

Spin-Off and University Patents: Evaluation processes of the University of Turin

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Abstract:

Great attention has been given in recent years to the means of evaluating university spin-offs and their impact on the social and economic context. Nevertheless, in literature, there is not an approach that takes into account the different elements linked both to the value of the organization and to the effects that technology and innovation have on the context. The study starting from the analysis of the different methods of evaluation of university spin-offs and the immaterial value of the spin-off proposes an approach that brings together the different elements. The case study of the University of Turin (Italy) highlights the components and characteristics that must be analyzed and which confirm what has already been highlighted by the reference theory. The study offers an integrated approach that can be adopted in other Italian and foreign universities, and that accentuates the attention on the gaps that should be explored in future studies.

Keywords: *university spin-offs, intangible assets, university, evaluation methods*

Introduction

In recent years, attention to the theme of university spin-offs has been constant and is still the subject of a global analysis (González-Alcaide, Gorraiz, & Hervás-Oliver, 2018; Mathisen & Rasmussen, 2019; O'Shea, Allen, O'Gorman, & Roche, 2004; Zhang, 2009). Of the 184 articles produced from 2015 to 2019 in peer review in international English-language journals, few deal with the best methodologies to be applied to assess the value and impact of university spin-offs. Although only magazines by Scopus related to management have been selected, it is possible to observe how the leading journals with the most significant impact mostly concern the theme of the technological spin-off effect on the environment and on how much the spin-offs push on innovation leading to a continuous improvement of social context thanks to the connection with the universities through the application of scientific research (Al Kharusi & Al Kindi, 2018; Hunady, Orviska, & Pisar, 2018) table 1.

Table 1 index of publication about Spin-off through bibliometric analysis (Aria, Cuccurullo, & Aria, 2019; Ruiz-Rosero, Ramirez-Gonzalez, & Viveros-Delgado, 2019)

Source	h_index	g_index	m_index	TC	NP	PY_start
JOURNAL OF TECHNOLOGY TRANSFER	12	18	2,4	359	28	2015
INTERNATIONAL ENTREPRENEURSHIP AND MANAGEMENT JOURNAL	4	6	1	41	7	2016
INTERNATIONAL JOURNAL OF ENTREPRENEURSHIP AND INNOVATION MANAGEMENT	2	2	0,4	10	7	2015
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	4	5	1	33	7	2016
INDUSTRY AND HIGHER EDUCATION	2	2	0,4	8	6	2015
INTERNATIONAL JOURNAL OF INNOVATION MANAGEMENT	2	3	0,4	11	6	2015
JOURNAL OF INTERNATIONAL ENTREPRENEURSHIP	4	5	1	26	6	2016
RESEARCH POLICY	6	6	1,2	237	6	2015
TECHNOVATION	5	6	1	130	6	2015
SMALL BUSINESS ECONOMICS	4	5	1	66	5	2016
INDUSTRIAL MARKETING MANAGEMENT	3	4	0,75	22	4	2016
INTERNATIONAL JOURNAL OF GLOBALISATION AND SMALL BUSINESS	1	1	0,25	2	4	2016
JOURNAL OF MANAGEMENT DEVELOPMENT	3	4	0,75	39	4	2016
JOURNAL OF SCIENCE AND TECHNOLOGY POLICY MANAGEMENT	1	3	0,2	9	4	2015
INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	1	3	0,2	11	3	2015
JOURNAL OF BUSINESS RESEARCH	3	3	0,6	51	3	2015
JOURNAL OF TECHNOLOGY MANAGEMENT AND INNOVATION	2	2	0,5	8	3	2016
TECHNOLOGY ANALYSIS AND STRATEGIC MANAGEMENT	2	2	0,666666667	8	3	2017
ACADEMY OF ENTREPRENEURSHIP JOURNAL	1	1	0,2	1	2	2015
INTERNATIONAL JOURNAL OF BUSINESS AND GLOBALISATION	1	2	0,333333333	6	2	2017

Spain and Italy are the countries with the highest scientific production on the subject, followed by England, Germany, and Portugal. This represents more considerable attention from Europe to the development of university start-ups as a means to spread and have a more significant impact on the system (Guerrero, Cunningham, & Urbano, 2015). Furthermore, in European countries, legislation has existed for several years, pushing for the spread of these hybrid models. The creation of the Spin-offs is now an integral part of the strategic plan of all the universities in the world. However, their diffusion is still limited, especially in Italy for different reasons which will be discussed in the following chapters. In fact, only since the end of the nineties with the introduction of Law 297/1999 (Law 297/1999: Reorganization of the discipline and streamlining of procedures for supporting scientific and technological research, for the diffusion of technologies, for the mobility of researchers) universities have begun to focus on this type of activity. The new law, in fact, allowed institutions to have more freedom as regards the methods of marketing university research. In the rest of the world this new type of enterprise had already attracted the attention of major prestigious universities, such as MIT or Harvard University, in the wake of the global trend following the Bayh-Dole Act of 1980 (The Bayh – Dole Act or Patent and Trademark Law Amendments Act Pub. L. 96-517, December 12, 1980) is United States legislation dealing with intellectual property arising from federal government-funded research). The definitions of the academicians of a Spin-Off are multiple and mostly similar if not for some nuances (Backs, Günther, & Stummer, 2019; Parmentola & Ferretti, 2018). Basically, it is a company, with limited liability or for actions, whose main purpose is to exploit and market the fruit of university research. The definition can be broadened by specifying that the spin-offs are different from the others in that the entrepreneurial initiative springs from the idea and the will of individuals belonging to the academic world (professors, researchers, students, etc.) to undertake an entrepreneurial activity in order to market the discoveries resulting from the research (Gubitta, Tognazzo, & Destro, 2016). They are distinguished from start-ups by their connection with the "mother" institution of origin and by the high technological potential that gives them a high rate of growth and greater attractiveness for potential investors. Instead, what they have in common is their small size, especially in terms of the use of human capital and the difficulty of finding equity capital. A distinction can be made between two macro-categories according to their corporate composition:

- University Spin-Offs: The University is a capital shareholder and is present on the Board of Directors with one or more directors;
- Academic Spin-Offs: The University supports entrepreneurial activity but does not in any way fall within the corporate structure.

The spin-offs find their place in the business world, especially in the highly technological sectors and in Italy for the most part they are economic activities focused on the service sector. They represent a valid meeting point between the public sector and the private sector. The representation of the Co-occurrence Network defines the main themes and the relationships between lines of research, it is evident that technology transfer through the entrepreneurial activity of academics influences a set of other factors and research themes. The methodology is that of the patents and inventions that often condition and define the value of spin-offs in the long term (figure 1).

Figure 1. Topics of research on the spin off and university



In Italy the number of spin-offs still appears to be still limited compared to the potential held in universities scattered throughout the peninsula (Iacobucci & Micozzi, 2015). This is because the whole system is still relatively new and little used by the operators in the sector and, moreover, in order to observe the results of the efforts made in creating a spin-off, waiting times are quite long and difficult to analyze for the singularity of each spin-off. Especially when you observe the time necessary for a new company of this type to be able to detach itself from its mother university and become independent, or how long it takes the young company to get investments and have its own capital and available means, the precise estimate is difficult (Colletti G., 2018).

The analysis will focus on existing methods for assessing university spin-offs and the main capital generated. In a second phase, through the analysis of the University of Turin (Italy), the adopted methodology will be highlighted verifying and integrating existing models through a new approach.

Literature review

Patent and intangible asset in the Universities

Intangible assets in all their forms and variables represent one of the main elements of competitive advantage compared to other peer organizations (Cantu-Ortiz, Galeano, Mora-Castro, & Fangmeyer, 2017; Fernández-Esquinas, Pinto, Yruela, & Pereira, 2016). This also applies to universities and all the growing entrepreneurial activity around it.

Since knowledge is the main product offered by university research, patents, and in general, all intangible assets find ample space and take on the high value in this context. The two groups of intangible assets in the specific case of the university world are analyzed below:

PATENTS: Researchers working within the University are direct employees of the academy, but in the case of a patent for new research or discovery carried out, he is the direct owner of all the rights attached to the patent (Bucks et al., 2019; Huyghe & Knockaert, 2015; Ito, Kaneta, & Sundstrom, 2015). The Universities, however, since the novelty arises from within its structures, is entitled to establish the extent to which the license fee must be imposed for the use of the patent by third parties. In any case, the researcher/inventor cannot be recognized as less than 50% of the revenue generated by the transfer of licenses. However, if the owner does not exploit it within five years of registering with the Patent Office, this step is taken directly and free of charge to the University, which can use it at its discretion. All these rules are not applicable if the origin of the research funding is of private and not the public origin. In Italy, as is well known, funding for public research is lacking and very often left in the background to make room for issues of more compelling interest. Collaborations with businesses in mutual convenience seem to be a viable alternative for finding the resources needed to conduct research (Belitski & Heron, 2017; Fischer, Schaeffer, Vonortas, & Queiroz, 2018; Secundo, Ndou, Del Vecchio, & De Pascale, 2019). The practice must, however, still be increased and spread throughout the national territory. The higher the industrial applications of research, the greater the chances of being able to attract new investments from private sector companies.

INTANGIBLE ASSETS: The university environment, taking up what is its first "mission", is the place par excellence where "intellectual capital" can be developed.

Human capital is the center of development for all universities. Forming minds and preparing students and future professionals for the profession is one of the main objectives. Not only students, but also professors, researchers, etc. constitute the soul and the university spirit (Cattaneo, Meoli, & Vismara, 2015; Guerrero et al., 2015; Scholten, Omta, Kemp, & Elfring, 2015). Their propensity for research and discovery for scientific, social, cultural and economic purposes moves the whole organization. Within spin-off companies, they represent a type of human resource with a very high level of training, professionalism and propensity for innovation (especially in the scientific sphere) and can only be an element of wealth for the company / university. Furthermore, if the sectors they belong to are different and heterogeneous, the intellectual and productive level of the team grows considerably. In this case, the structural capital corresponds to all those practices implemented by the university to support research and guide researchers towards entrepreneurship, seen from the point of view of the patent or the creation of a new business. Moreover, the culture of the university and the means available to its internal actors can constitute a strength for the development of both the fame of the academy, but also of the value of the organizations and of the people related to it.

Relational capital, especially in terms of spin-off companies, represents one of the most valuable elements at the asset level (Fernandez-Alles, Diáñez-González, Rodríguez-González, & Villanueva-Flores, 2019; Prieto & Holgado, 2019). The creation of networks both within the various departments, but also outside with other academies and with the industrial sector represents development in terms of innovation and knowledge development. The greater the breadth and heterogeneity of the network, the greater the success achieved by the university and its associated companies.

National principles of accounting on intangibles asset

In order to obtain objective and truthful analyzes, the companies, in comparison with their competitors on the market, must follow the same principles and the same criteria in assessing their own business situation (Abbate & Cesaroni, 2017). In the past, therefore, the need arose at the central government level to establish unanimously recognized rules, both at the level of public and private companies, which could be used in order to have a uniform accounting representation, easy to understand and objective. The Italian Accounting Body through the OIC 24 regulates the criteria for the recognition, classification, and valuation of intangible assets. The information to be presented in the Notes to the Financial Statements is also restricted. The principle is applicable by all companies that prepare the financial statements following the principles of the Civil Code. "Intangible assets are non-monetary assets, individually identifiable, without physical substance and are, as a rule, represented by legally protected rights. An intangible asset is individually identifiable when:

- (a) it is separable, ie, it can be separated or separated from the company and therefore can be sold, transferred, licensed or rented, traded; or
- (b) derives from contractual rights or other legal rights, regardless of whether these rights are transferable or separable from the company or other rights and obligations.

They include industrial patent rights, intellectual property rights, concessions, licenses, trademarks, and other similar rights "Point 9, OIC 24. As for tangible fixed assets, they also consist of costs that do not exhaust their usefulness in a single period but show the economic benefits over a period of several years and include long-term charges (set-up and expansion costs; development costs), intangible assets (industrial patent rights and intellectual property rights, concessions, licenses, trademarks and similar rights), goodwill, intangible assets in progress and advances. In this case, intangible assets will be considered as they relate to the subject (patents and intellectual capital).

Extending the vision towards the international principle of IAS / IFRS 38, with regard to intangible assets, they must be recorded in the financial statements only if the following requirements are met:

- it is probable that future economic benefits will flow from the intangible asset;
- the cost of the asset can be reliably determined.

The principle is applicable both to those intangible assets purchased externally and to those produced internally by the company.

Also, in the case of this principle, as for that of OIC 24, the estimated useful life of patents and trademarks must not exceed twenty years. Therefore, the amortization plan of the same cannot be greater than this maximum time limit.

As already identified by the previous principle, also for IAS/IFRS 38 the intangible asset must have certain specific characteristics to be defined as:

- Be a non-monetary type of activity;
- Easy to identify;
- Without physical consistency;
- Owned in order to: be used in production or supplied as a good or service; be leased to third parties; be used for administrative purposes.

Intangible assets in the specific case of patents are classified and valued within the company and the accounting documents. The accounting principles, both nationally and internationally, provide precise indications on the elements to be considered or not in consideration in the general estimate of the economic-financial situation of an organization. The monetary aspects of the asset prevail over non-monetary ones, although both are taken into account. The positioning within a bright and pre-established scheme allows a more likely compared with the assets of other companies, providing objective data.

The evaluation of "intellectual capital" is not yet regulated and precise within the accounting principles, despite its relevance in terms of value generated is a concept widely shared by the operators of the sector.

The valuation models of this type of asset are innumerable and very often applicable to the individual reality in which they were designed. Some models take into consideration purely monetary aspects, while others consider both elements at the same time. The major problem in many models is that at the end of the analysis process, managers have an immense amount of data, often with difficult interpretation and trivial implications if translated into traditional financial terms. The use of these models is still little exploited by the actors of the sector, accustomed to analyzing economic-financial models (Balluchi, 2013).

A general subdivision of the different types of evaluation models and the various study approaches used was proposed by (Sveiby, 2010) in 2001 and is as follows:

- Direct Intellectual Capital Methods: the different components of the intangible asset are identified, and they are given an estimate in terms of monetary value. The determination of the various elements allows in a second moment to evaluate in financial terms the good in a global view;
- Market Capitalization Methods: based on the calculation of the difference between the book value and the market capitalization of the company;
- Return on Assets Methods: the ROA index is calculated in terms of profits and cash flows concerning the standardized index of the sector of production activity, and for the difference, it is possible to calculate the ROA index for intangible assets;

- Scorecard Methods: the different components of "intellectual capital" are observed and identified, and indicators and indices are created ad hoc to be able to find and monitor the asset over time. The evaluation, in this case, is not monetary, and the results obtained from the indices are represented within scorecards and graphs.

The models in the literature on the subject can be placed in one of the four proposed categories.

Since this non-financial and non-monetary asset, the traditional valuation in these terms is not adequate and is not very often right. The main difficulty faced by the study of the subject in finding a solution to this type of economic evaluation is that the good in question is composed of individuals with specific characteristics and that interact with the external environment in a particular and precise way often challenging to predict. The codification of these elements in numerical and accounting terms turns out to be very complicated, and the opinions in this regard very discordant and debated.

Methods and evaluation of a spin-off

The two models considered most "traditional": the income method and the discounted cash flow method. The balance sheet method is excluded from the analysis, as both the start-ups and the spin-offs make the capital element an element to be established and strengthened.

According to the income methodology, the value of the company is determined by the company's ability to generate profit. The value of the organization, therefore, is directly linked to its capacity to produce income in future years (Krishnaswami & Subramaniam, 1999; Ramaciotti & Rizzo, 2015; Veld & Veld-Merkoulova, 2009). The correctness of the forecast is based on the precision and accuracy of the data generated by past flows. This calculation is therefore very approximate for a company with few exercises carried out behind it, and in itself, the practical calculation of the forecast turns out to be difficult to achieve due to the simple lack of data. Deciding to use this model for the analysis equally, what can be foreseen in relation to the possible income generated by the company in the years to come, can be envisaged taking into consideration three information also available for start-ups, namely:

- the speed of the life cycle of the products belonging to the company;
- the technologies used by the organization and any expected technological leaps;
- the company's operating sector.

These three elements that can be analyzed are incorporated into other more reliable models of analysis in this type of business assessment, and for this reason, the income method is not among the main ones exploited for this type of analysis (Grimaldi & Grandi, 2005).

Calculation formula: $W = \sum_{t=1}^n R_t / (1+i)^t$, where R represents the income obtained by the company in future years; n represents the time horizon; i represents the expected rate of return.

The discounted cash flow method has the purpose of updating, according to the use of a correct risk rate, future flows generated by the company in the analysis. All expected future flows are discounted at the present zero time. In this way it is possible to obtain an approximate value of the company and its potential (Gélinas, 2013, pag. 0). The recent entrepreneurial history and the high rate of the fallibility of the typology of companies in analysis in this paper also render this model of evaluation inadequate at the same level as the previous one, especially as regards the choice of the adequate risk rate to be used. Calculation formula: $VA = \sum_{i=0}^n CF_i / (1+ri)^i$, where VA represents the current value of the analyzed company, CF_i is the generic cash flow, i are the relative time frames considered, RI is the rate adjusted for the risk related to the asset to be valued. The application of this model has as its starting point certain elements such as:

- cash flow deriving from assets already present in the company (totally or almost completely absent in a young organization under development);
- expected growth deriving from new investments implemented (not present in the early stages of business development);
- discount rate depending on the business risk (these companies have a very high rate of fallibility);
- possibility of estimating the terminal value (It can be calculated either with the perpetual valuation of cash flows or with the methodologies of market coefficients (multiples). The terminal value is normally estimated using Gordon's synthetic formula).

The main difficulty for all these elements is always the lack of historical data on company activities. In order to be able to use this method anyway when evaluating the company, a series of factors must be taken into account, so as to be able to minimize the distortion of the final information:

- forecast of future revenues by analyzing the size of the market and the potentially achievable portion of the company, considering the competitors already active. Furthermore, the quality of the management and the product held in comparison with those of the competitors must be taken into account;
- need to estimate operating margins in the future. The company must be able to generate positive flows in future years. First, it is appropriate to evaluate the target operating margin that the company should reach once the initial problems related to growth are overcome. Second, it is appropriate to take into consideration what will be the necessary efforts so that the company can reach the target, without ignoring the influence of the fixed costs to be incurred and of the present competition;
- Evaluate which reinvestment is needed overtime to support growth. These investments have an impact on the company's cash flow and for this reason they must be carefully evaluated. They must be estimated in parallel with costs and revenues and not considered separately in order to avoid errors;
- Estimate the cost of equity over time, using however not the company data, but rather sector averages and beta parameters for risk calculation, considering small and growing companies at first; in a second phase mature and stable companies;
- An estimate of the value of the Terminal Value, concretely determining what can be the achievement of the maturity of the company, making the most realistic forecasts possible, not using, therefore, too long-time frames.

The appropriate considerations are many and the reliability of the analysis is not always high, as the reading of some data or the interpretation of the available information can distort the evaluation (Di Diego, 2016). This type of model, therefore, requires an accurate evaluation and a deep knowledge not only of the newly established company, but also of the market and of competing companies. There are also three analytical assessment methods for the specific assessment of Start-ups. The venture capital model of analysis is the one most used by venture capital funds in the decision-making phases for the granting of resources to new companies. Introduced in the sector in 1987, the model is based fundamentally on the evaluation of the start-up based on the expected ROI and the terminal value of the company. The latter is calculated using the Multiples Method to try to have realistic forecasts, comparing the subject with other similar companies in different aspects, such as the turnover (Trichkova & Kanaryan, 2015). From a practical point of view, the analysis process of this model can be divided into four main phases:

- PHASE 1: The economic results achieved by the company in a specific year in the future are estimated. Usually the time frame is not too wide to make the forecast as close as possible to the economic reality, for this reason the choice fluctuates between two and five years. Usually the choice of the year coincides with the achievement of the listing of the company or the achievement of the moment in which the venture capitalist expects to sell the company;
- PHASE 2: The value is determined at the end of the forecast period using the Multiples Method. The multiples taken as a reference are usually those of companies recently sold or listed on the stock exchange;
- PHASE 3: The value obtained at the end of the calculation must be updated at present, using the investor's target return rate. The rate is in most cases always very high so as to be able to cope with the high probability of default by the new company;
- PHASE 4: In the final phase, the venture capitalists, after having carried out the evaluation, ponder under what conditions to grant capital, or what percentage of the shares or units of the company receive compensation in exchange for the risk incurred.

The second method of analytical analysis, Berkus method, is preferred by analysts especially when the object of evaluation is start-up companies at the early stages of development. It finds greater application in the evaluation of companies operating in the high-tech sector and which expect to reach the critical turnover threshold (usually around 20 million dollars) over a period of five years from the market launch (Payne, 2011)

The model makes it possible to obtain a pre-money assessment based on a series of fundamental elements and characteristics for start-ups and which is assigned a score based on the impact on the company's success. This model appears to be easy to apply compared to other models, as it is based on what the company has in terms of assets, mainly intangible, rather than on future estimates made on items such as turnover and capital. The values given to the

various elements considered also depend on the size of the market in which the company is located. In practical terms, the model works by assigning a value ranging from \$ 0 to \$ 500,000 to the following elements of the enterprise:

- Team Managerial Quality;
- Value Proposition;
- Working prototype;
- Strategic relations;
- Product already launched and / or sold.

In the event that the company fully satisfies all the aspects considered, the assessment of the company will be a maximum of 2.5 million. Considering these aspects, the investor interested in financing the organization ponders all possible risks, namely execution, product, technological, market and competitive, financial or production risks. The model to be valid must be monitored over time and supported by other models in order to allow a comparison of results. It must not be an end in itself. The third model, scorecard method differs from the Venture Capital Method, in that it is based on an initial comparison of the average of the pre-money valuations of other startups active in the same sector and in the same geographical area, also considering other specific variables of the enterprise, such as: the characteristics of the management team, the product and the technology used, the size of the market and the relative competitiveness present in it, the need for further future investments, ongoing partnerships, sales channels, etc. (Di Diego, 2016). The model combines features of the previous two models, making a pre-money evaluation, but also considering other aspects relevant to the new company.

Method

The study was conducted through the case study of the University of Turin. In the case study analysis, it is not possible to control the context, but it is possible to analyze the main characteristics (Benbasat, Dexter, Drury, & Goldstein, 1984; Yin, 2017). The analysis was conducted through direct reporting of the data, analysis of procedures and models adopted by the University of Turin, and periodic semi-structured interviews to spin-off and research office employees between 2017 and 2018 to verify the possible approach to be adopted and the future strategic choices that the university could have undertaken. To ensure the validity of case studies, data were collected through the presence and direct observation and presence during the internal meetings aimed at analyzing the case study. Furthermore, the triangulation guarantees the results relative to the collected elements. The data are original, and the case study and the analyzed sample presents elements that cannot be modified (Silverman, 2013). The flanking of qualitative analysis around the case guarantees the veridicity of what is expressed and analyzed (Glaser, 1999). External validity is possible because of the characteristics related to the document. The generalization of research results in similar contexts is possible through the analysis of the elements (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). The analysis and the treatment were conducted taking into consideration also reliability as the scholars usually would need to do when talking about case studies. "Reliability" refers to the absence of random error, enabling subsequent researchers to arrive at the same insights if they conducted the study along with the same steps again (Denzin & Lincoln, 2002). Transparency and the possibility of replicating research allow and guarantee this aspect. The narrative collected during the study and the methodological approach of analysis and the replication of the case study analysis (Leonard-Barton, 1990).

The case study

The history of the University of Turin has secular origins. Its foundation is traced back to how, in 1404 Ludovico di Savoia-Achaia promoted the foundation of a center of higher education precisely in the city of Turin. Since at the time the city was a bishopric, the birth of the university was formalized thanks to a papal bull of 27 October 1404 of Pope Benedict XIII. The illustrious personalities who forged their culture in this university context are many and range from Erasmus of Rotterdam, who graduated in theology in Turin, to names in more recent history such as Norberto Bobbio, Alessandro Galante Garrone, Leone Ginzburg, Massimo Mila, Vittorio Foa, Giorgio Agosti, Dante Livio Bianco, Cesare Pavese, as well as two presidents of the Italian Republic, Luigi Einaudi and Giuseppe Saragat. The last decades have seen an ever-growing process of internationalization and constant attention to scientific research, as well as particular attention to the subject of teaching, placing it at the top of the rankings of Italian universities. The challenges of the third millennium, as in the particular case of this elaboration of the approach of the universities to the business world, find ample space for discussion and practical realization even in the University of Turin.

From the data available in 2018, the University of Turin includes:

- Over 74,500 members, of which 61% are women, 21 are residents outside Piedmont and more than 4,400 international students;
- 67 three-year degree courses, 75 master's degree courses, 9 single-cycle degree courses, 49 first-level masters courses, 40 second-level masters courses, 32 research doctorate courses (of which 11 are convention/consortium), 10 courses of the specialization, 56 specialization schools, 1 institute of excellence: Scuola Studi Superiori;
- About 12,600 graduates in 2017;
- About 600 projects present on competitive tenders and 22 patents filed (2015-2017);
- 411 full professors, 744 associate professors, 727 researchers.

The mission to which all Italian universities tend is the following:

"The universities have the institutional mandate to pursue research, teaching and third mission activities, contributing to the social, cultural and economic development of society, through the direct application of the knowledge developed internally, through technology transfer and transfer actions in practice." In order to define its policies and seek the best way to follow the guidelines illustrated by the institutional mission, the University makes use of the University's Integrated Programming Document, which is updated and reviewed every year (Unito.it). It includes:

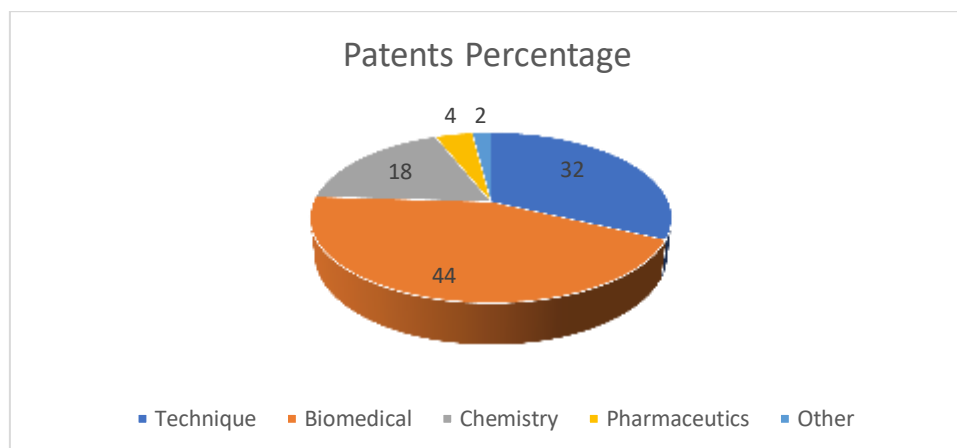
- The Strategic Plan;
- The Three-year Plan, which combines the specific plan of the specific university with the ministerial programming lines;
- The University Quality Policy Document;
- The integrated Plan, which defines the objectives and development plans of the University Administration.

The University of Turin promotes the "third university mission," that is, to bring the fruit of market research through entrepreneurial activity. At the institutional level, the University promotes both the development of new spin-off companies, but also follows the path of registration and exploitation of patents.

In 2018 the University had in its portfolio multiple patents that have completed the evaluation and filing process, as well as many spin-off companies. There is a total of 114 patents, including both patent applications submitted and patents already filed; the active spin-offs, on the other hand, are in total 37.

The sectors in which the University's spin-off companies operate are many and varied, as can be seen from the table above. The companies that did not follow a path of birth and development within the incubator were, for the most part, created within the different departments of the various poles dependent on the university. Their role as an incentive department appears to be fundamental as a promoter of entrepreneurship. It often does not originate only from the central organization but finds fertile ground even in the different university divisions. The role of the department can represent a supporter of entrepreneurship, but sometimes also an obstacle in some cases (Mosey, Kirkham, & Binks, 2015).

In terms of the patents held by the University of Turin, the current situation of the portfolio appears to be distributed in the various sectors in almost this way:



The portfolio is in its entirety composed of 64 patents with national coverage, 43 with international registration, and 7 in priority to receive coverage also outside the national territory. From the practical point of view and of the entrepreneurs interested in any exploitation or purchases of university patents, 43 are still available, while 71 are not available for commercial exploitation. However, it is necessary to define a methodology able to assess the impact that spin-offs and technology transfer through patents have on the reference context and on the market.

The first evaluation

In the approval of an entrepreneurial initiative such as that of spin-offs, the prior evaluation process by the appropriate Commission established by the University is fundamental. The evaluation, in this case, appears to be of greater importance since, in case of approval of the validity of the idea to be developed, the university will act as a partner in university spin-offs and entrepreneurial promoters in the case of academic spin-offs. Like any other potential investor/partner and promoter, therefore, the evaluation is a useful tool to understand which projects to support and which do not.

The evaluation of the Commission, for both types of spin-offs, touches on aspects, such as:

- Scientific quality of the project and economic viability: usually the projects carried out by the new entrepreneurs within the spin-offs have a high level of technological innovation arising from university research (Cho et al., 2016), but it is often appropriate to evaluate if these projects are economically sustainable or how to support them economically and, an aspect not to be ignored, if they can find their place within the market. There are often cases in which projects are so highly technological that they do not yet find an adequate market for a correct allocation in the current state of the art. The creation of specific commercial outlets requires not only vast uses of resources but also the possession of specific skills. For this reason, it is essential to carry out a preliminary assessment in these terms. The bases on which the valuation of the company is based are:

- o Market research to understand the needs of specific consumers and the presence of potential replacement products and competitors with the relative market shares held;

- o Analysis of the costs necessary to be able to produce the product and support production. Identification, therefore, of fixed costs and variable costs and the possibility of the presence of sink costs;

- o Growth and development plan both in the short term and in the long term.

- Composition of the share capital: just like any other type of existing business, a careful evaluation of the composition of the starting social capital allows us to understand the development potential and the resources available to the company. In this phase it is crucial to evaluate in favorable terms not only the capital from a purely economic-financial point of view (not always present and above all in significant quantities at a competitive level), but above all from the point of view of human capital formed by individuals of excellence and which in concrete terms represent the major resource available to the company (Hayter et al., 2017). From a legal point of view, it is necessary to distinguish:

- o If the company is a university-type spin-off and consequently to what extent the university participates in the capital and in what proportion it has decision-making power within the Board of Directors;

- o If it is a limited liability company or a joint-stock company;

- o Possible need and to what extent the company needs external support and investments from the company. Debt capital to which this type of company has difficulty in accessing in still premature phases of realization is excluded (at least in the early stages) (Miglietta et al., 2012);

- o The contribution in terms of contributions by all members and if these are mainly represented by material, immaterial, or if their skills are given as the added value for the company's share capital.

- The commitment of the proponents: that is the project to which those who decide to undertake the entrepreneurial path want to commit themselves, the type of commitment that every single member wants to take;

- Commitment and opportunity to extend social participation or work commitment to other subjects: that is, the company's plan to create new corporate prospects and generate new jobs within it. The possibility of incompatibility and conflict of interest must also be taken into consideration based on the subject that must be involved within the company;

- Evaluation of the Business Plan: it appears to be the document presented that covers all aspects of the company and summarizes the juridical and economic aspects of the project in development. It also includes the type and size in which the company will want to operate;
- Evaluation of the presence of relevant profiles within the management or the management of the company: individuals with previous positive experiences in the same field of implementation or positive experiences at the level of business management appear to be elements in favor of the approval of the project;
- Origin of the entrepreneurial idea: that is from which typology of research the need to find an application in entrepreneurial terms of the academic research arises. Consideration is also given to the type of funding provided to the specific research concerned and from which department it originates;
- Marketing Plan: the reference market is presented and specified if a market analysis has already been carried out; if so, current and future inclusion opportunities are listed. This document indicates the main external factors that may affect the activity carried out by the Spinoff, taking into account the potential competing companies present on the market and the portion of the market in their possession. The marketing plan also allows us to look at the nascent company from its strengths and weaknesses, but also, looking at the external market, at the possible threats to be taken into consideration or the opportunities to be seized;
- Economic-Financial Plan: individually, those presented as: are evaluated
 - o the volume of investments necessary for the spin-off activity;
 - o recourse to internal or external financing and of what type;
 - o the current presence of external financing and to what extent;
- Management organization: in this phase, the company organization chart presented is evaluated if this has already been established. About the composition of the organization, individuals who hold the respective offices, their competences, and their past experiences are also taken into consideration if there are any. In the hypothesis in which all these elements are considered positive, or most of them result to exceed the evaluation of the Commission, the spin-off or the patent in the first case, find the first approval of validity of the project. This is only a preliminary assessment, which must find a positive counter-test in the future actions of the subjects involved and in the positive results obtained. The growth process must be monitored over time. In terms of the methodology used by the Commission in charge of the respective assessments, it is assumed that the Multiples Method is the preferred one (Luehrman, 2005), as a specific evaluation method is not specified. The comparison with other similar companies already launched on the market and with similar characteristics makes it possible to foresee in general what will be the possible development path of the new economic reality. In the choice of multiples, it is fundamental to take into consideration the background of the research activity, but above all, the aspect of the intellectual capital present within the management and of the context in which the initiative originated. Furthermore, having to choose a relatively small number to which to give its support and limited resources, be they public or private, it is plausible to think that the various proposals for spin-offs and patents are put in "competition" in terms of suitable characteristics and to what extent.

Approach proposal and method

The analysis conducted seeks to identify and study the model adopted by the University of Turin for the evaluation of spin-offs and the results obtained. The model integrates different approaches with a marked emphasis on the Berkus model and the introduction of the GE matrix model (a business portfolio management tool, created by the consulting firm McKinsey as an alternative to the Boston Consulting Group matrix - BCG matrix).

The GE matrix is built using aggregated variables that summarize the various factors underlying the competitiveness of the business and the attractiveness of the sector. The evaluation of a spin-off in the early stages of development will be structured according to three phases, preliminary internal and external evaluation, project evaluation and assets owned by the spin-off, evaluation of the intellectual capital generated. In each of them both internal and external aspects of the business will be considered and for each aspect a specific score will be assigned, justified by the information and application of existing methodologies. The score is structured on a scale from 0 to 100. For each phase-specific aspects will be analyzed and evaluated and each of these, taking the Berkus method as a model, will be assigned a rating from 0 to 100, in which 0 will represent the inadequacy of the element considered (except for what concerns capital independence), while 100 will represent the maximum level attainable by the company. Behind the will of university operators to create a new entrepreneurial reality is the result of research conducted in the academic field (Novotny, 2017). This result must be turned into a product that can be offered to the market and for which it is

worth registering a new patent or setting up a news organization. This is precisely the starting point for business evaluation. The product / patent will be one of the crucial points that will allow the company to achieve success or not.

The aspects to be evaluated in the first phase are the following:

- Evaluation from the technical/scientific and commercial point of view of the product presented: for this phase, it is advisable to have an assessment by experts in the field and who have the right skills and knowledge to estimate the result from a technical research point of view. From a managerial point of view, on the other hand, it is advisable to identify, using market research or through searches within the registers of the patent offices, the presence or otherwise of similar products or products that fulfill the specific requirement of the consumer in different ways. Combining the information that will provide the technicians and the results of the market research carried out, the product will receive a rating from 0 to 100 based on the scale: 0 non-original or presence of similar products, 50 evolution of products already on the market, 100 innovative and revolutionary. The greater the originality and the level of technological innovation present in the product, the greater the level attributed to this characteristic. It is also opportune to make sure that the product is actually designed to meet a particular need expressed by the consumer and not yet fully satisfied.
- Mapping of the context of action of the company: in addition to identifying potential similar or replacement products, it is necessary to analyze what will be the terrain of action of the new company and above all which competitors will have to take into consideration and in which scale of size it represents a threat or not (Bassi, 2008). For the hypothetical collocation of the company on the market, the model of the GE Matrix is taken as a basic model, which identifies on three distinct levels (low, medium and high), respectively on the two dimensions, the attractiveness of the market and the competitive position of the company in analysis and its competitors (Kotler, 2005). In the model presented here, a different score is assigned for each position in which the company can be placed, which is assigned in table 2:

Table 2 Score of position

		Market activity		
		low	medium	high
Competitive position	low	0	25	33
	medium	25	50	75
	high	33	75	100

Regarding the estimation of market attractiveness (The calculation for the growth rate from one year to another is $\text{variation\%} = (x1-x0) / x1$), it is suggested to consider the growth rate of the market taken into consideration and to look not only at the last value provided by the statistical institutes but rather to consider at least the 5 years preceding the analysis.

Instead, the consideration and relative evaluation of potential competitors is based on the turnover data achieved in the last financial year available, compared to the market share held. The calculation to determine the total market share of a company is as follows:

$$\text{Market Share\%} = \text{Turnover Company} / \text{Turnover Tot. Market}$$

In the second phase of the model, the aspects considered in the assessment go down specifically to the characteristics of the company that surrounds and supports the project and the product conceived. This phase specifically concerns the fundamental characteristics of the establishment and functioning of a newly established company. For some traits, some points will also be used in the Berkus evaluation method. The elements analyzed in this phase are:

- Composition of Own Capital: As in all companies, also concerning spin-offs, it is fundamental to analyze the elements that characterize the bases of the activity. First of all, it is essential to distinguish which type of social organization it is, which is usually a limited company (Srl or a Spa). According to the legal form, according to the law, there must be a minimum number of contributions to start the activity. Furthermore, when the company is set up, and the related contributions by the shareholders, the different percentages of ownership of the business are established. In the specific case of university spin-offs, the university from which it originates takes part in the social structure in a percentage such as agreed in the preliminary stages of applying.

The model foresees that at this point in the evaluation, a score is always assigned from 0 to 100 based on the level of independence of its founders from the institution of origin. This is considered to be a synonym of financial solidity that has to depend, as early as in the early stages of development, as little as possible at the university. Points are awarded in reverse for this aspect or, the higher the university's participation in the share capital, the lower the points awarded. A score equal to 49% foresees the participation of the university, equal to 50 provides for the participation of less than 49% and a score of 100 foresees the absence of participation of the university. The valuation of the company's own capital will also make it possible to assess the level of independence possessed by the organization, through the classic calculation:

Financial Independence = Own Capital / Tot. Assets

- Need to turn to external investors to carry out the business project: As in the case of university participation within the shareholding structure as regards the involvement of external investors, it represents an indicator of the potential value attributable to the spin-off — the higher the level of independence of the company, the greater the value held by the company. Not having to resort to external parties and, therefore, not introducing new subjects within the Board of Directors with related decision-making power, also allows the management/founders to maintain a certain level of decision-making autonomy in the appropriate actions to be taken (Calvo, Rodeiro-Pazos, & Fernández-López, 2017; Corsi, Prencipe, Rodríguez-Gulías, Fernández-López, & Rodeiro-Pazos, 2017; Meoli & Vismara, 2016).

In the same way as the attribution of points for the participation of the university, based on the presence in the corporate composition, the assignment will be in inverse proportional way, that is, the higher the quotas of external actors, the lower the attribution of value (0% quotas to external subjects = 100 points).

- Evaluation of the owned patent: after assessing in the first phase what concerned the level of innovation and the technical validity of the project in question, in this phase, the one that represents the potential attributable patent value present is considered from the organizational and financial point of view in business assets. Above all, the development status of the project is underlined, and if, eventually, it has already achieved registration and it has already been included in the patent register to receive the necessary protection (Ndonzuau, Pirnay, & Surlemont, 2002).

For the first aspect, the most significant number of points is assigned based on the progress of the project. For the second one, instead, the score is assigned to the maximum extent if this is already inserted in the patent register, equal to the minimum if the registration practices have not yet been started. The score equal to 0 represents a project in an embryonic phase difficult to estimate the value, equal to 50 ready prototype and industrial project to be structured, 100 registered patent and product ready to be launched on the market.

- Presence of strategic relationships: the presence of collaborations with other companies regarding some essential functions for the realization of the entrepreneurial project, such as distribution, technological development, production, and many others, allows the company to obtain more significant advantage competitive compared to similar companies on the market. The creation of networks with other companies or experts in the sector can significantly contribute to the development of the project (Christopher S. Hayter, 2016).

To consider a strategic relationship for the company, the data to be taken into consideration are turnover, years of operations in the sector, and size of market operations. The evaluation assigns to a score equal to 0 the absence of strategic relationships, 50 the support collaboration with the business activity and 100 the key relationships for the success of the company.

- Value proposition through Venture Capital Method: for this point of the evaluation the same element required in the Berkus model is taken up. Since the spin-off is an activity at the first stages of growth, the lack of previous data would not allow projecting value in the future of the likely company through the exploitation of classical methods, such as the income method (Müller, 2010). For this reason, as already presented in the chapter on valuation methods suitable for start-up companies, the method used to estimate the value of the company considered will be the Venture Capital Method ($ROI = \text{Terminal Value} / \text{Evaluation Post-Money}$), which, as already stated, is based on the estimate of the expected value of ROI and Terminal Value ($\text{Value} = FC_n + 1 / (\text{wacc} - g)$, where FC represents the cash flows in the different periods, g represents the growth rate over the period, wacc is the weighted average cost of capital) calculated through the Multiples Method (The market multiples method is based on the price of comparable assets (listed companies belonging to the same sector), applied to balance sheet data such as turnover, gross operating profit (ebitda), gross operating profit (ebit), net profit, equity, net financial position and cash flow. The multiples, therefore, represent the relationship between price (capitalization) and balance sheet data). Once the hypothetical value of the company is calculated by applying the method indicated above, the value of the companies presents on the market in which the company wishes to operate is estimated. For the evaluation of companies that are already mature and in

progress, the use of the Profit Method is considered (Kroll & Liefner, 2008). With a value of 0, the marginal follower, with a value of 50, the value of successful firms and with a value of 100 attributed to the market leader. The human and intellectual capital of spin-off companies is the most critical and vital element within the composition of the business capital (Visintin & Pittino, 2014). In this third section of analysis of the spin-off, the skills acquired, the technical/specific skills related to the subject treated and the complementary skills of the subjects that make up the management of the company are taken into consideration (C.S. Hayter, 2015). As for the previous phases, also for this will be attributed scores to the different aspects considered but, unlike the previous ones, the scale considered will be between 0 and 10, following the guidelines of the Scorecard model, in which some characteristics are selected specifications to be considered significant. A total of ten characteristics have been evaluated, considered to be those of the most significant importance. The total sum will allow, even in this case, to reach a maximum value of 100. The overall score will indicate the overall level assessed by the intellectual component of the spin-off. The evaluation can be performed either considering the totality of the company team or considering the individual components and performing an average of the evaluations at the end, in such a way as to obtain an aggregate data that can be included in the overall final score. Due to the level of accuracy, it is having the interested parties' different skills and experiences, it is recommended to use the evaluation of the single subjects and aggregate the data later.

The points taken into consideration for the specific assessment of the subjects are the following:

- Experiences conducted in the academic field: a score is given based on the experiences carried out concerning scientific research and teaching activities both within the university of belonging and in different external structures. The achievement of concrete results will allow the subject to obtain a higher evaluation;
- Publications: the presence of highly popular publications will allow the subject to receive a medium-high level of evaluation. The higher the number of publications in contexts of relevance to the subject matter, the higher the value attributed.

Moreover, the realization of conferences on results obtained thanks to academic research represent an additional positive element;

- External experiences: experiences always carried out in the same scientific and technological field, but external for the university field, represent an element of wealth and growth of the skills possessed by the individual, mainly if these have been carried out in the industrial or research centers of different from the academic one. The typology of the experience and the project carried out, considering the results obtained, are evaluated based on the context of the application, especially if it is a large scale or not;
- International experiences: collaboration and experience in academic research and not in international contexts is an additional element for team members. A global vision allows for more significant and broader growth and development prospects, with ideas also from different perspectives. The score is awarded based on the level of work performed and the research and institutional context in which it was carried out. Experiences in prestigious universities allow reaching the maximum score level for this particular evaluation.

As for the complementary skills, instead, the analyzed elements are:

- Financial Skills: the optimal management of the resources of the activity started up, allows adequate management of the company over time, and above all, allows us to foresee and carry out long-term planning projects. Skills in these terms can be evaluated positively if the team members know thanks to courses taken or in-depth study of the subject in the case of elements specifically chosen for business management and therefore experts;
- Administrative competences: more or less basic knowledge is required for the management of an economic organization. Also, in this case, in-depth courses can represent the bases for the acquisition of knowledge of this type;
- Marketing skills: like previous competences, much importance is also given to the ability to sell and distribute the product owned by the spin-off. Major is the preparation in these terms, the higher the possibility of the company to be successful in the market compared with competitors. It often happens that within the team there are subjects specialized in marketing (as well as the previous two characteristics), who deal specifically with this business function;
- Company experience: if the members have previous experience in the world of entrepreneurship or any case in the industrial world, it is assumed that they have acquired knowledge about the sector and the mechanisms behind a company. The score is assigned based on the number of experiences, the time spent, and the role held in the company;

- Possession of soft skills, such as leadership and team management skills: the natural inclination to these two characteristics of the team members allows them to attribute a more excellent evaluation to some subjects rather than to others. The scoring can be performed through interviews with team members or the presence of previous experiences in similar roles of responsibility;
- Motivations: an active or less healthy motivation towards the project undertaken can mean in terms of the result, the difference compared to other realities of similar companies. Through the drafting of motivation letters explaining the reasons that push individuals towards entrepreneurial activity, it is possible to assign a specific score. The higher the validity of the motivations, the higher the evaluation will be.

Considering individuals at first in a single way and then in a second in an aggregate manner, it allows the team to find compensation on specific characteristics, which may be better in one subject than in another. In this way, it is possible to have a homogeneous view of the intellectual factor. It also allows the best identification of the critical points to be strengthened and those that instead represent the sharp points on which the team can count. Once all the analyzes and assessments of the case have been carried out as indicated, the maximum value at which the company can aim will be a total of 800 points. The level indicated represents a utopian and purely indicative level, as in many respects, the spin-offs never possess the necessary skills to be able to reach the maximum level of evaluation in the early stages of corporate life. This above all with regard to the assessment of the composition of the capital, for which it is unlikely that a recently established company can grow from the first phases without the intervention of external support; the evaluation of the product/patent, which has not yet been launched on the market, there can be no certainty of how consumers will receive this and how competitors can react to the entry of new competitors in the market. The value represents only a reference point for identifying the validity and its relative level in the preliminary start-up phase. With regards to the conversion in monetary terms of the score achieved by the company, the value can be found by comparing it through the analysis performed with the same method as other similar companies already present on the market and operating from a long time on the market and which already has an assessment in monetary terms. By comparing the scores obtained and the relative assessment attributed to the company taken as a term of comparison, it is possible to obtain a monetary representation indicative of the value of the spin-off. It would be advisable to take into consideration 2 to 3 subjects in order to obtain a value as close as possible to the market value.

The application of an essential proportion will give the value of the spin-off company:

Spin-off points: $\frac{\$ \$ \text{ Spin-off value (x)}}{\text{Similar business points}} = \text{Value } \$ \$ \text{ Business}$

Conclusion

The search for the optimal method of evaluation for companies in the early stages of activity and development has been confirmed, as already envisaged in the first phases of research, a field that is still evolving and the subject of studies and tests by sector experts. In the same way, as university and academic spin-offs are still a form of enterprise at a rather marginal level of diffusion, especially as regards the Italian panorama, the methods of measuring the potential are still in the process of evolution. They are owned by this particular type of start-up with high innovative content. Some of the traditional models used for company valuations are not meaningful, if not difficult, to apply and interpret for this type of activity. The lack of previous data available to the company appears to be the major obstacle to obtaining concrete results close to market values for similar companies. The adaptation of some models to overcome this particular problem of the available data seems to find a partial solution, applying evaluation methods that provide estimates by comparison with other similar companies, especially as regards the income profile. The use of accurately chosen multiples in the financial field seems to be the best solution to get as close as possible to the market value of the company. Many critical issues remain with regards to aspects related to intangible assets present within the company assets. The transposition in numerical and monetary terms of intellectual assets or of the human capital represented by the members of the company team is still a debated topic and is difficult to estimate for all types of business. What emerges as a possible solution to be able to obtain a concrete enhancement of these elements, in any case, is the integration in the purely economic / financial methodologies of methods belonging to other fields, such as technical / engineering as regards the estimation of patents, or methodologies linked to the universe of psychology and business organization for the evaluation of the human component present in the organization. The evaluation of these elements from other points of view makes it possible to obtain a more thorough and productive evaluation, before comparing the company in question with other similar realities and estimating hypothetical market value. The enrichment of the evaluation also makes it possible to distinguish the different types of spin-offs and similar organizations better. The proposed approach contributes to the literature in terms of impact assessment and the real value of university and academic spin-offs. However, it must be considered that the method is still complicated and restrictive. At the University of Turin, the approach adopted helps to guide the possible application and to highlight the innovative aspects from the technological point of view, reconfirm the reference theory. Future studies could focus

on the balances between internal elements that can lead to successful spin-offs and optimal factor levels. The data obtained from the evaluation through comparison are, in any case, a starting point for being able to carry out industrial and managerial development projects for the spin-off and to be able to follow the entrepreneurial activity along its path of growth and success.

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