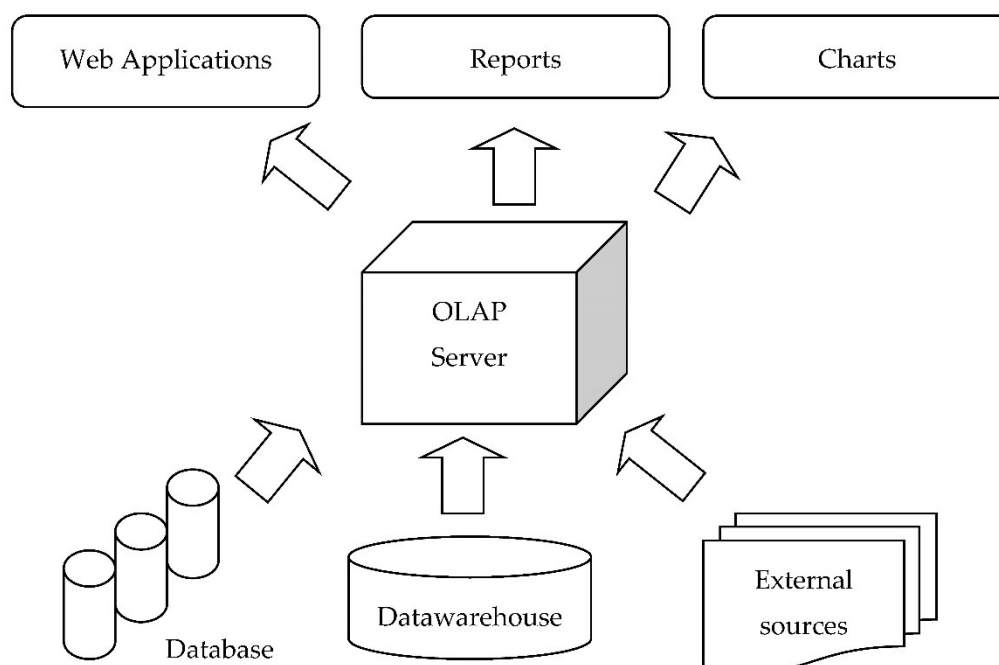
New business intelligence technologies develop real-time data storage by providing end-users with quick updates and real-time centralised situations generated using transaction systems (TPS).

OLAP technologies allow analysts and managers to have quick and interactive access to data warehouses [57], because they are consolidation technologies that aim to turn ordinary information into synthesized information, and then a light analysis can be made [58]. The functionality of OLAP is characterised by a multi-dimensional dynamic analysis of the consolidated data by the economic organisation supporting the analytical, search, and retrieval activities of the information carried out by the end-user; calculation and modelling applied to cross-dimensions through hierarchies or members; trend analysis; analysis of subsets gotten by sectioning; analysis of data by deepening merged data levels; and analysis based on dimensional comparisons. One of the simplest methods of analysis is comparing data using the same criteria, having just only one different criterion.

Comparisons are made between data sets. and the techniques used are observation for signalling patterns, correlations, associations by similarities, and reporting deviations or exceptions [59].

From the user's point of view, the computer system provides him with a wide range of information in graphical form, transforming quantitative information into qualitative information. Some analytical data observation techniques are based on mathematical theories by which we compare real data with theoretical data produced by a hypothetical model. Based on observation techniques, automated, data-driven techniques have been developed. Through the analytical observation process, we can obtain patterns, correlations, or models from which we can deduce the trend or predict with probability the future value of the data [60]. Online analytical processing (OLAP) is a technology that is used to organize large business databases and to support business intelligence. Online analytical processing databases (OLAP) facilitate business-intelligence queries. OLAP is a database technology that has been optimized for querying and reporting, instead of processing transactions (Figure 2). The source data for OLAP are the online transactional processing databases (OLTP) that are frequently stored in data repositories. OLAP data come from these historical data and are aggregated in structures that allow for a sophisticated analysis [61]. OLAP data are also organised hierarchically and stored in cubes instead of tables. OLAP technology is a dynamic and advanced way of processing and analysing data, giving decision-makers the opportunity to gain their own perspective on data, to create flexibility, and directly obtain centralised and synthetic situations, but also to navigate facilities for predicting and simulating future situations, representing an effective solution for analysing data from data storage. OLAP systems help the user synthesise the information of the organisation through a comparative and personalised view, but also through an analysis of historical data using scenarios of the type "what if?" [62]. They are obtained using an OLAP server specially designed for handling multi-dimensional

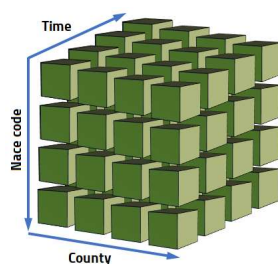
data structures (see Figure 2). Server architecture and data structure are optimized for quick retrieval, ad hoc analysis, flexible calculations, and data transformation [63,64]. Unlike operational systems, which operate based on pre-defined procedures (there is a relatively limited range of transactions operated by an organisation), an online analysis system (OLAP) provides support for a variety of requirements beyond what can be anticipated.



**Figure 2.** Architecture of an on-line analytical processing (OLAP)-based processing system.

#### 4.3. Building the Entrepreneurial Pilot Model

The data analysis used the Tableau Public V. 2019.3.0 (TP) software. The data, collected and loaded to a relational database in the form of tables, were loaded to the TP program. This led to obtaining links between the primary key and external key tables of collected and coded information and detailed tables of those codes (e.g., NACE codes). Dimensions were composite structure attributes, structured on various hierarchical levels, according to how the data was grouped (Figure 3). These attributes were usually descriptive and were used as a source for restrictions and for rows in reports. They were considered as secondary tables due to their small dimensions. The OLAP Council defines the concept of size as a structural attribute of a cube comprising a list of members, which users perceive as being of the same type (e.g., all months, quarters, and years form the Time dimension). The data were collected at the most detailed level and aggregated at the higher levels of analysis (Figure 4). Thus, in the TP program, seven dimensions were created: NACE code (NACE), full name of NACE code (DEN), County (County), City (city), company name (company name), unique registration code (URC), and time (Figure 5).



**Figure 3.** The structure of the cuboid that resulted from the combination of the three dimensions.

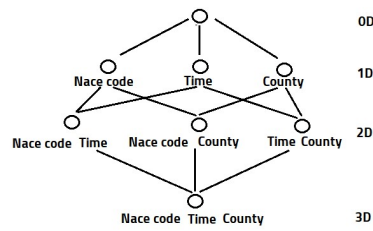


Figure 4. The apex cuboid produced by combining the three dimensions.

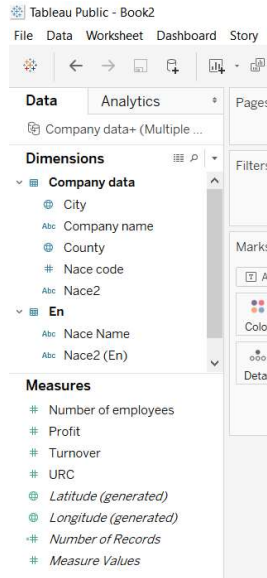


Figure 5. Creation of dimensions and measures in the Tableau Public V. 2019.3.0 (TP) software.

The most relevant of these dimensions were NACE code, County, and time.

The analysis required the creation of the following measures: turnover, the number of employees, and profit (or loss).

Items generated from online analysis:

1. A dashboard containing the analysis based on county filtering weights and NACE codes comprising the following analyses: the number of firms by NACE code, the number of employees by NACE code, the profit weight by NACE code, and the turnover (CA) weight by NACE code, all of which have the possibility of being filtered by county and NACE code (Figure 6).

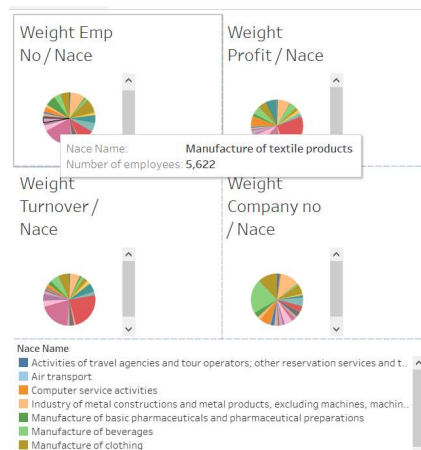


Figure 6. Completed dashboard.

- A story comprising the following analysis sheets: the raw data of the companies (name, NACE code name, turnover, the number of employees, profit) with the possibility of filtering by county and NACE code, the total number of firms by NACE code with the possibility of filtering by county, the aggregated turnover grouped by NACE code, the number of firms by NACE code per county (size and colour-related tree-maps), aggregated profit by NACE code with county filtering capability, the number of employees aggregated by NACE code (packed bubbles graphics with associated size by number) (Figure 7), turnover, employees, aggregated by profit by the NACE code with the possibility of filtering by county, and the NACE code with the possibility of filtering by county (Figure 8).

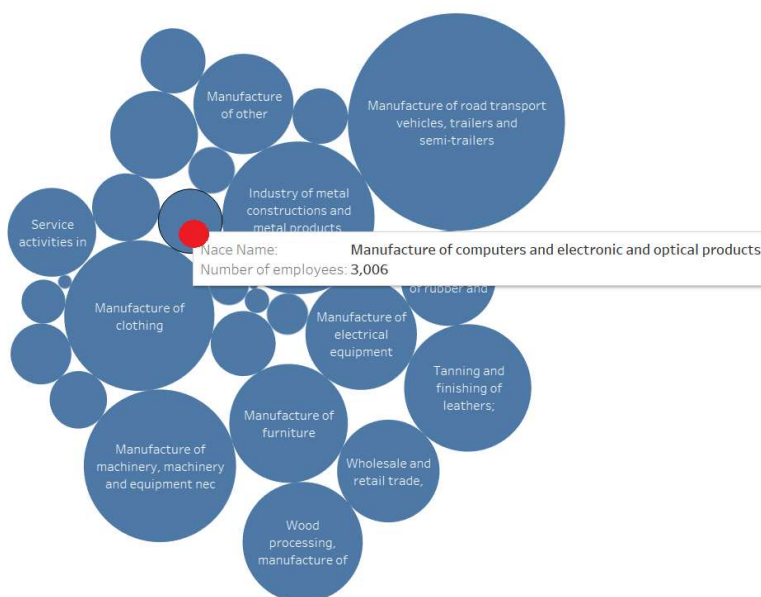


Figure 7. Packed bubble chart for the number of employees aggregated by NACE code.

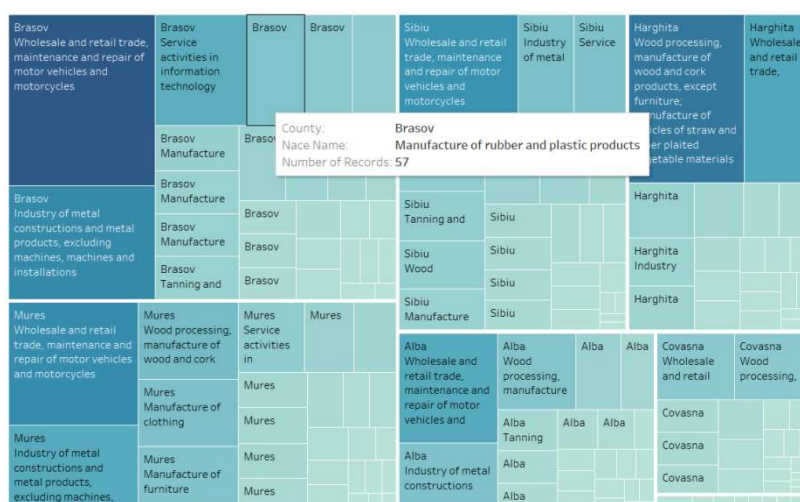


Figure 8. Map heat chart for the total number of firms by NACE code with county filtering capability.

#### 4.4. The Entrepreneurial Pilot Model Online Data Analysis Results

The online publication of the dashboard and the above story has provided an online tool available to all decision-makers who want to develop and manage businesses in the Centru Region of Romania. It can be suggested that by detailed analysis at the level of the companies studied, and by the possibility of dynamic aggregation of online data, using any combination of desired values at the level of county

dimensions and NACE code, the proposed pilot model represents a very accurate and concise picture of the business environment analysed.

## 5. Conclusions and Suggestions

The principles of sustainable development of universities and the need for them to play an important role in regional development require a close relationship with the economic environment [3–9]. Regarding the first issues addressed in the paper, sustainable development of universities, we consider that Transilvania University of Brasov has taken important actions to become the first sustainable university in Romania, in accordance with existing models in the literature [3]. Transilvania University of Brasov applied the management model for a sustainable university [13] and established its strategy for sustainable development and resources for implementation. Regarding the second issue the increasingly entrepreneurial role of universities, through this study, Transilvania University of Brasov took another step towards integrating the third mission [16–18] and transforming into an entrepreneurial university [11,20–24], in addition to the Student Entrepreneurial Society [44] and the Technological and Business Incubator [46].

The results of the study reveal that the collaboration between companies from the Centru Region and Transilvania University of Brasov is still in the early stages, as is the case of many universities [6], with the most requested services being economic and financial. The involvement of a university in meeting the needs of the firms is important in order to support businesses [7,28,31–33] and the representatives of the firms understand this. The firm representatives are interested in future collaboration that can bring benefits for both partners [9]. Collaboration is the prerequisite for sustainable development of the entrepreneurial university [32] and to help companies to promote themselves better in order to develop their market. Having in mind these results, the answer to our research question is that the companies generally want to develop relationships with Transilvania University of Brasov in order to increase their popularity in domestic and foreign markets. Such a collaboration model could contribute further to sustainable development of the region.

Universities use different ways of interacting with the business environment [35] and fulfil their entrepreneurial role in economic and social development [16], but they have to be innovative [8,12,19,27]. In this respect, Transilvania University of Brasov tries to create the premises for collaboration with companies from the Centru Region. Starting from the needs of the companies, their main external markets, and their openness for collaboration with Transilvania University of Brasov, the authors designed an innovative entrepreneurial pilot model for data analysis using the OLAP technology in order to assure the background function of the proposed electronic catalogue. Such an electronic catalogue could be a promotion tool and could be accessed from any country in the world.

The main limitation of the research is the small number of companies that made up the sample, only 457 of the 3506 included in the panel. However, for the objective intended, to develop a pilot model, the authors consider that the purpose of the research was achieved. Another limitation is the small number of responses received from companies in certain counties of the analysed development region.

The authors consider that the proposed innovative model enriches the literature by creating a concrete framework for collaboration between universities and the business environment, especially for Romanian universities where the initiatives for adding the third function (entrepreneurship) are uncommon (as was mentioned before). At the national level there are no other similar platforms. For this reason, the application created as a pilot refers only to one region of the country. Worldwide, there are databases of companies, such as <https://inc.com>, <https://libguides.mit.edu/> in the USA, <http://download.companieshouse.gov.uk/> in the UK, <https://datapo.com/> with data from around the world, but they do not make complex analyses as in the case of our research.

The pilot model can be extended to all Romanian counties, to other companies from different domains, companies with large turnovers, and could help Romanian universities in the process of transformation into entrepreneurial universities. For future purposes, the model can be enriched by adding new dimensions. An example of an additional dimension is time. Thus, the data analysis can

be carried out comparatively over several periods and forecast and trend analyses based on historical data (minimum 5 years) could be added to the model. Given the possible commercial nature of the model, it will be a challenge for researchers to make it sustainable and to prove its long-term utility for regional development. This can be achieved by continuously updating the model with new data about the analysed companies in the presented research, with new companies and even with new consulting services offered by the University. In this way, the collaboration between university and the business environment will be developed with obvious benefits for both partners.

A future research direction is to extend the research to other companies from different domains, with various turnovers, as well as to other universities from Romania. Another direction is the challenge to collect data from as many companies as possible and for as long as possible. Thus, much better views can be obtained about trends, forecasts at the level of companies, business branches, or globally.

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