A MEASURE OF ENTERPRISES' INNOVATIVE ACTIVITY FOR MICROFIRMS AND STARTUPS

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ABSTRACT

Presently knowledge represents a major factor for the development of a country's economy. Although several methods exist to measure a broad range of entrepreneurial intentions and entrepreneurial activities on the national and international level, it should be emphasized that evaluating the level of innovativeness (innovation degree of the product and/or innovation level of the management) is a research challenge tackled by public statistical services and private research institutions. Whereas the topic is relevant for research and practice, prior papers in the literature are limited. Therefore, there is a real need for examining startup ecosystems, which constitute the most dynamically changing legal entities, and have an increasing impact on the economy. Startup mentoring has received a special attention lately in developing countries, such as Ecuador, owing to continuously increasing governmental and private initiatives. In this study we analyze the innovative activity of enterprises enrolled in the Co-working StartUPS mentor program, in Ecuador. The concept of innovative performance introduced by Hagedoorn & Cloodt considers the number of patents awarded to companies. In present, the number of new products introduced to the local and international market is low (only 1.3% of local companies developing new products launch their manufactured goods on the market), and the number of patents owned by Ecuadorian microenterprises and startups is negligible. Therefore, we attempt to develop a new measure for assessing the innovative activity of local startups. For companies registered at the Co-working StartUPS mentor program we try to answer the question how innovative activity impacts the success of startups with constant monthly revenue. A straightforward critical success factor has been calculated by dividing the monthly revenue with the number of employees working at the startup. Next, the level of management's innovativeness and degree of product's innovativeness were determined. Finally, we calculated the total innovative activity using a self-developed index. In addition, we performed correlation analysis between the intellectual activity and the critical success factor.

Keywords: Innovative Activity, Management, Economic Development, Co-working, Startups.

INTRODUCTION

One of the most important strategic grounds of sustainable economic development is to achieve durable success of enterprises (Gurnovich et al., 2013). While entrepreneurial activities cannot be rigorously controlled, entrepreneurship data and measures allow for improving management in both the private and public sectors (Morelix et al., 2015; Mátyás et al., 2019). Although several procedures exist to assess a wide range of entrepreneurial intentions and entrepreneurial activities on the national (Fairlie, 2013) and international scale, it should be emphasized that in present, overall knowledge (rather than exclusively entrepreneurship) is

considered the most important factor for the development of any country's economy (World Bank, 2007, Piotrowska-Piatek & Matskevych, 2018).

The concept of startup companies is still in its early stages, as emphasized by Salamzadeh & Kirby (2017) a significant research question to focus on is *"what are the main stages in the process of new venture creation?"* Creating a new venture (start-up) involves a highly complex process, which should be conducted as a multi-level and a multi-stage phenomenon. It starts with an idea or opportunity; in order to create value a dedicated individual or entrepreneur should take on the opportunity, being able to organize the needed activities, to create competence, and to mobilize resources.

Innovation can be regarded as a multidimensional phenomenon, encompassing process, outcome, and mindset (Kenneth, 2018). It poses a real research challenge to measure the level of innovativeness, tackled by public statistical services and private research institutions (Piotrowska-Piatek & Matskevych, 2018). Nonetheless, the effort for measuring the level of entrepreneurial innovation should consider that a positive correlation exists between company-level innovation and productivity gains (Schaffer et al., 2018). Therefore, there is a clear demand for examining the innovative activity of startup ecosystems, as they represent the most dynamically changing legal entities, and their impact on the economy shows an increasing trend. This statement is supported by the Kauffman reports, which reveals that without startups, there would be no net job growth in the U.S. economy (Kane, 2010; AlQershi et al., 2019).

Innovative activity has been demonstrated to become a factor, which defines the strategic success of a company in the market of goods and services, as well as the stability of its development. Formation of innovative development strategies has become compulsory. It can be achieved via comparing theoretical opinions with empirical testing methods, including statistical studies and expert assessments. Using this approach Zavidna and co-workers concluded that (1) specifics of the strategy of a company in its of innovative development depends on the profile of its activities, the level of production, technical development, and efforts toward the introduction of innovations, (2) the specific type of innovative strategy depends on the depth of interaction of the enterprise with the external environment, being determined by the innovative activity, (3) the indicators chosen for assessing innovative activity must meet the requirements of universality and simplicity, enabling practical applications, (4) when forming a system of innovation indicators, resources should be analyzed for the ongoing production of innovations in all areas of company activity, including, but not limited to production, finance, R & D, and marketing Permanent developments of a company represents a necessary requirement for its effective functioning in the market, while the intensity, direction, and development trajectory of a entrepreneurship can be defined by a set of factors tied to the external and internal environment (Zavidna et al., 2019 a &b).

Startup companies are mostly based on magnificent ideas and they attempt to succeed by sustained growth. Nonetheless, most startups typically, struggle for survival. Salamzadeh & Kawamorita Kesimto (2015) conceptualized this phenomenon in a holistic perspective, identifying challenges faced by startup companies and performing an insightful review of their life cycle, such as (i) financial challenges, (ii) need for appropriate human resources, i.e., experts in the field, and (iii) demand for support mechanisms, including angel investors and/or venture capital, technological incubators, science parks, accelerators, and small business development centers. It was shown that creating a new venture needs to follow a process in which a businessperson engages in entrepreneurial activities, to develop a new venture idea or an opportunity into value. A process view of this phenomenon should consider the relevant theories

and frameworks in the field. It has been demonstrated that new ventures focused on research, would increase their rate of success (Salamzadeh, 2015).

Although the topic is relevant for both research and practice, there are a limited number of prior papers in the literature. Previous studies on the reputation for technological innovation focused on the *"innovative performance in the narrow sense"*, such as product innovations (Hagedoorn & Cloodt, 2003, Höflinger et al., 2018). Though there are practical and visible aspects of any new technology (Henard & Szymanski, 2001, Szymanski et al., 2007), it is a clear shortcoming of focusing exclusively on product introduction (Hagedoorn & Cloodt, 2003). Henard & Dacin (2010) state that one cannot simply rely on a proxy (regarding the number of patents, R&D, and USD spent) to properly measure the reputation of a company in product innovation. Höflinger and co-workers extended this approach by applying multiple proxies, based on patents, their citations, and R&D spending (Höflinger et al., 2018).

The ability of companies to design, develop, produce, and launch innovative products to the local or the international market is a key requisite, which confers competitive advantages (Lengnick-Hall, 1992). An insightful analysis of startup companies in Iran encompassed their entire development, from formation to the exit stage (Salamzadeh & Kawamorita Kesim, 2017).

We believe that Hagedoorn & Cloodt (2003) achieved a breakthrough in measuring the level of innovativeness, when they introduced the concept of *"innovative performance"* defined *"as the achievements of companies in terms of their ideas, sketches, models of new devices, products, processes and systems"* (Hagedoorn & Cloodt, 2003). Their concept is based on the output of the innovative activity of companies, which correlates with the intellectual creativity and the available knowledge within a company (Hagedoorn & Cloodt, 2003, Höflinger et al., 2018), and is regarded as a capability of a company to launch new and/or novel products to the market (Hagedoorn & Cloodt, 2003). Nevertheless, in practice, innovation predominantly happens by exploiting open source technologies and based on different kinds of unrestrictedly available knowledge and information systems, particularly in the Latin-American market, where adopting an existing technology (mainly from developed countries) with minor modifications is a fully accepted common practice.

Startup mentoring has received special attention lately in developing countries, including Ecuador, owing to continuously increasing governmental and private initiatives (Lasio et al., 2014; Mátyás et al., 2019). Ecuador's efforts to support innovation are noteworthy, as since year 2012 the country is allocating 25 percent of its national GDP, i.e., US$140 million of the national budget to research and development (KPMG, 2012). In Ecuador 36.21% of the 3,188 registered companies offer innovative products. An in-depth analysis reveal, however, that only 7.39% of the local companies introduce new products to the national market and as few as 1.3% of them launch new products to the international market. For this reason, it is important to educate skilled students for innovation.

For rendering Ecuadorian startups more profitable one should consider three criteria that enable successful innovations, namely the idea must be desirable, viable, and feasible (Brown, 2009). Unfortunately, most companies focus overwhelmingly on viability and feasibility, considering either a new technological invention, or a novel business model, while disregarding users' demands. Therefore, it is not surprising that many of otherwise promising concepts fail (Müller & Thoring, 2012). When users' needs are not explored and carefully evaluated at an early stage, developed products disappear shortly after being confronted with the market.

In the famous case of Segway®, the two-wheeled, self-balancing personal transporter has failed to gain significant market acceptance, becoming today something of a curiosity. Expected

to solve an actual problem for the user, the zero-turn radius and zero emission vehicle has been adopted mostly by a narrow segment of tourism and part of the police. The product is clever, it works well, Segway Inc. had tremendous funding and resources, and the level of mass media exposure was amazing; nevertheless, the innovation was unsuccessful (Sloane, 2012). To overcome this lack of success, the company has extended its product portfolio with a go kart and various models of kick scooters (Segway, 2019).

Sloane (2012) examined the learning experience from Segway's failure, identifying five causes: (1) Expectations were too high, as it was believed to become the future of personal transport; (2) Segway was a product, rather than a solution; it lacked the proper infrastructure to support it (charging its power supply, parking, and answering the dilemma, whether to be used on roads or sidewalks); (3) The product did not have a clear need or a target market and it was very expensive; (4) Segway was an invention, rather than an innovation; kept under wraps until its launch, there was no user feedback or iteration in the process; and, lastly (5) There was a lack of regulation in many countries.

Segway was banned from sidewalks and roads as it did not belong to any existing vehicle categories. This important road traffic management issue was not properly anticipated (Sloane, 2012). It is likely that Japanese company Yanmar is aware of the above failure analysis, when taking on the idea of a Segway-like device riding on water. Called the Wheeebo, the floating disc will be released in year 2020, at a still unknown price. The new device can be controlled by individuals riding it via the simple shift of their body weight in the desired direction; sensors intuitively detect this change, and the electric craft will speed up, stop, or turn in the chosen direction. Wheeebo's speed is indicated as *"walking speed"* at 3.5 mph (5.6 km/h). Its powering is secured by a nickel-hydrogen battery pack, and a single charge enables 60 minutes of *"water walking"*. According to the inventors, Wheeebo demonstrates *"the application of design thinking and rapid prototyping to discover the needs and difficulties that users themselves did not necessarily realize they faced and offer a solution that reflects the needs of the market"* (King, 2019).

Published studies reveal that business accelerators are playing a key role in facilitating the process of a new venture creation, as they expedite the learning curve, and by this they can shorten significantly an otherwise long journey. The task of a business accelerator is to enable start-up founders to learn fast during the start-up process, such that they can prevent mistakes or even the failure of their business. Six main tools have been described for shortening the learning curve by start-up accelerators, namely: (1) short creation period, (2) seminars and courses, (3) co-working space, (4) divided teams, (5) cohort peers, and (6) mentorship (Salamzadeh & Markovic, 2018). Business accelerators are particularly suitable for developing entrepreneurial universities, which not only consider their traditional mission of teaching and research, but also pursue a third mission, entrepreneurship. Entrepreneurial universities should pay attention to technology transfer, academic entrepreneurship, creating spinoffs, and improving entrepreneurial activities (Salamzadeh et al., 2016). Innovative activities of entrepreneurs can be effective at achieving innovative performance within an organization, given that entrepreneurs can identify and exploit new business opportunities within their organization or establish new undertakings under the patronage of their existing organization. This avenue is preferred in many third-world countries as Nigeria, where the motility rate of small and medium enterprises in present is of major concern. Therefore, innovative activities of entrepreneurs are encouraged, as they can be effective at achieving innovative performance of SMEs in Nigeria. It is intended to create a platform for employees to voice their creative abilities aimed at improved innovation

performance. By this an effective organizational work environment is established, which keeps businesses in Nigeria competitive and well positioned (Olokundun et al., 2017).

Many of these generic concepts have been applied successfully in Ecuador. Hence, an outstanding co-working space has been created, where Co-working StartUPS (CWUPS) is one of the most recognized Ecuadorian academic startup mentor programs, established in 2015 by the Universidad Politécnica Salesiana, a private academic institution. The university runs a total of four Co-working places, synchronizes startup mentoring activities, business courses, marketing meetups, and bootcamps in each of its campuses (Cuenca, Quito-North, Quito-South, and Guayaquil). Innovative students can participate, acquire knowledge on global problems, can cluster in interdisciplinary working groups and create academic startups. Should an academic startup decide to move out from the university's facilities for acting as an independent company, the university would not request a stake from the company or from it's patent. This wise and realistic approach, without placing a financial burden on startups and small companies is aimed to stimulate initiatives. In the CWUPS framework the Working with People (Ríos Carmenado et al., 2016), Project-based learning (Ceca, 2018), Happy Canvas School (The happy canvas school, 2016), SCRUM (Scrum, 2018), Resilencia (Manciaux, 2013), and Idea, Design, Prototype, Validation (Milla, 2018) mentoring and learning methods are used and combined (Mátyás et al., 2018).

In our previous study, we examined by means modified-Kauffman indicators the effectiveness of the academic startups. Here we analyze the roots of success of startups, which have ongoing monthly revenue. The success of the CWUPS is remarkable considering that 45.83% of its newly founded enterprises (less than 1 year old companies) are achieving 2.86 times greater monthly revenue (Mátyás et al., 2019) as compared to average Ecuadorian revenue (El Universal, 2018) and 1.87 times greater monthly revenue than the average revenue of the country's capital, Quito (Check in price, 2019). For this reason, we have chosen enterprises registered at CWUPS to measure their innovative activity.

The concept of innovative performance designed by Hagedoorn & Cloodt (2003) considers the number of patents generated by companies. Since Ecuadorian microenterprises and startups have introduced a negligible number of new products to the local and international market, and there are a scarce number of patents owned by such companies, we attempted to develop a new measure for analyzing the innovative activity of local startups.

Our intent was to answer the question how innovative activity affects the success of startups registered in the CWUPS mentor program.

In this paper, authors first reviewed literature data on presently used approaches for evaluating innovation of enterprises, highlighting the lack of an adequate methodology for assessing innovativeness of microenterprises. To overcome this hiatus, a straightforward and easy to apply measure was proposed for appraising the value of newly founded companies, and a comparative study of the new indicator versus previously used measures was performed. The main theoretical contribution of the disclosed work is the definition of levels of innovativeness, according to the scores of Total Innovative Activity. This represents an original contribution to the quantitative evaluation of the real value of a given startup company, allowing the innovation-based ranking of startup companies according to the extent of their innovativeness.

MATERIALS AND METHODS

A total of 22 academic startups are being quantified in this study. Each of them has been participating in the CWUPS over the time frame encompassing late 2017 to early 2018, and all

have been rated as viable startups (with ongoing revenue since January 2019). Data source: Data related to the startups' ongoing revenue were provided by the Technical Secretary of Statistics (Secretario Técnico de Estadística), Universidad Politécnica Salesiana and by the Vice President's Office of Research (Vicerrectorado de Investigación, Cuenca). The monthly gross revenues (MGR) were disclosed in our previous study (Mátyás et al., 2018) Based on their MGR we divided these startups into three groups, namely: *"Low income"* (between 20 and 1000 US$,) *"Medium income"* (between 1000 and 3000 US$,) and *"High income"* (≥3000 US$). Composition of the selected startups according to business areas was the following: Social enterprises – 9.1%; Catering services – 4.5%; Marketing – 4.5%; e-Commerce – 4.5%; Business coaching – 18.3%; Gift making – 9.1%; Food industry – 13.6%; Branding – 4.5%; Technology support – 4.5%; Healthcare – 9.1%; Electronics – 4.5%; Bakery – 4.5%; Handicrafts – 4.5%; and Construction industry – 4.5%. In addition, we matched the MGR groups with the business areas (Table 1).

Table 1
MGR GROUPS MATCHED WITH BUSINESS AREAS

Business Area	Number of startups within MGR groups			MGR (USD)
	High income	Medium income	Low income	
Social	1		1	4030
Catering	1			3000
Marketing			1	800
E-Commerce			1	500
Business coaching	1		3	5150
Gift making			2	800
Food industry		1	2	2100
Branding			1	200
Technology			1	300
Heath Care			2	250
Electronics			1	500
Bakery			1	100
Handicrafts			1	20
Construction industry	1			5000

Startup founders were surveyed regarding the competition and key of their success. Surveys were conducted by the directors of the CWUPS offices of each campus (Cuenca, Quito-North, Quito-South and Guayaquil) from October 10 to 16, 2019. On a self-declaration basis, we received answers to the following questions: (i) How many competitors does your startup have on the Ecuadorian market? (ii) What is the key of your success? Did your company develop a completely new technology, unavailable in the country before? Or did you introduce an existing technology from abroad, which is new in the country? Or do you use the same technology as your competitors, but you are positioning your company better than others; or do you believe that there is another reason?

For the sake of straightforwardness, a simplified critical success factor (CSF) was calculated by dividing the monthly revenue with the number of startup employees, as shown in below equation.

$$CSFsimpl = MGR / NOE$$

Where, MGR = Monthly Gross Revenue of the startup; NOE = Number of Employees of the startup.

Next, the level of the product's innovativeness (LPI) was determined as follows:

1. To startups that did not develop a new technology nor used innovative solutions the value 1 was assigned, these startups use the same technology as their competition, they achieve success owing to their market positioning;
2. To startups that have adopted an existing technology from abroad value 2 was linked, these startups became aware of the need for the adopted technology and they introduced them in the country at the right time;
3. To startups that have developed a new technology value 3 was assigned.

Next, the level of management's innovativeness (MGT) was determined, according to below equation.

$$MGTinnov = CSFnorm * CATEGcomp$$

Where, CSFnorm = normalized CSFsimpl values, min-max scaling [0, 1]
CATEGcomp = categorized number of competitors:
Category 1: number of competitors is between 0-50,
Category 2: number of competitors is between 50-100,
Category 3: number of competitors is between 100-500,
Category 4: number of competitors is between 500-1000,
Category 5: number of competitors is ≥ 1000.

Finally, the Total Innovative Activity (TIA) was calculated, as shown in below equation.

$$TIA = MGTinnov.(2) * LPI\,(1)(3)$$

Where, MGTinnov and LPI are weighted by a 2:1 relation.

The correlation was investigated using the Pearson correlation coefficient between CSF and LPI in SPSS 25.0.0.0.

RESULTS AND DISCUSSION

As a result of the present study, a new measure (according to the TIA categories) was created to analyze the effect of the innovativeness on enterprise's success (Figure 1.)

Five levels of innovativeness were determined in accordance with TIA values. When a startup achieves a value between 0-1, it means that its innovative activity in the firms' life is insignificant. Value achieved between 1-3 corresponds to some well-known technology and management techniques applied in the company, which are appreciable in the firm's achievements. For startups with values between 2-4, some new innovation aspirations can be detected. Values achieved in the range of 3-5 mean that the startup represents something significantly new to its business category. Startups achieving 5 or more than 5 TIA score lead the local and/or international market, representing innovation in terms of management and product development, as well, and the effect of innovativeness on the enterprise's success is incontestable.

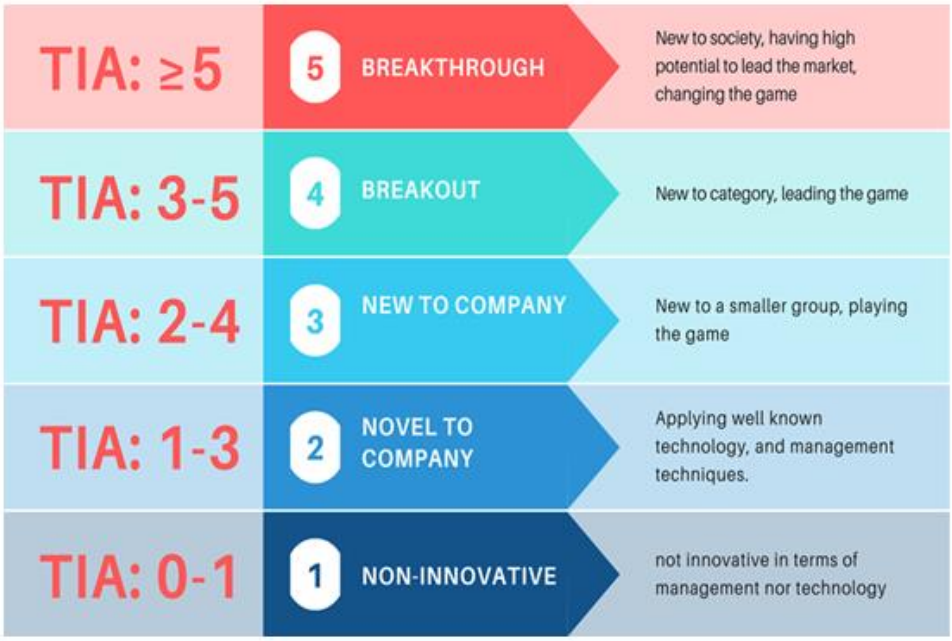

FIGURE 1
LEVELS OF INNOVATIVENESS ACCORDING TO THE SCORES OF TOTAL INNOVATIVE ACTIVITY

Survey results reveal that only one startup out of 22 developed a new technology; 18% adopted existing technologies from abroad; and the rest of the startups use the same technology as their competitors, but they are positioning better their product and/or service in the market. It can be observed from the CSF values that 32% of the examined startups provide higher salaries to their employees than the average Ecuadorian companies, which is a noticeable performance, when considering that all startups in this study are academic micro firms, established by university students. Figure 2 displays TIA scores of the examined startups.

It can be observed that only one startup belong to the *"breakthrough"* category based on its TIA value. This firm has more than 500 local competitors, but it is able to provide over 1,500 US$ monthly salary to its employees (Table 2), which is almost four times greater than the basic salary in the country. This startup did not develop a new product or service, the representative of the firm declared that they focus on management innovation and their marketing campaigns are engaging.

Surprisingly, the only firm (Startup 7) with the highest assigned LPI value, which represents an indicator of the product's innovation level, does not achieve a high TIA score. The explanation is that they are not strong in management innovation, which translates into the low monthly revenue. Despite of this, firm has only 6 local competitors, they cannot engage the Ecuadorian people, at least not in a way that leads to a breakthrough success.

We did not find a significant correlation between CSF and LPI, which suggests that only the level of product's innovativeness itself is not enough to render a company successful. This is evidenced by the above example, according to which the company (startup 7) with the highest LPI value, achieved one of the lowest TIA scores that indicates a reduced total innovativeness of the company.

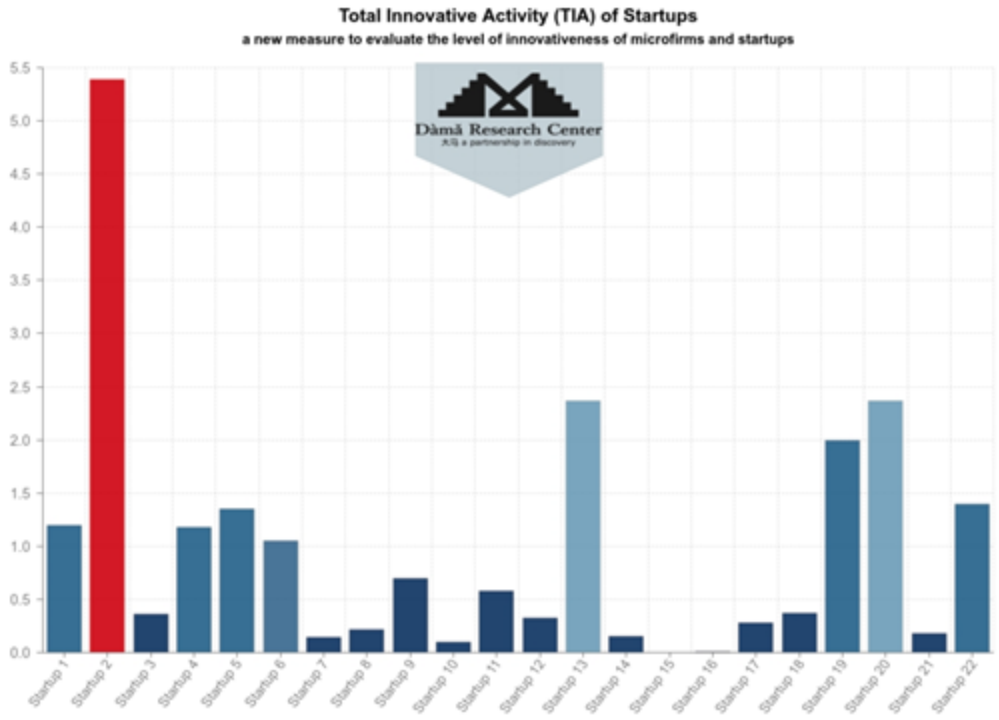

FIGURE 2
TOTAL INNOVATIVE ACTIVITY OF STARTUPS ENROLLED IN CWUPS, 2019

Table 2
INDICATORS OF INNOVATIVE ACTIVITY

№	NOE	CSF simpl.	CSF norm.	CATEG comp.	MGT Innov.	LPI	TIA
1	4	1000	0.6	1	0.6	1	1.2
2	2	1500	0.9	3	2.7	1	5.4
3	5	160	0.1	2	0.2	1	0.4
4	1	500	0.3	1	0.3	2	1.2
5	7	571	0.3	2	0.7	1	1.4
6	1	300	0.2	3	0.5	1	1.1
7	2	50	0.0	1	0.0	3	0.1
8	2	100	0.1	2	0.1	1	0.2
9	1	300	0.2	2	0.4	1	0.7
10	2	50	0.0	2	0.0	1	0.1
11	2	250	0.1	1	0.1	2	0.6
12	1	100	0.1	3	0.2	1	0.3
13	3	500	0.3	2	0.6	2	2.4
14	2	75	0.0	1	0.0	2	0.2
15	2	10	0.0	5	0.0	1	0.0
16	2	15	0.0	1	0.0	1	0.0
17	4	125	0.1	2	0.1	1	0.3
18	4	88	0.0	4	0.2	1	0.4
19	3	1667	1.0	1	1.0	1	2.0
20	1	500	0.3	4	1.2	1	2.4
21	6	83	0.0	2	0.1	1	0.2
22	1	300	0.2	4	0.7	1	1.4

CONCLUSIONS

A new measure, Total Innovative Activity (TIA scores) was created to analyze the effect of innovativeness on the success of an enterprise. It is a result of a rating of multiple performance-related indicators, which translates into a global score. Authors believe that this measure should be useful mainly for microenterprises and freshly established startups, where the customary measurement methods (such as Innovative Performance introduced by Hagedoorn & Cloodt) cannot be applied at an early stage of the startup company's development, given the negligible number of patents owned by the enterprises. TIA scores represent a useful tool in startup mentoring, which is a key toward their market success. Over the past years, startup mentoring has received a special attention in developing countries. When innovative *"Made in Ecuador"* products are being launched internationally, this becomes not a solely economic accomplishment, but also a matter of national pride.

Limitation of the study: CSF was calculated in a straightforward, though simplified manner. In its current form, it can be applied mainly for academic startups, given that their expenditure is predominantly personnel. To apply a CSF described in our study to more advanced companies, an extended CSF calculation is needed in which other types of expenses are also accounted for.

As experienced by other companies worldwide, for startups in Ecuador, there is an immediate need for

(1) User-centered approach, by considering the perspective of the users and stakeholders; extensive user testing is mandatory in the process of improving the initial concepts;
(2) Prototypes should be built and tested in early stages of the R&D process; by gathering user feedback on their needs and expectations, resources can be saved, as no product would be made that nobody wants;
(3) Rapid iteration: as most concepts may be unclear in the beginning, their uncertainty can be reduced by the developed prototypes, which should undergo successive iterations in the R&D process.

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