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A Taxonomy of Equity Crowdfunding Startups in Brazil

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ABSTRACT

Objective: this study addresses a gap in the literature by providing a taxonomy of startup profiles in the equity crowdfunding (ECF) market, analyzing their financial performance from an accounting perspective. **Methods:** using cluster analysis, t-SNE dimensionality reduction, cross-tabulations, and regression trees, we classified 37 equity offers from six platforms (2017–2020). The proposed taxonomy distinguishes two groups: operational performance, characterized by negative profitability but high fundraising values, and financial performance, marked by positive profitability but modest fundraising values. **Results:** we argue that startups' financial goals, the amount raised in fundraising campaigns, the category of ventures, the type of business, and financial performance indicators are relevant KPIs for investors in the Brazilian ECF market. The taxonomy also identifies distinct entrepreneurial profiles, complementing the ex-ante analysis with an ex-post perspective. **Conclusions:** this approach offers a strategic tool for investors and managers to make informed decisions based on historical results, contributing to a refined understanding of the determinants of business success.

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INTRODUCTION

Small companies have historically faced difficulties in financing their businesses (Berger & Frame, 2007). This difficulty occurs due to the asymmetry of information that exists when seeking the intended capital (Courtney et al., 2017; Meoli & Vismara, 2021; Torabi & Mirakhor, 2018). As a rule, startups have different means of financing than large companies and end up becoming more dependent on financial intermediaries who require collateral and demand a history of financial information that they do not yet possess (Berger & Udell, 1995). This situation has given rise to the emergence of new forms of business financing, such as equity crowdfunding (Block et al., 2018; Cason et al., 2024; Di Pietro et al., 2023; Miglo, 2021).

Equity crowdfunding (hereafter called ECF) can be understood as a business financing modality in which individuals invest capital to become shareholders (Ahlers et al., 2015). The investors who deposit capital in these businesses (generally startups and fintechs) receive a defined percentage amount or variable financial participation, which depends on the size of the investment made and the financial performance of the startup (Agrawal et al., 2016). Another striking feature of the ECF market is the presence of operational risks and uncertainties related to the funding acquisition process (Mollick, 2014). This has revealed the need for specific regulation and structured economic plans for companies that use ECF as a financing instrument (Ferreira & Felipe, 2020).

ECF has helped to democratize business financing. This is because many individuals were unable to obtain financial resources from the usual sources to develop their businesses (Vismara, 2016). Financing via ECF occurs through an amount made available by a group of investors who choose startups that present capital offers on crowdfunding platforms. Those interested in this type of business can also offer expertise and support in publicizing the project within their network (Signori & Vismara, 2016). Fundraising processes via ECF mostly occur on online platforms (Vismara, 2016). These platforms are websites that host business proposals for investment in startups (Belleflamme et al., 2015) and serve as tools to promote trading activities in the ECF market.

Financial transactions carried out in the ECF market are monitored by regulatory agencies in each country. The SEC (Securities and Exchange Commission) in the United States and the Brazilian Securities and Exchange Commission (*Comissão de Valores Mobiliários* [CVM]) perform this task. In Brazil, the ECF market traded more than BRL 46 million in 2018, representing a 461% growth compared to 2016. The number of investors also increased, advancing by about 716%, from 1,099 investors (2016) to 8,966 (2018) (CVM, 2019). The number of successfully completed offers went from 24 to 46. Then, the ECF market grew approximately 43% more in 2020 than in 2019, trading more than BRL 84 million — 10 times the amount in 2016 (CVM, 2021).

In Brazil, most of the previous studies are related to the following outcomes: (1) the description, operation, or regulatory aspects of the ECF platforms (Arruda, 2019; Lupi et al., 2019; Siqueira & Diniz, 2017); (2) the legality of financial relations (Santos & Cruz, 2020); (3) the determinants of success of ECF campaigns (Ferreira & Felipe, 2020); and (4) the influence of geographic distance between the investor and the investee on the value of investments (Felipe et al., 2023). Although these previous studies have contributed to advances in understanding the dynamics of allocating financial resources in the ECF market, we have not found evidence or studies that provide a general perspective on the Brazilian ECF market. The lack of a taxonomy makes it difficult to develop a more comprehensive discussion on business clusters, their characteristics, and aspects of financial performance. We believe that taxonomy studies are relevant because they help to clearly present events or entities that are not yet well known (McKelvey, 1982). In our case, we are talking about the Brazilian ECF market.

Our taxonomy provides a structure for fundraising profiles in the Brazilian ECF market. The taxonomy approach offers various contributions, ranging from the classification and organization of elements (Geiger et al., 2011) to a deeper exploration of the underlying logic of a phenomenon (Alamsyah & Syahrir, 2024; Derave et al., 2024). Therefore, our study is pioneering in constructing a taxonomy of ventures financed through the Brazilian ECF market. To provide a broad set of information about this market, we also use fundamental analysis based on the key performance indicators (KPIs) of startups. This expands our taxonomy strategy and allows us to access not only the attributes of venture profiles but also the economic aspects of the financial health of startups. This information can be considered the drivers of success in the Brazilian ECF market.

The proposed taxonomy allows us to verify the main financial (or risky) profiles of equity fundraisers and to understand whether some profiles are more likely to succeed than others. Our study advances the understanding of the attributes of startup fundraising campaigns, which can be important in supporting investment allocation decisions in this market. We claim that the startups' financial goals, the amount raised in the fundraising campaign, the category of ventures, the type of business, and the startups' financial performance indices are the relevant KPIs for investors in the Brazilian ECF market.

Like traditional financial markets, information asymmetry can hamper the investment allocation process in the ECF markets. The information is not readily available to investors and participants in the ECF market for several reasons, ranging from poor management of crowdfunding platforms to the absence of disclosure of economic information that reflects the financial health of the businesses by the entrepreneurs. Thus, research on the ECF market can generate useful information for the investment decision-making process and also for public policymakers involved in regulating this market. We hypothesize that startups with greater disclosure of financial information and better performance indicators have a higher probability of success in fundraising campaigns through equity crowdfunding in Brazil.

Therefore, the objective of this study is to provide a taxonomy of the profiles of startups that raised capital via ECF platforms. In addition, we also analyzed the financial performance of startups funded by these platforms. First, we manually collected the financial statements available from startups that used ECF platforms to raise capital from 2017 to 2020. We consider this period as it covers the legal framework for the regularization of startup capital offers via ECF by the CVM. Startups that disclosed accounting information for at least one full year were included — this was our criterion for inclusion in the sample. Thus, we collected 37 offers from six Brazilian ECF platforms, which is almost 20% of the total number of platforms registered with the CVM. It is worth mentioning that this sample includes the total number of startups that disclosed their financial information in the period analyzed in this study.

Seven financial performance indices discriminate between the two groups in our taxonomy. They are: net profit, gross profit, EBITDA, ROIC, goal (BRL), total capital raised (BRL), and PAmount (%). Startups in the financial performance group tend to be more profitable, even if they raise less capital than startups in the operational performance group. We observed that there is a 67.5% chance of a startup belonging to the financial performance group, and if that happens, there is a 40% probability that it will be profitable. We noticed that most startups (72%) presented poor economic performance, reduced liquidity and profitability, and a high level of debt. Finally, we were able to find, with great difficulty, the financial information of only six out of 33 ECF platforms listed by the CVM. This fact reinforces our initial intuition that information asymmetry can make it difficult to assess the quality of businesses in the Brazilian ECF market. These results can be important for platform managers, entrepreneurs, and market agents, such as supervisory institutions.

RELATED LITERATURE

Financing by ECF

Bootstrapping refers to the practice of financing a company's operations and growth using internal resources, such as reinvested earnings (Malmström, 2014). This concept is especially relevant for small companies, which often face difficulties in obtaining external financing due to bureaucratic requirements and restrictions imposed by traditional financial institutions (Cosh et al., 2009; Ryan et al., 2014). Bootstrap funding plays a significant role in these ventures. It allows small companies to overcome resource constraints and continue to expand their business (Tomczak & Brem, 2013). This financing type provides entrepreneurs with flexibility and independence, since they are not dependent on external investors or creditors. Additionally, it encourages resourcefulness and creativity, as entrepreneurs must find innovative ways to maximize the limited resources available (Malmström, 2014).

By adopting bootstrap financing, entrepreneurs can maintain full control over their companies and avoid the burden of paying interest and dividends to external investors (Malmström, 2014). This approach promotes financial independence and the freedom to make strategic decisions without third-party interference. Moreover, this financing modality encourages entrepreneurs to explore creative and innovative solutions to face the challenges arising from the scarcity of resources (Harrison, 2013).

Bootstrap financing and crowdfunding are distinct but related approaches to funding startups and projects. Both approaches focus on obtaining capital in non-traditional ways, without resorting to large investors or financial institutions (Chit & Rizov, 2024). Bootstrapping refers to the practice of financing a company or project with personal resources, without seeking external funding such as bank loans or investor capital. In this approach, investments come from personal savings, early business revenues, or even help from family and friends. The main characteristic of bootstrapping is financial independence and the full retention of control over the business (Chit & Rizov, 2024).

On the other hand, crowdfunding is a form of collective financing, where many people contribute small amounts to support a project or company, usually through online platforms (Ermawati, 2024). The idea of raising financial resources through people is not necessarily new (Colombo et al., 2015). However, it was only in recent decades that technological advances allowed the evolution of business models, profoundly modifying the relationship between businesses and consumers (Brenner et al., 2014). Thus, crowdfunding has been highlighted for its ability to gather large sums of finan-

cial resources originating from small investments by a wide set of people, enabling individual entrepreneurial initiatives and startups (Belleflamme et al., 2015).

ECF can be understood as a type of financing for small companies (Agrawal et al., 2016). Many small investors invest capital in exchange for a portion of a company's shareholding structure. This entire procedure takes place through a virtual platform, in which the entrepreneur requests an investment round and presents their venture to investors, usually specified in a structured business plan (Ahlers et al., 2015).

These virtual platforms are responsible for providing the legal means of transaction and the legal basis (Miglo, 2021). They also carry out the campaign and raise the financial value for startups, thereby offering investment opportunities for companies and stakeholders (Vismara, 2016). ECF platforms allow entrepreneurs to start and develop their businesses (Alharbey & Van Hemmen, 2021). They also serve as a source of information and data for investors, entrepreneurs, and market agents (Piva & Rossi-Lamastra, 2018). Hornuf and Schwienbacher (2018) add that the financial evaluation process of the venture is also carried out through the ECF platform, in which the platform and startups must agree on the pricing of the business.

On the other side of the mechanism are the entrepreneurs, who are the creators of projects and carry out funding campaigns on crowdfunding platforms. Ryu and Kim (2018) identified four types of entrepreneurs. The first of them, called social entrepreneurs, have greater prosocial motivation and less monetary motivation. They are generally younger, develop projects with greater viability and social contribution, and have shown competitive performance in relation to other types. The second type, the daring dreamer, is more motivated to achieve, develops projects with lower funding goals, and is recognized as less viable, more reliable, and active.

The third is the fund seeker, who has a higher need for resources compared to the others, is more experienced, seeks greater rewards, and accounts for a higher average financing value. The last type, the indie producer, seeks to build and strengthen relationships, is typically involved in artistic projects, and provides a lesser social contribution. Each of the characteristics presented by Ryu and Kim (2018) can help differentiate communities of project creators, their motivations, and behaviors in the context of crowdfunding.

In summary, the ECF financing process effectively begins with the entrepreneur requiring capital to develop their business. This capital is then requested in an investment round on an ECF platform. This platform should describe the purpose of the business, the profile and general information about the venture, and the financial participation promised in exchange for the investments (Correia et al., 2024). If the offer is successful, the return the investor obtains is proportional to the company's performance after the offer and may result in a loss equivalent to all the capital invested. If the company goes bankrupt, or if it makes capital offers with higher pricing values and there are no subsequent offers, there is no way to assess the gain or loss of the invested capital (Signori & Vismara, 2018). It is worth noting that if the offer is not successful, the amount invested is returned to the interested party and the 'business does not take off' (Signori & Vismara, 2018).

Building on the previous discussion of how equity crowdfunding (ECF) operates and the different profiles of entrepreneurs utilizing these platforms, it is essential to also consider the role of investors in this ecosystem. The ECF market relies on the participation of external investors, meaning individual investors and professional investors, who can be classified as financial angels or risk investors (Di Pietro et al., 2023; Mahmood et al., 2019; Signori & Vismara, 2018). The main motivation behind the investments made in ECF campaigns is to obtain a high return on capital (Hornuf & Schwienbacher, 2018). However, Arruda (2019) highlights that investments in startups can present low liquidity, high risk, and a scenario of constant uncertainty.

In Brazil, the ECF market emerged around 2014, prior to its formal regulation by the Securities and Exchange Commission of Brazil (CVM) in 2017. This regulation was crucial for ensuring greater legal security and fostering the development of the sector. The CVM rule positioned Brazil as having one of the most comprehensive and flexible regulations globally, allowing the inclusion of companies of various sizes and structures, with a maximum fundraising limit of BRL 15 million (CVM 88).

The market's potential is significant. According to Brazilian Macro and Small Business Support Service (*Serviço Brasileiro de Apoio às Micro e Pequenas Empresas* [SEBRAE], 2023), in 2021 it is estimated that the Brazilian ECF market raised more than BRL 188 million, which represents a 123% increase compared to the total investments made in 2020. This financial model has emerged as a strong ally to angel investment, sharing similar characteristics in terms of average ticket size and target company profile, especially startups and small businesses (Correia et al., 2024). One of the main advantages of ECF is its ability to promote 'bottom-up' growth in the capital market, focusing on small offerings and fostering entrepreneurship (Miglo, 2021).

By bringing investors closer to companies in their early stages, this model creates a more direct connection, where investors can make influential decisions and

identify with the entrepreneurial team or the products offered (Miglo, 2021). This helps to partially mitigate the lack of liquidity and market unfamiliarity, which are recurring challenges for individual investors (Correia et al., 2024). However, challenges remain. The Brazilian market still struggles with the low participation of personal investors, a result of factors such as a history of high interest rates, the concentration of investment opportunities in the hands of large players, and economic volatility associated with government measures (Felipe et al., 2023).

Fundamental analysis

One of the objectives of fundamental analysis is to evaluate a business based on indicators extracted from its accounting information, such as debt, liquidity, and profitability (Malta & Camargos, 2016). These authors argue that the idea of evaluating businesses and companies based on information has been attributed to Fama's (1970, 1991) theory of market efficiency. This theory advocates that any and all information important to a business must be examined and verified. This assessment must be fundamental for the company's financial decisions, whether linked to the past or the future of the business (Altman, 1968).

Fundamental analysis also deals with the existence of a relationship between the intrinsic value of a company and its market price. In other words, it investigates the variation of elements that can affect the balance between supply and demand in a specific market, as suggested by Penman (2010). Therefore, micro and macroeconomic, strategic, financial, and accounting aspects can influence the intrinsic value of the business (Altman, 1968). Fundamental analysis is a tool that investigates why the value of a business should vary over time (Damodaran, 2009a). This analysis is therefore concerned with translating the impact of available information about the company into an estimate of how the future performance of the business should be. Its use should serve as a tool for investors and other interested parties to access business plans and performance (Damodaran, 2009b).

Fundamental analysis observes aspects that imply the evaluation of accounting rules and conventions. It identifies whether these represent the economic and strategic reality through financial statements and, if necessary, develops measures for accounting adjustments (Richardson et al., 2010). It is subsequently possible to implement economic analysis based on fundamental analysis, which uses economic indices and measures of financial performance from the cash flow of the company's operations, financing, and investment. Good examples of these ratios are: EBITDA, net debt/EBITDA, gross margin, EBITDA margin, net margin, ROIC, net debt, net debt/equity, ROE, and current liquidity. Nossa et al. (2010) also add that financial analysis makes it possible to evaluate the present and past performance of a business and its sustainability, and is therefore a very relevant strategy in the financial decision-making process.

Fundamental analysis, widely used to assess publicly traded companies, can be adapted for the evaluation of startups by focusing on the fundamental aspects that underpin these emerging companies' potential for growth and value generation. Although startups often present uncertainties and lack a consolidated financial history, fundamental analysis can provide a valuable framework for understanding their economic viability and the key factors driving their growth (Damodaran, 2012).

This type of analysis allows for a qualitative view of the business by evaluating the product or service offered by the startup. It assesses the innovation, the value proposition, and whether the product meets a clear market demand (Ries, 2011). The target market is also analyzed, considering its size, growth trends, and competitiveness (Damodaran, 2012). In addition to qualitative aspects, the fundamental analysis of startups also involves a quantitative assessment based on the companies' accounting and financial information.

Revenue is one of the main indicators to observe since, for many startups, profit is not the primary focus in the early stages (Schwienbacher & Larralde, 2012). Another important aspect is the analysis of profit margins, such as gross margin and operating margin, which indicate how efficiently a startup can turn revenue into profit (v). Additionally, debt, liquidity, and profitability are relevant indicators, as they signal the financial health of a startup (Picken, 2017).

One of the main benefits of using fundamental analysis in startup evaluation is the possibility of making more informed decisions. This approach allows investors to make a comprehensive and more rational assessment of the company, relying on solid data and indicators rather than market trends or speculation (Damodaran, 2012). Moreover, fundamental analysis helps identify startups with greater potential for sustainable growth, providing insights into their ability to generate value over time (Denis, 2004).

Another important benefit is risk management, as the detailed analysis of a startup's fundamentals can help predict potential problems, such as low cash flow generation capacity or difficulties in scaling the business. This foresight allows investors and managers to adjust their strategies to mitigate the risks involved (Gompers et al., 2010). Additionally, fundamental anal-

ysis contributes to a better understanding of startup valuation, assisting in estimating the company's fair value based on growth projections and competitiveness, which is essential for investment decisions (Damodaran, 2012). By providing a balanced view of operational and financial fundamentals, this approach allows investors to make more informed decisions, backed by solid data, contributing to the development of a more robust investment strategy in a landscape of innovation and volatility.

Fundamental analysis can be significantly enhanced with the application of multivariate statistical techniques such as cluster analysis and t-SNE (t-distributed stochastic neighbor embedding). These techniques help identify underlying patterns in complex data, facilitating the classification of assets with similar characteristics and optimizing the evaluation of companies' financial performance. Cluster analysis, for example, organizes multivariate data into subgroups based on structural similarities, highlighting nuances in investment strategies or firms' financial performance (Wooldridge, 2003).

On the other hand, t-SNE is a dimensionality reduction technique useful for visualizing and analyzing high-dimensional financial data. By grouping variables based on their geometric proximity, t-SNE identifies asset pricing factors and provides insights into the intrinsic relationships between variables that are difficult to visualize directly, being particularly effective in studies with small samples. This approach becomes even more powerful when combined with other multivariate techniques, such as principal component analysis, providing a clearer view of the correlations between financial variables (Greengard et al., 2020). These methods, which handle complex financial data and small samples robustly, expand the applicability of fundamental analysis in varied contexts, such as forecasting stock performance and analyzing diversified portfolios.

Several studies, both national and international, have addressed methodologies applied to crowdfunding analysis, particularly equity crowdfunding, using multivariate statistical techniques. Safitri and Rita (2022) investigated the performance of small and medium-sized Brazilian enterprises through multiple regression analysis, highlighting the importance of equity crowdfunding as an alternative form of funding for micro-enterprises.

Vismara (2016) explored equity retention and the role of social capital in equity crowdfunding campaigns, using a sample of 271 projects from platforms in the United Kingdom. Both studies emphasize the relevance of robust statistical analyses to understand the determinants of success in crowdfunding campaigns.

Regarding the application of techniques such as cluster analysis, t-SNE, and regression trees in small samples, there is a growing body of literature exploring these approaches in financial scenarios, particularly for segmentation and forecasting. Greengard et al. (2020), for instance, used t-SNE to group asset pricing factors, identifying different clusters of investment strategies. Furthermore, studies adopting machine learning techniques, such as neural networks and decision trees, in small samples have shown that these methodologies provide more accurate predictions compared to traditional techniques.

Ralcheva and Roosenboom (2019) employed logistic regression in their predictions of success in equity crowdfunding campaigns, reinforcing that these techniques are effective even in situations of limited data availability. These approaches highlight the statistical robustness of multivariate techniques in small samples, offering a solid foundation for the methodological choices in the present study. However, as Yeh and Chen (2020) show, the main limitation of these techniques lies in their sensitivity to available data and the need for fine-tuning to ensure result accuracy.

METHODOLOGY

Data

The data collection process was conducted in September 2022. At that time, the total population consisted of 33 equity crowdfunding platforms. In 2023, the new CVM report on registered ECF platforms indicated the existence of 64 platforms (CVM, 2023), representing an increase of 31 new platforms. However, only the six platforms initially identified in 2022 published financial reports. It is worth noting that a significant portion of the platforms not included in this study ceased operations and were removed from the CVM's published list. Once the platforms were identified, we decided to analyze the timespan from 2017 to 2020, as it contained the entirety of available information. Hence, the sample presented in this study represents the totality of publicly accessible data for any interested party, to the best of our knowledge.

The primary criterion for platform selection was the availability of comprehensive financial data on equity crowdfunding investment rounds in Brazil. All platforms included in our sample disclosed financial information between 2017 and 2020. We collected information on the websites and social networks of the ECF platforms regarding the total capital raised by the startup financing campaigns, the number of offers made by the platforms, and the foundation year of the platforms. We emphasize that the analyzed platforms dominated the Brazilian equity crowdfunding market between

2017 and 2020, both in terms of transaction volume and operational longevity. This ensures that the sample is highly representative, minimizing potential selection biases. Although other platforms were registered with the CVM, their market share was minimal, further reinforcing the validity of our findings for the sector.

After collecting operational information, we proceeded to search for accounting and financial information of startups that participated in capital offerings managed by the platforms under analysis. The financial documents found were the startups' balance sheets and income statements for at least one full year. In doing so, we were able to account for 37 startups that participated in capital offers between 2017 and 2020, making their financial statements available. It is worth mentioning that this sample comprised the totality of startups that disclosed their financial information in the period analyzed in this study. The 37 offers considered in this study and the platforms that managed these offers are presented in Table 1.

Table 1. ECF platforms and startups considered in this study.

Startup (group)	Platform	Goal (in million)	Total capital raised (in million)	PAmount	Category	Type
Adimplere (OP)	Eqseed	BRL 3.075	BRL 3.075	100%	Financial services	Service
Lady Driver (OP)	StartMeUp	BRL 2.500	BRL 2.501	100%	Technology	Product
Trade food (FP)	StartMeUp	BRL 0.540	BRL 0.540	100%	Food	Service
Membran-i (OP)	StartMeUp	BRL 1.050	BRL 1.105	105%	Technology	Service
Glebba Investimentos (FP)	StartMeUp	BRL 0.345	BRL 0.400	116%	Financial services	Service
Aurratech (FP)	StartMeUp	BRL 1.500	BRL 1.014	68%	Industry	Service
Zaply (OP)	StartMeUp	BRL 0.650	BRL 0.390	60%	Technology	Product
Babuxca (FP)	StartMeUp	BRL 0.400	BRL 0.320	80%	Drinks	Product
Gama Ensino (FP)	StartMeUp	BRL 0.850	BRL 0.567	67%	Technology	Service
Fishtag (FP)	StartMeUp	BRL 0.900	BRL 0.900	100%	Technology	Product
SuperOpa (FP)	StartMeUp	BRL 2.600	BRL 2.300	88%	Technology	Product
SkyDrones (FP)	CapTable	BRL 0.901	BRL 0.901	100%	Technology	Product
Eirene Solutions (FP)	CapTable	BRL 0.750	BRL 0.750	100%	Technology	Product
LIVIMA (FP)	CapTable	BRL 1.000	BRL 1.000	100%	Real estate market	Service
WUZU (OP)	CapTable	BRL 1.000	BRL 1.200	120%	Technology	Product
UNAIL (FP)	StartMeUp	BRL 0.500	BRL 0.250	50%	Beauty	Service
FLAPPER (OP)	StartMeUp	BRL 2.500	BRL 2.533	101%	Air transport	Service
Play2sell (OP)	CapTable	BRL 2.000	BRL 1.950	98%	Gamification of training	Product
Novidá (FP)	Eqseed	BRL 0.875	BRL 0.875	100%	Technology	Product
Kavod (FP)	Eqseed	*	*	*	Financial services	Service
Pink Farms (OP)	StartMeUp	BRL 4.000	BRL 4.800	120%	Urban farms	Product
SQED (OP)	CapTable	BRL 0.866	BRL 1.060	122%	Technology	Product
GAV (FP)	CapTable	BRL 0.500	BRL 0.750	150%	Technology	Product
Vela bikes (OP)	Kria	BRL 1.000	BRL 1.785	178%	Urban transport	Product
Fluke telefonia (OP)	Kria	BRL 5.000	BRL 5.000	100%	Mobile telephony	Product
The Ifriend (OP)	CapTable	BRL 1.333	BRL 2.000	150%	Technology	Product
Solar21 (FP)	StartMeUp	BRL 2.900	BRL 1.943	67%	Energy	Product
Substância (FP)	Cluster21	*	*	*	Food	Service
OAK'S (FP)	CapTable	BRL 0.948	BRL 1.100	116%	Food	Product
Inbeauty (FP)	CapTable	BRL 0.467	BRL 0.700	150%	Nutricosmetic	Product
VULPI (FP)	CapTable	BRL 0.939	BRL 1.000	106%	Technology	Service
LEIGADO (FP)	CapTable	BRL 0.592	BRL 0.592	100%	Technology	Product
4.events (FP)	CapTable	BRL 0.736	BRL 0.736	100%	Technology	Service
xGB (FP)	Wiztartup	BRL 0.450	BRL 0.495	110%	Technology	Product
Kuke comercio e alimentos (FP)	Eqseed	BRL 0.500	BRL 0.500	100%	Technology	Service
HIPERDADOS (FP)	CapTable	BRL 1.930	BRL 1.930	100%	Technology	Product
Organicos Inbox (FP)	Eqseed	BRL 2.500	BRL 2.500	100%	Food	Product

Note. Elaborated by the authors. * Information not available. OP: Operational performance group. FP: Financial performance group. Goal, variable in thousands of Brazilian reais, informs the financial target of raising funds for the startup campaign. Total capital raised, variable in thousands of Brazilian reais, represents the total amount raised during the startup financing campaign. PAmount(%) informs the percentage variation of the collected volume of resources according to the goal. Category is the framework of the campaign according to its field of activity. Type informs whether the startup offered a solution in the form of a product or service.

Additionally, Table 1 informs the funding goal of each campaign, the total amount of capital raised, the percentage of the total amount raised versus the goal, the startup's classification category, and the type of business offered.

ECF Platforms

We assert that all publicly available market information was collected. However, the limited disclosure by some platforms may indicate a structural weakness in the sector, linked to information asymmetry and the

absence of robust corporate governance mechanisms (Di Pietro & Butticè, 2020; Torabi & Mirakhor, 2018). The literature suggests that non-disclosure of financial information may be intentional, either to obscure businesses with limited future financial viability (Vismara, 2018) or to conceal firms that have already failed financially (Cumming et al., in press).

Table 2 presents the Brazilian platforms that manage ECF campaigns and disclose financial information through their websites and/or social media. Our study considered all platforms that offered startup investment opportunities between 2017 and 2020 and provided complete financial information for at least one year of a startup's operations. These platforms include StartMeUp, Kria, Eqseed, Wiztartup, Cluster21, and CapTable.

Table 2. Observed platforms and their offers.

Platform	Opening	Number of completed offers	Total value of offers (in BRL million)	Number of offers with available statements	Proportion of offers found with available statements (%)
StartMeUp	2013	30	32.20	14	46.66
Kria	2014	70	40.00	2	2.85
Eqseed	2014	30	30.50	5	16.66
Wiztartup	2018	2	0.85	1	50.00
Cluster21	2018	2	1.68	1	50.00
CapTable	2018	21	22.57	14	66.66

Note. Elaborated by the authors.Information for each ECF platform was collected on their official websites and/or social media.

StartMeUp, the oldest platform, was founded in February 2013. It actively invests in and monitors all campaigns hosted on its website, aiming to connect entrepreneurs with strategic partners and smart money investors. Kria, founded in 2014 and formerly known as Broota, is one of Brazil's most established ECF platforms, dedicated to democratizing startup investments across various sectors. Eqseed, also launched in 2014, focuses on bridging the gap between startups and the investment market.

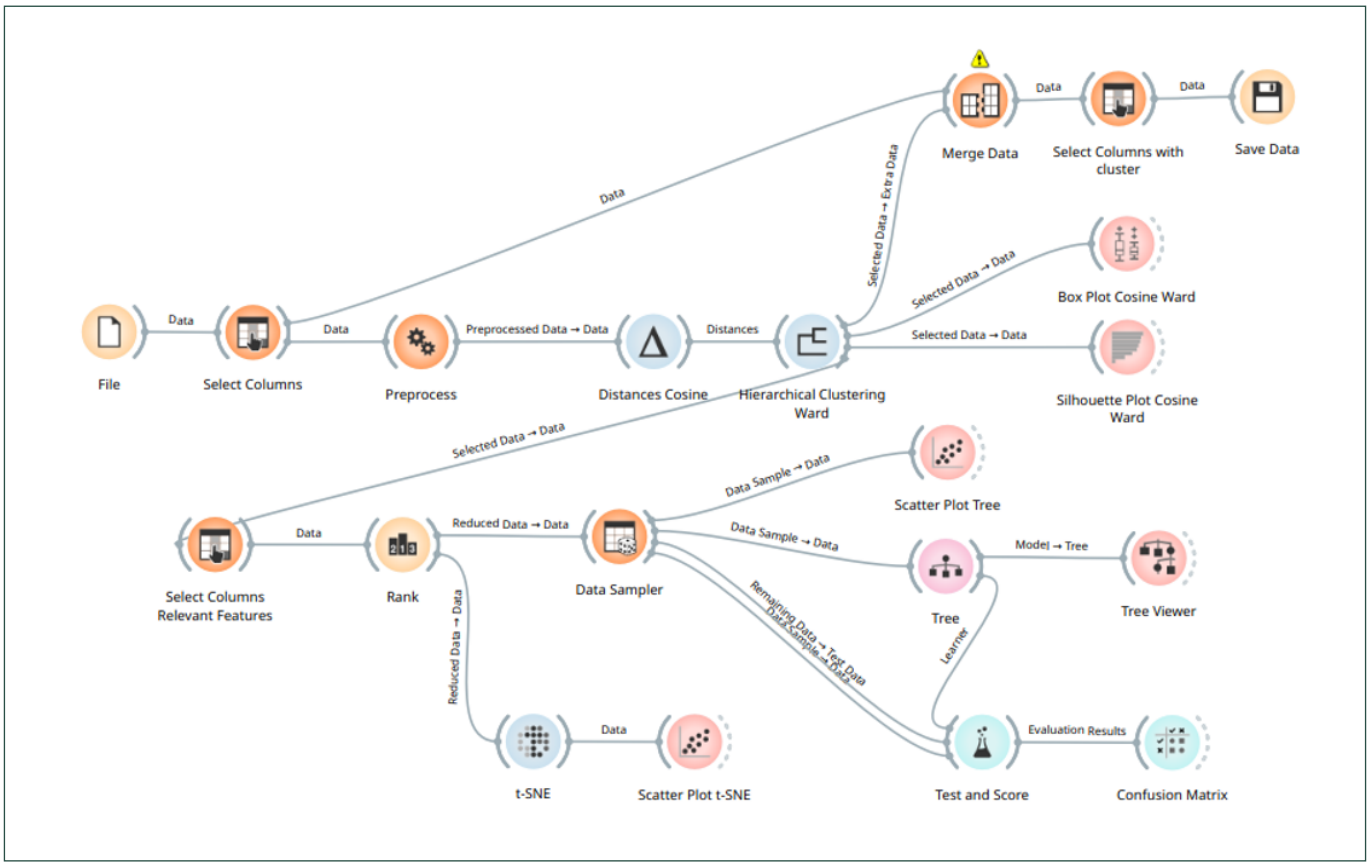
The next three platforms are more recent and were created in 2018. With two founding partners, Wiztartup was also one of the platforms that presented at least one offer with financial statements. Cluster21 aims to make fundraising for startups simple and accessible, intending to cooperate in democratizing capital for entrepreneurs. Finally, we examine the campaigns managed by CapTable, whose activity is based on expert assistance for entrepreneurs to scale their businesses, by bringing offers closer to their potential investors. Among the platforms that provide financial information on their offers is CapTable, with 66.66% of offers with available data. In second place are the Cluster21 and Wiztartup platforms, both with 50%; however, it is worth noting that these platforms only accounted for two complete offers.

What most draws attention in the data in Table 2 is the lack of disclosure of financial information on the offerings, which goes against what Brazilian legislation has determined in recent years. Brazil regulated Instruction 588 — ICVM through the CVM in 2017, which defines the procedures and conditions for raising funds via ECF. Brazilian law regulates the performance of virtual platforms and the actions of experienced investors and entrepreneurs. We have two intuitions regarding the absence of financial information: the first is that most Brazilian platforms might remove financial information from offers made after the end of the campaigns, since the sale of shares requires disclosure of this information to investors. The second is that some ECF platforms in Brazil may not be complying with the legislation.

Cluster analysis

Figure 1 shows the workflow developed for data analysis using the free Orange Data Mining software, whose source file and database are available in the supplementary materials for reproducibility. Each workflow step is illustrated by widgets that identify different tasks related to: (1) loading, preprocessing, and saving data [File, Rank, Save Data], (2) data transformation [Select Columns, Preprocess, Data Sampler, Merge Data], (3) data visualization [Box Plot, Silhouette, Scatter Plot, Tree Viewer], (4) supervised [Tree] and unsupervised modeling techniques [Distances, Hierarchical Clustering, t-SNE] of data, and (5) the evaluation of supervised models [Test and Score, Confusion Matrix].

Once the data were loaded and processed (filling in any missing data and normalizing the independent variables), the hierarchical analysis of clusters was applied with the objective of aggregating the startups according to the characteristics of their financial indicators, namely: net profit, gross profit, EBITDA, net revenue, net debt, equity, net debt/equity, debt/EBITDA, net profit margin, gross margin, EBITDA margin, ROIC, ROE, current liquidity, goal, total capital raised, and PAmount (%). In this regard, the measure of similarity based on the distance that best fitted the data was the Cosine, combined with Ward's grouping method, so that the groups found tended to have approximately the same number of observations.



Source: Elaborated by the authors.

Figure 1. Workflow for data analysis.

The silhouette score was used as a post hoc measure to evaluate the internal consistency of the clusters found. With the identified groups, mean comparison tests of the financial indicators of the startups (Student's t-test or ANOVA) were performed through the box graph using a parametric approach. In addition, a non-parametric test of equality of medians (Mann-Whitney) was also used via the free PSPP software in case the assumption of data normality in the groupings was violated.

Then, the possible financial indicators that discriminate between the groups of startups were identified from the mean/median comparison tests. The t-SNE dimensionality reduction technique was used as a post hoc test to verify the discriminating power of these financial indicators in the groups in 2-D space. Then, their averages were calculated by the identified group in order to characterize their profile.

Furthermore, a regression tree model was used to obtain the parameters applied to the financial indicators needed to classify startups in the identified groups in a decision flowchart. In this sense, a stratified training sample (50% of the total sample) was created via random draw to build the regression tree, whose classification efficiency was measured by the confusion matrix of the stratified test sample (50% of the total sample).

Key performance indicators (KPIs)

The indices used in this study are presented in Table 3. These indices are widely implemented in the economic analysis of companies, as they can reflect the performance of the business as well as provide evidence on the profitability and return of business activities in the short and long term (Damodaran, 2012). We used the main indicators pointed out by Damodaran (2009a, 2009b, 2012)for the economic-financial analysis of the accounting information of young, startup, and growing companies.

We highlight that metrics such as net profit or loss, gross profit, net revenue, and equity do not need any calculation because the statements already provided these values. Net debt was calculated using a simple and customary formula: current liabilities plus non-current liabilities minus cash and cash equivalents.

Table 3. Key performance indicators used.

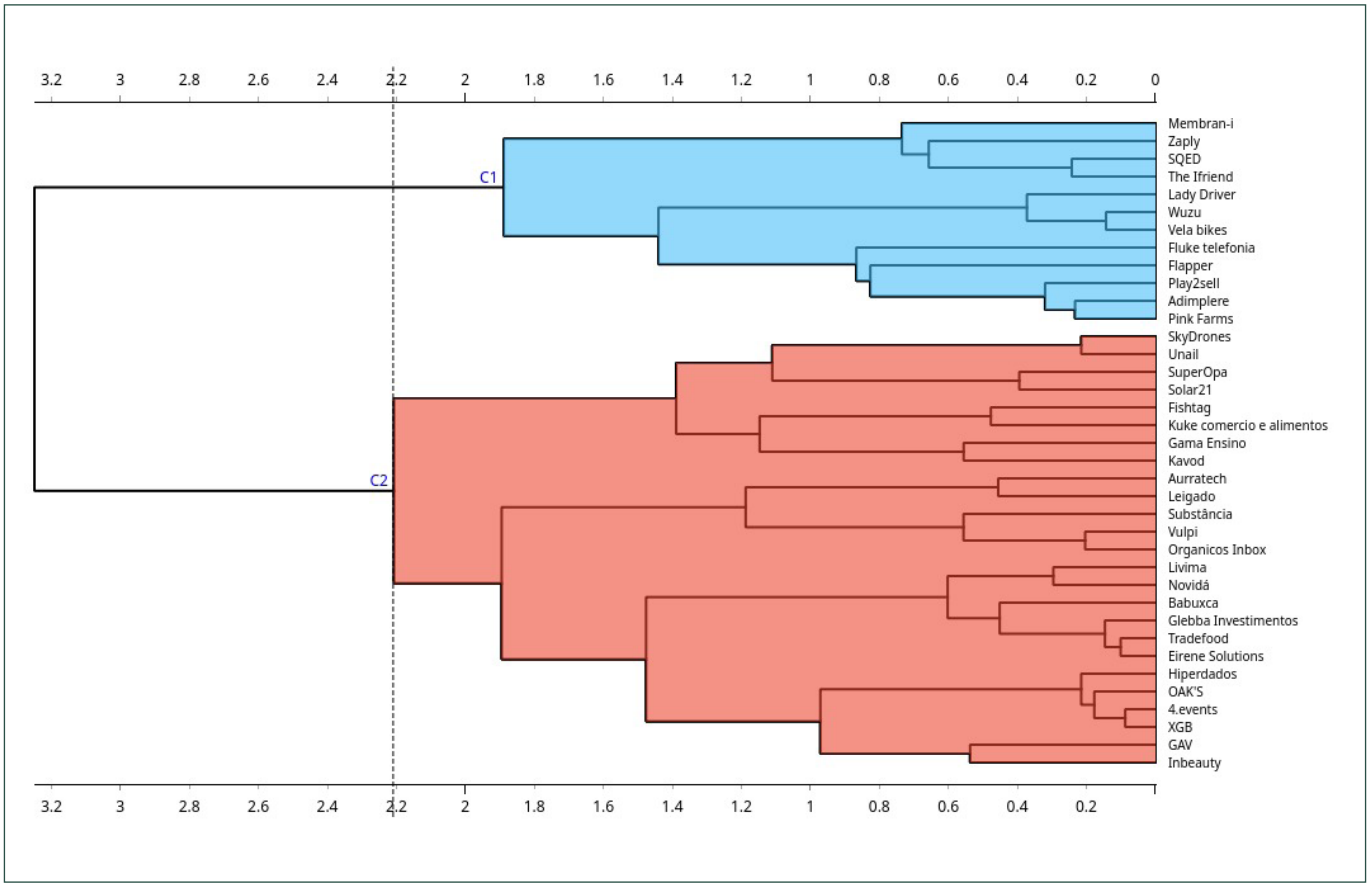
Index	Calculation	Informs what?
EBITDA	Profits – interest – taxes – amortizations – depreciation	Approximation of cash generated in the period.
Net debt/EBITDA	Net debt/EBITDA	Relationship between potential cash generation to pay net debt.
Gross Margin	Gross margin = Gross profit / Net revenue	Percentage of sales and their profitability.
EBITDA margin	EBITDA / Net revenue	Measures the approximation of generated cash to revenues.
Net margin	Net profit / Net revenue	Percentage of each currency unit left after deductions.
ROIC	NOPAT / Invested capital	Profitability from the perspective of total capital.
Net debt	Current liabilities + Non-current liabilities — Cash and cash equivalents	Net amount that the company owes to third parties.
Net debt/Equity	Net debt / Equity	Company's debt, by comparing equity and third-party capital.
ROE	Net profit / Equity	Profitability from the perspective of equity.
Current liquidity	Current assets / Current liabilities	Ability of the company to settle its short-term debts.

Note. Elaborated by the authors based on studies by Damodaran, A. (2009a). Valuing young, start-up and growth companies: Estimation issues and valuation challenges. https://dx.doi.org/10.2139/ssrn.1418687; Damodaran, A. (2009b). Damodaran on valuation: Security analysis for investment and corporate finance, Wiley Finance Book; and Damodaran, A. (2012). Investment valuation: Tools and techniques for determining the value of any asset, university (3rd ed.). John Wiley & Sons.

RESULTS

Cluster analysis

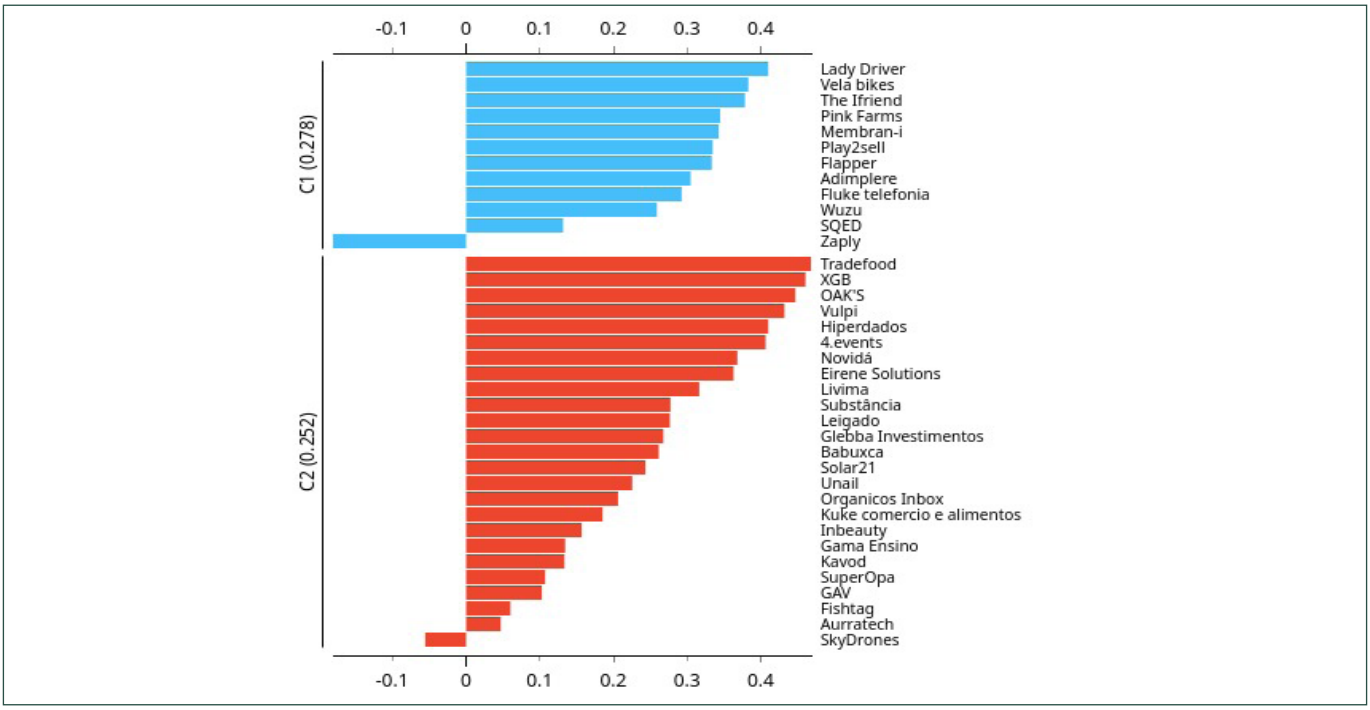
Figure 2 shows the dendrogram resulting from the hierarchical analysis of clusters, whose rescaled distance of 2.21 (68%) suggests the existence of at least two groups of startups, given that it is the situation that has the greatest leap in distance from each of the agglomeration stages (3.25 – 2.21 = 1.04 or 100% – 68% = 32%). Thus, the C1 group (operational performance — OP) has 12 startups, while the C2 group (financial performance — FP) has 25 startups.



Source: Study's results. Note. Group C1 (operational performance) and Group C2 (financial performance).

Figure 2. Dendrogram for agglomeration of startups.

Figure 3 shows the silhouette chart, whose positive scores in both groups indicate an adequate correspondence of most startups to their own grouping. Exceptions were only seen for Zaply and SkyDrones, whose negative scores suggest a classification error in the groups found.



Source: Study's results. Note. Group C1 (operational performance) and Group C2 (financial performance).

Figure 3. Silhouette graphic for startup groups.

Table 4 shows the p-values of the Mann–Whitney (MW) and Student's t-tests in verifying the equality of the median/mean of the financial indicators (H0) between the groups of identified startups. It also shows the Shapiro–Wilk test (SW) to verify the normality of the financial indicators in the groups.

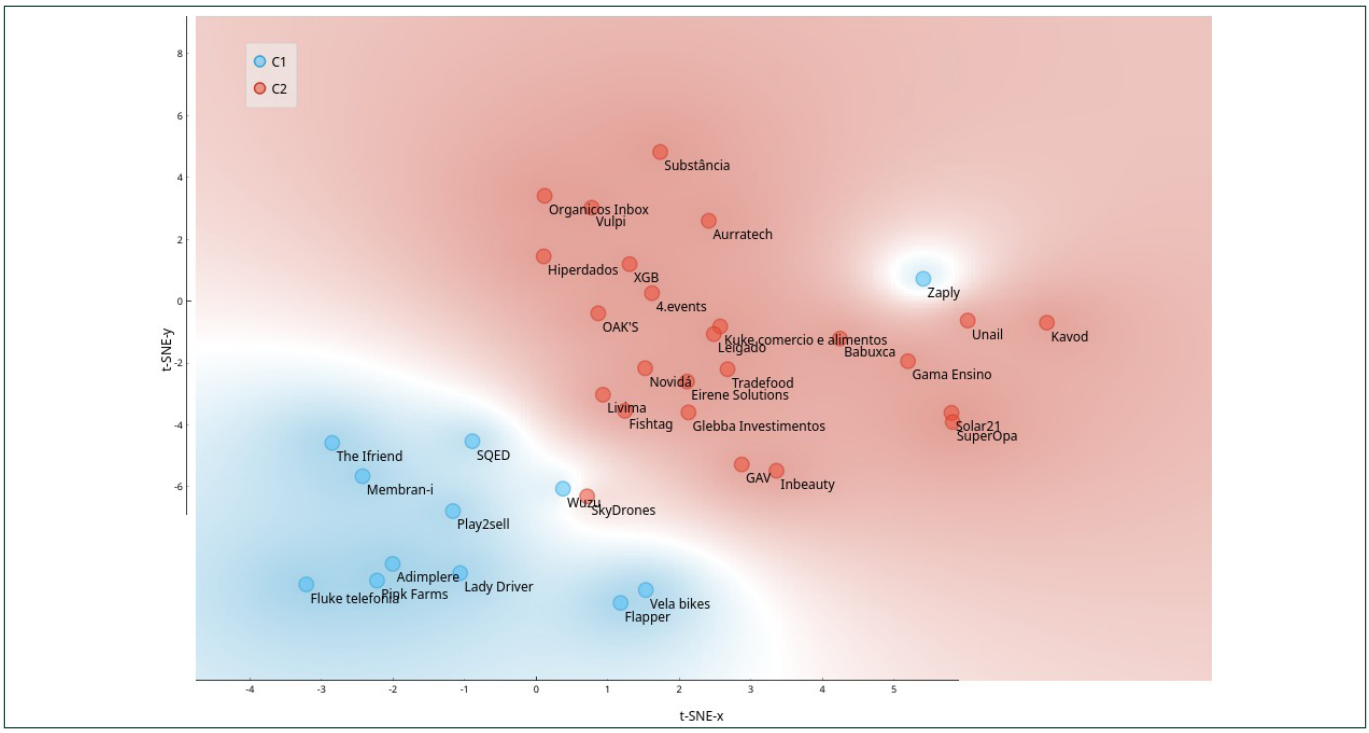
Table 4. p-values of the median/mean equality tests for the financial indicators of the identified startup groups.

Financial indicator	MW p-value	Student's t-test p-value	SW p-value C1	SW p-value C2
Net profit	**.000**	**.002**	**.03**	**< .01**
Gross profit	**.022**	**.021**	**.04**	**< .01**
EBITDA	**.000**	**.002**	**.02**	**< .01**
Net revenue	.077	.889	**< .01**	**< .01**
Net debt	.085	.180	**.01**	**< .01**
Equity	.314	**.030**	**.03**	**< .01**
Net debt/Equity	.399	.595	**< .01**	**< .01**
Net debt/EBITDA	.315	.849	.11	**< .01**
Net profit margin	.153	.349	**< .01**	**< .01**
Gross margin	.322	.175	**< .01**	**< .01**
EBITDA margin	.112	.350	**< .01**	**< .01**
ROIC	**.003**	.042	**< .01**	**.01**
ROE	.338	.184	**< .01**	.51
Current liquidity	.284	.222	**< .01**	**< .01**
Goal	**.000**	**.000**	.28	**< .01**
Total capital raised	**.000**	**.005**	.17	**< .01**
PAmount(%)	**.038**	**.048**	.14	**< .01**

Note. Elaborated by the authors. Group C1 (operational performance) and Group C2 (financial performance).

Considering a significance level of 5%, only seven of the 17 financial indicators were significant in rejecting H0 in both tests, and most of them did not have a normal distribution in the groups (their values are highlighted). Thus, these financial indicators suggest that they are, a priori, the main discriminating factors of the groups of startups identified in Figure 2.

Figure 4 shows the dimensionality reduction of the seven most relevant financial indicators by the t-SNE technique (highlighted in Table 1), in a 2-D space, in order to facilitate the spatial visualization of startups in the groupings found in Figure 2. With this, the existence of two groups was again confirmed (operational performance [C1] and financial performance [C2]), which respectively have 12 and 25 startups, and that Zaply and SkyDrones may be misclassified.



Source: Study's results. Note. Group C1 (operational performance) and Group C2 (financial performance).

Figure 4. t-SNE chart for the most relevant financial indicators found in the startup groupings.

Table 5 shows the average results of the seven relevant financial indicators by group. It can be seen that C2 (financial performance) is greater than C1 (operational performance) regarding the financial indicators of profitability (net profit, gross profit, EBITDA, ROIC). However, the opposite occurs regarding the financial indicators for revenue targets — goal, total capital raised, and PAmount(%); i.e., C1 (operational performance) is greater than C2 (financial performance). Thus, these results suggest that startups located in C2 (financial performance) tend to be profitable, even though they collect much less monetary value than startups located in C1 (operational performance), which tend to have losses.

Table 5. Average results of the financial indicators of the startup groups identified.

Financial indicator	C1 average	C2 average	Conclusion
Net profit	-1.24	.03	C2 > C1
Gross profit	-.02	.48	C2 > C1
EBITDA	-1.24	.06	C2 > C1
ROIC	-3.14	.04	C2 > C1
Goal	2.19	.39	C1 > C2
Total capital raised	2.28	.88	C1 > C2
PAmount(%)	1.13	.91	C1 > C2

Note. Study's results. Group C1 (operational performance) and Group C2 (financial performance).

Table 6 tests the assumption that belonging to a certain group influences the startup's profitability, meaning there is an association between them. To this end, a categorical variable called 'profitable' was created, in which the startup is considered profitable if most of its financial profitability indicators are positive (profitable: yes; otherwise, no).

Table 6. Cross table between groups of startups and their profitability in financial indicators of profitability.

Group	Profitable		Total
	No	Yes	
C1 (operational performance)	12	0	12
C2 (financial performance)	15	10	25
Total	27	10	37

Note. Study's results.

When performing its crossing with the categorical variable group, it is verified that none of the startups belonging to the C1 (operational performance) group was considered profitable. For example, the sample suggests a 67.57% chance (25/37) of a startup belonging to C2 (financial performance), and, if so, a 40% chance of it being profitable (10/25). This results in an overall chance of 27.03% (10/37) of any startup being profitable in Brazil between 2017 and 2017. Finally, Fisher's exact test at 5% significance confirms the existence of an association between the variables group and profitable (two-tailed p-value = 0.015), and the strength of this association is considered moderate (Cramer's V = 0.47).

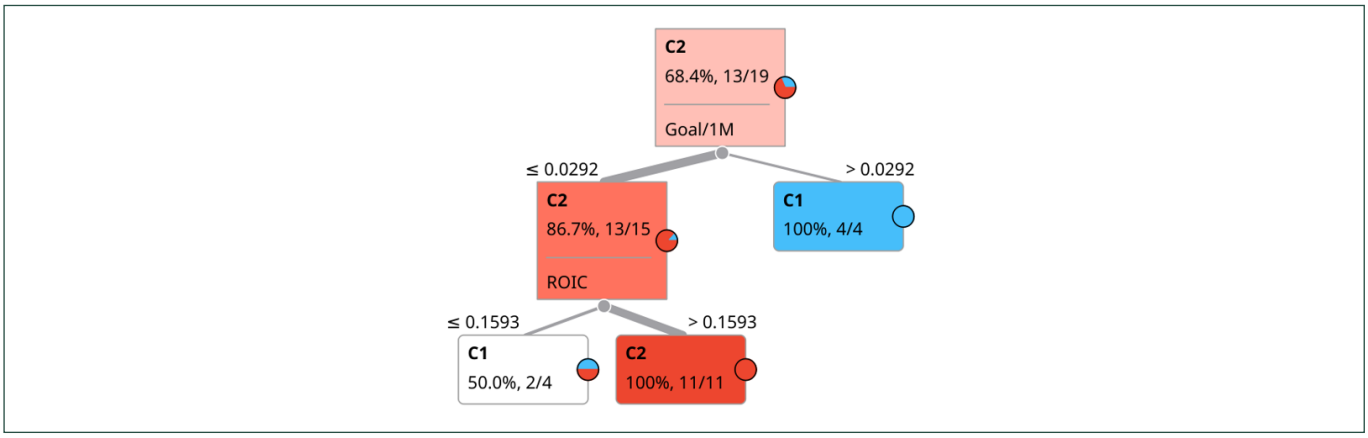
Similarly, Table 7 tests the assumption that belonging to a certain group influences startup success, indicating an association between them. Therefore, a categorical variable called 'success' was created, in which the startup is considered successful if it manages to reach the fundraising goal (success: yes; otherwise, no). However, Fisher's exact test at 5% significance indicates the absence of association between the variables group and success (two-tailed p-value = 0.641), as well as the strength of this association, if any, would be considered weak (Cramer's V = 0.15), even though the sample apparently has a greater chance of success in C2 (financial performance) (20/31) than in C1 (operational performance) (11/31).

Table 7. Cross table between startup groups and success in their funding campaign.

Group	Success		Total
	No	Yes	
C1 (operational performance)	1	11	12
C2 (financial performance)	5	20	25
Total	6	31	37

Note. Study's results.

Figure 5 shows the regression tree that contains the decision flowchart for classifying startups in clusters C1 (operational performance) and C2 (financial performance). Here are the financial indicators selected by the Gini diversity index (whose values vary between 0 and 1, with 0 being the purity of the ranking) with the best ranking performance. It shows that: (a) with only two of the seven relevant financial indicators (goal and ROIC), and (b) with only two classification criteria, it was possible to correctly classify 17 of the 19 startups randomly selected for the training sample.



Source: Study's results. Note. Group C1 (operational performance) and Group C2 (financial performance).

Figure 5. Regression tree for classifying the groupings found for the startups.

Applying this same decision flowchart to the test sample shows similar ranking performance, as shown in Table 8, with 16 out of 18 startups correctly ranked. In these terms, the accuracy, specificity, and weighted average sensitivity of the groups are 88.9%, 94.4%, and 88.9%, respectively.

Table 8. Confusion matrix for the test sample in ranking startups.

Actual	Predicted		Total
	C1 (operational performance)	C2 (financial performance)	
C1 (operational performance)	6	0	06
C2 (financial performance)	2	10	12
Total	8	10	18

Note. Study's results. Group C1 (operational performance) and Group C2 (financial performance).

Table 9 presents the intrinsic characteristics of the two groups formed based on the cluster analysis described. The startups in group C1 (operational performance) have significantly higher financing goals than those in group C2 (financial performance). While the financial goal for resource acquisition in group C2 (financial performance) is moderate, at just over BRL 944,000, in group C1 (operational performance), the amount is 45% higher, approximately BRL 2.8 million.

Table 9. Intrinsic characteristics of the groups.

Groups									
C1 (operational performance) (n = 12)					C2 (financial performance) (n = 25)				
Variable	Mean	Std. Dev.	Min.	Max.	Variable	Mean	Std. Dev.	Min.	Max.
Net_profit	-1.24	1.16	-4.00	-0.05	Net_profit	0.03	0.56	-1.06	2.23
Gross_profit	-0.18	0.49	-1.11	0.83	Gross_profit	0.48	0.77	-0.44	2.97
EBITDA	-1.24	1.18	-4.16	-0.05	EBITDA	0.06	0.59	-1.01	2.35
Net_revenue	0.62	1.94	-1.11	6.64	Net_revenue	0.71	1.11	0.00	4.68
Net_debt	2.39	2.77	-0.10	7.11	Net_debt	1.08	2.81	-0.28	12.36
Equity	-1.20	2.25	-6.05	0.89	Equity	0.58	2.31	-0.82	11.53
Net_debt/Equity	0.82	4.10	-1.57	13.39	Net_debt/Equity	-0.31	9.21	-32.03	27.97
Debt/EBITDA	-1.71	1.46	-4.74	0.19	Debt/EBITDA	-1.03	18.04	-57.37	47.81
Net_profit_margin	72.10	275.39	-29.68	946.02	Net_profit_margin	-2.31	6.12	-25.01	0.69
Gross_margin	0.58	0.54	-.28	1.05	Gross_margin	-0.16	2.61	-10.27	1.00
EBITDA_margin	72.14	275.38	-29.29	946.02	EBITDA_margin	-2.18	5.93	-23.70	0.73
ROIC	-3.14	5.00	-17.36	1.32	ROIC	0.04	0.59	-0.88	1.99
ROE	-1.11	2.85	-9.76	0.91	ROE	0.08	1.71	-3.09	4.20
Current_liquidity	5.81	13.73	0.02	49.11	Current_liquidity	16.57	39.60	0.00	181.59
Goal (BRL millions)	2.08	1.38	0.65	5.0	Goal (BRL millions)	0.94	0.77	-	2.9
Total capital raised (BRL millions)	2.28	1.43	0.39	5.0	Total capital raised (BRL millions)	0.88	0.65	-	2.5
Type	0 .75	0.45	0.00	1.00	Type	0.56	0.50	0.00	1.00

Note. Study's results.

The final amount raised by the campaigns between the two groups also shows a significant difference. In the C1 (operational performance) group, the average amount raised is just over BRL 2.2 million, whereas in the C2 (financial performance) group, the amount revolves around BRL 880,000. Another interesting characteristic is related to the type of goods offered in the business. In group C1 (operational performance), 75% of the startups are engaged in businesses with a focus on products, while in group C2 (financial performance), only 56% are.

Financial analysis

After collecting the accounting information for each offer, the proposed metrics were calculated for each of the 37 startups considered in this study (from the six platforms under analysis). The analysis revealed that there are 27 startups in the set of enterprises observed which offered non-profitable businesses, meaning businesses with poor economic results, such as reduced liquidity and profitability, with a high level of debt. On the other hand, we found 10 startups with profitable business offers, meaning high liquidity and profitability, with a low level of debt.

Table 10 presents the economic-financial results of startups with reduced profitability. Of the total of 37 startups analyzed, only four had net revenue equal to zero, or close to zero. In these four cases, gross margin, EBITDA, and net margins were not calculated. Moreover, 27 startups had a net loss, and 25 of them had negative EBITDA, which means negative cash flow in the period, ranging from 0.05 to 30 times the value of net debt (net debt/EBITDA).

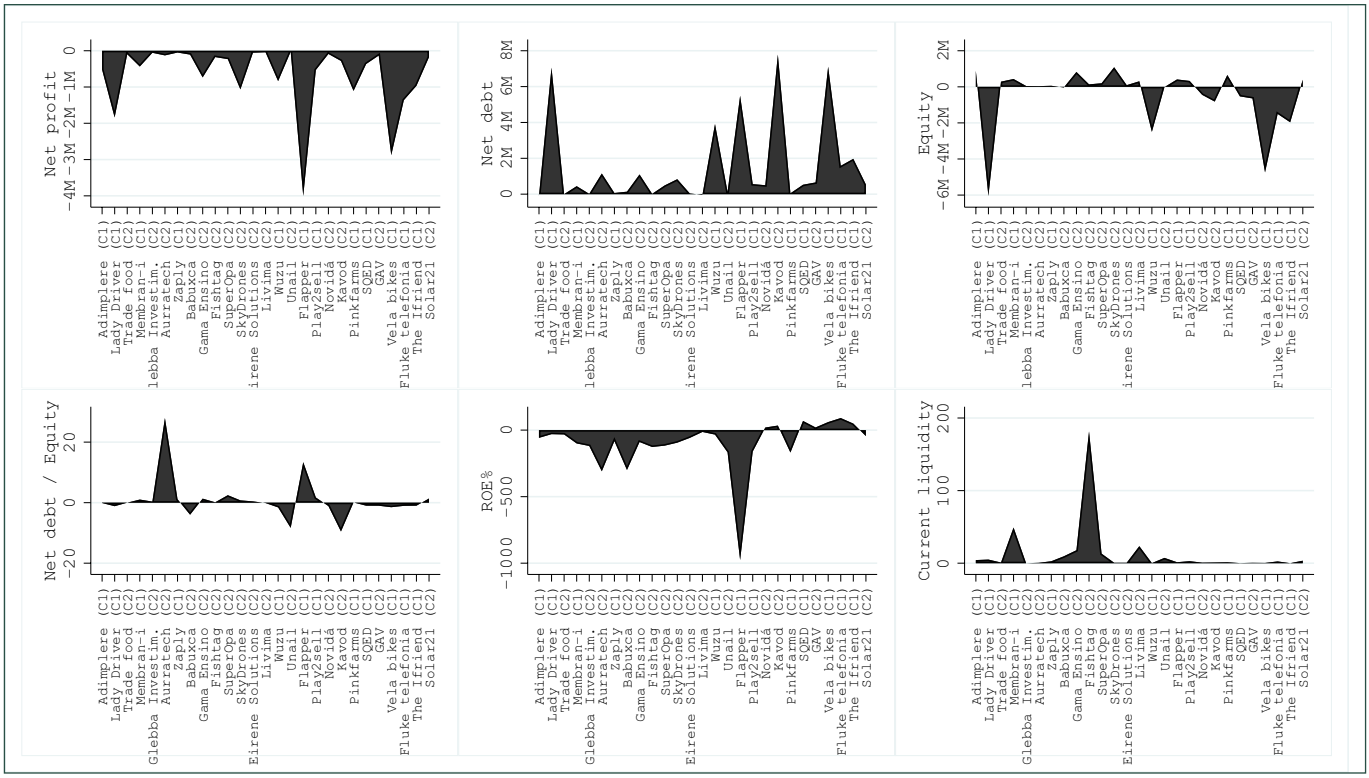
Table 10. Financial performance of startups with reduced profitability.

Indicators	Adimplere (C1)	Lady Driver (C1)	Trade food (C2)	Membran-i (C1)	Gleba Investimentos (C2)	Aurratech (C2)	Zaply (C1)	Babuxca (C2)	Gama Ensino (C2)	Fishtag (C2)	SuperOpa (C2)	Skydrones (C2)	Eirene Solutions (C2)	Livima (C2)
Net profit*	-0.52	-1.84	-0.09	-0.44	-0.06	-0.13	-0.05	-0.11	-0.73	-0.17	-0.23	-1.06	-0.05	-0.04
Gross profit*	0.62	0.83	0.19	NA	0.07	1.36	0.00	0.02	0.27	-0.18	-0.03	-0.44	-0.01	0.11
EBITDA*	-0.52	-1.72	-0.05	-0.44	-0.04	0.02	-0.05	-0.10	-0.73	-0.18	-0.22	-1.01	-0.05	0.00
Net revenue*	0.62	0.79	0.37	NA	0.07	1.85	0.00	0.15	0.27	0.14	0.03	0.04	NA	0.11
Net debt*	-0.10	7.06	0.00	0.45	0.02	1.15	0.07	0.14	1.10	0.02	0.49	0.84	0.04	-0.04
Equity*	0.89	-6.05	0.29	0.43	0.05	0.04	0.06	-0.04	0.83	0.14	0.20	1.09	0.09	0.31
Net debt/ Equity	-0.11	-1.17	0.01	1.03	0.37	27.97	1.13	-3.99	1.34	0.13	2.47	0.77	0.43	-0.12
Net debt/ EBITDA	0.19	-4.11	-0.05	-1.02	-0.42	47.81	-1.39	-1.43	-1.51	-0.10	-2.20	-0.83	-0.75	-8.61
Net profit margin	-84%	-234%	-25%	NA	-81%	-7%	NA	-71%	-277%	-123%	-886%	-2501%	NA	-37%
Gross margin	100%	105%	51%	NA	100%	74%	NA	12%	100%	-127%	-126%	-1027%	NA	100%
EBITDA margin	-84%	-218%	-13%	NA	-61%	1%	NA	-66%	-274%	-125%	-852%	-2370%	NA	4%
ROIC	49%	-90%	-29%	-475%	-53%	3%	-607%	-88%	-36%	-11%	29%	-56%	-32%	-10%
ROE	-58%	-30%	-33%	-100%	-119%	-309%	-82%	-299%	-89%	-127%	-117%	-94%	-58%	-14%
Current liquidity	4.31	5	0.97	49.11	0	0.54	2.72	9.52	17.86	181.59	13.18	0.6	0.64	23.47

Indicators	Wuzu (C1)	Unail (C2)	Flapper (C1)	Play2sell (C1)	Novidá (C2)	Kavod (C2)	Pink Farms (C1)	SQED (C1)	GAV (C2)	Vela bikes (C1)	Fluke telefonia (C1)	The Ifriend (C1)	Solar21 (C2)
Net profit*	-0.84	-0.03	-4.00	-0.53	-0.09	-0.28	-1.11	-0.37	-0.13	-2.88	-1.36	-0.97	-0.17
Gross profit*	0.03	-0.01	-0.57	-0.11	0.25	0.24	0.03	0.02	0.30	-1.11	0.00	0.05	0.29
EBITDA*	-0.83	-0.03	-4.16	-0.52	-0.09	-0.26	-1.12	-0.37	-0.11	-2.88	-1.36	-0.97	-0.18
Net revenue*	0.03	0.00	6.64	0.39	0.38	0.24	0.09	0.02	0.33	-1.11	0.00	0.05	0.53
Net debt*	3.91	0.13	5.49	0.56	0.50	7.79	0.05	0.53	0.66	7.11	1.58	1.97	0.54
Equity*	-2.50	-0.02	0.41	0.33	-0.44	-0.82	0.66	-0.53	-0.64	-4.74	-1.50	-1.97	0.39
Net debt/ Equity	-1.57	-8.33	13.39	1.7	-1.13	-9.52	0.07	-1	-1.02	-1.5	-1.06	-1	1.38
Net debt/ EBITDA	-4.74	-5	-1.32	-1.08	-5.87	-30.43	-0.04	-1.44	-6.05	-2.47	-1.16	-2.04	-3.08
Net profit margin	-2968%	-1783%	-60%	-136%	-23%	-118%	-1287%	-1638%	-40%	259%	94602%	-1927%	-33%
Gross margin	100%	-658%	-9%	-28%	66%	100%	29%	100%	91%	100%	100%	100%	54%
EBITDA margin	-2929%	-1783%	-63%	-134%	-22%	-107%	-1300%	-1638%	-33%	259%	94602%	-1924%	-33%
ROIC	-49%	-23%	-152%	-13%	-24%	-4%	132%	-408%	-70%	-114%	-305%	-1736%	-18%
ROE	-34%	-167%	-976%	-161%	20%	34%	-168%	69%	20%	61%	91%	49%	-44%
Current liquidity	0.17	7.33	1.34	2.78	0.81	1.01	1.33	0.15	0.55	0.4	2.48	0.02	3.47

Note. Authors' calculation based on information available on ECF platforms. Note: * = BRL million. NA = Not available. Group C1 (operational performance) and Group C2 (financial performance).

In comparison with net revenue, the gross profit of startups with poor profitability showed percentages with strong variation, from –1.027% to 105%. In addition, they showed strongly negative EBITDA and net margins, with six cases below –1.000%. This highlighted an urgent need for improvement in their operating results. In accordance with these results, profitability indexes such as ROIC were only positive in a single start-up, whose loss was exclusively due to a large amount of payable taxes. For the other startups, the variation in the levels of this indicator was from 3% to –1.736%, and in eight cases the value was close to –100%, which means a return of –100% on all capital employed in the business.



Source: Elaborated by the authors. Note. In this figure we present the performance indicators of startups with reduced profitability. Group C1 (operational performance) and Group C2 (financial performance).

Figure 6. Performance indicators of startups with reduced profitability.

Furthermore, 27 startups had a loss in the period analyzed, and this loss was on average BRL 676,000. The average net debt was around BRL 1.6 million, and the average equity was BRL 482,000. With this data, it was possible to observe that this set of startups with reduced profitability has an average net debt/equity ratio of 0.77, as shown in Figure 6. This shows that, on average, they have controlled debt, with the value of third-party capital not exceeding equity. However, there were also cases where startups demonstrated more third-party capital than equity or negative equity.

The profitability index used was the ROE, which was close to –101% on average, corresponding to a significant loss of shareholder value, as this constitutes a bad return on the capital placed in the company by the partners. This can cause demotivation in thinking of these companies as an investment. With regard to short-term debt, the average of the current liquidity indicator, which analyzes current assets and current liabilities, showed good capacity for startups to pay their debts, representing an average of 12.27. In other words, startups have an average of BRL 12.2 to pay for every BRL 1.00 of short-term debt. Next, the performance of startups with reduced profitability based on six classic indicators (net income, net debt, equity, net debt/equity, ROE, and current liquidity contained in Table 10) is shown in Figure 6. We did this to provide a more general view of the financial situation of businesses offered as investment opportunities by ECF platforms.

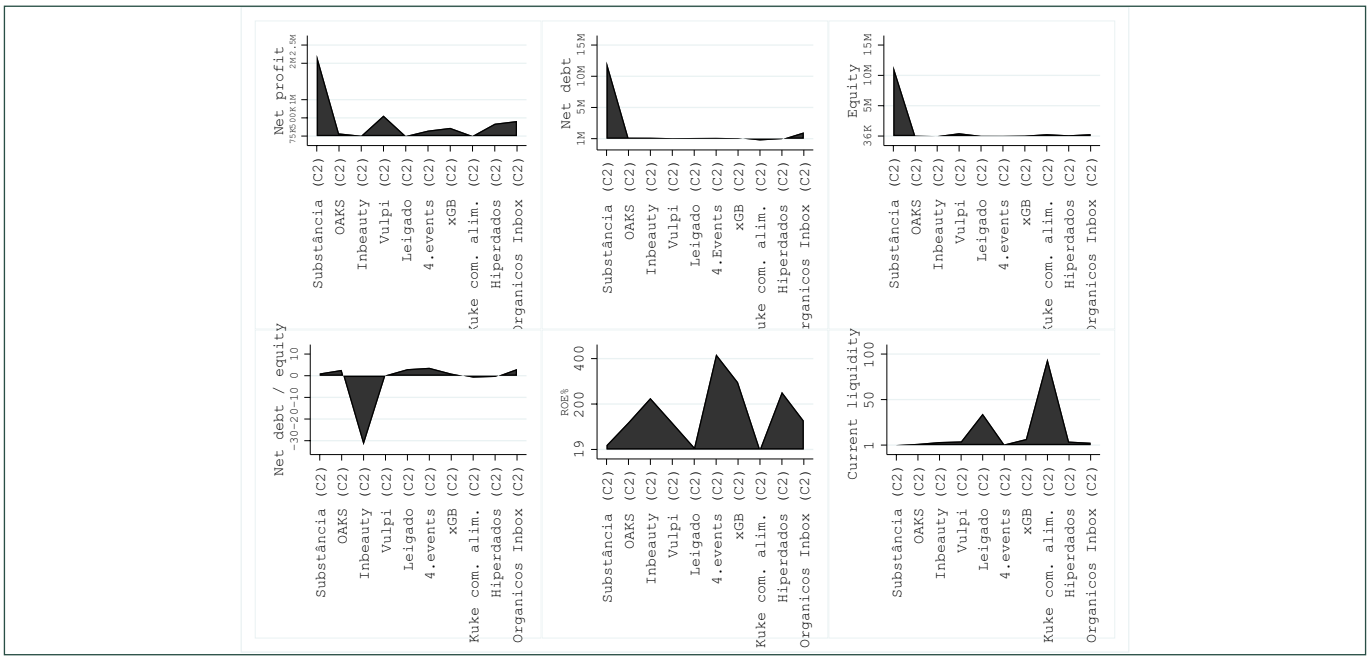
Table 11. Financial performance of profitable startups.

Indicators	Substância (C2)	OAK'S (C2)	Inbeauty (C2)	Vulpi (C2)	Leigado (C2)
Net profit*	2.23	0.08	0.01	0.57	0.00
Gross profit*	2.97	0.30	0.18	1.60	0.10
EBITDA*	2.35	0.08	0.02	0.76	0.00
Net revenue*	3.21	0.61	0.24	1.70	0.10
Net debt*	12.36	0.17	0.16	0.09	0.12
Equity*	11.53	0.06	0.00	0.47	0.04
Net debt/Equity	1.072	2.70	-32.03	0.18	3.05
Net debt/EBITDA	5.26	2.27	7.05	0.11	32.64
Net profit margin	69%	12%	5%	33%	4%
Gross margin	92%	49%	74%	94%	100%
EBITDA margin	73%	12%	9%	45%	4%
ROIC	10%	45%	4%	90%	3%
ROE	19%	120%	227%	119%	10%
Current liquidity	0.08	1.43	3.43	4.11	34.56
Indicators	**4.events (C2)**	**xGB (C2)**	**Kuke comercio e alimentos (C2)**	**Hiperdados (C2)**	**Orgânicos Inbox (C2)**
Net profit*	0.15	0.23	0.01	0.34	0.41
Gross profit*	0.46	0.86	0.12	0.80	2.13
EBITDA*	0.15	0.40	0.00	0.34	0.54
Net revenue*	0.54	1.16	0.17	0.80	4.68
Net debt*	0.13	0.08	-0.28	-0.08	1.01
Equity*	0.04	0.08	0.32	0.13	0.33
Net debt/Equity	3.67	1.02	-0.89	-0.57	3.11
Net debt/EBITDA	0.86	0.20	-57.37	-0.22	1.89
Net profit margin	28%	20%	3%	43%	9%
Gross margin	86%	74%	71%	100%	45%
EBITDA margin	29%	34%	3%	43%	11%
ROIC	75%	64%	2%	199%	32%
ROE	420%	296%	2%	254%	127%
Current liquidity	0.76	6.65	95.11	3.94	2.67

Note. Authors' calculation based on information available on ECF platforms. * = BRL million. Group C2 (financial performance).

Only 10 of the 37 startups analyzed showed profits. Profitable startups had a very positive EBITDA, meaning a positive cash flow in the period, which reached a ratio 32 times the net debt value (net debt/EBITDA), as can be seen in Table 11. When compared to the net revenue, the gross profit of this set of startups showed a relatively high percentage, ranging between 45% and 90%. These values suggest efficiency in obtaining raw materials and direct labor. The EBITDA margin presented a more accentuated variation, between 3% and 73%; however, the startups presented a considerable cash flow and a net margin in line with the EBITDA margin, between 3% and 69%.

The profitability indexes were also in line with the operating results, which were positive. For example, ROIC, which ranged from 3% to 199%, demonstrated a high return on total capital employed. As mentioned earlier, there were 10 startups from the entire sample collected which showed a net profit, averaging BRL 402,000, with only one startup exceeding BRL 2 million. The net debt value of this set was shown to be at the same level as equity, around BRL 1 million, indicating that most startups in this set have a balanced combination of equity and third-party capital, of around 1.4. However, it is worth noting that there were cases in which net debt was negative, so that the company has more cash available than debt, as in the case of InBeauty. Furthermore, the ROE of these companies showed an intense variation, between 2% and 420%. Still, their average was substantially high, being close to 160%, signaling that this group of startups can bring significant returns that outweigh the risk to which the investor is submitted.



Source: Elaborated by the authors. Note. In this figure we present the performance behavior of profitable startups. Group C2 (financial performance).

Figure 7. Performance behavior of profitable startups.

Regarding short-term debt, most startups had a current liquidity ratio close to 1. However, the average for this indicator was 2.88. This may have been motivated by the existence of cases whose current liquidity was much above average. We can see in Table 10 that startups would have BRL 2.88 to pay for every BRL 1.00 of debt in the short term. It is worth noting that two startups had very high liquidity ratios, such as Kuke Comercio e Alimentos (95.11) and Leigado de (34.56). Figure 7 shows six indices used in this study to better visualize the behavior of the economic viability of profitable startups.

Implications of the findings

The proposed taxonomy distinguishes two distinct groups. Group C1 (operational performance) showed average negative profitability and return indicators but had the highest values for fundraising indicators. Conversely, group C2 (financial performance) revealed, on average, positive profitability and return indicators but modest fundraising values. Our taxonomy evaluates companies ex post, classifying startups based on the consequences of managerial decisions, quantified through financial indicators (net profit, gross profit, EBITDA, net revenue, net debt, equity, net debt/equity, net debt/EBITDA, net profit margin, EBITDA margin, ROIC, ROE, and current liquidity) and operational indicators (goal, total capital raised, and amount).

The taxonomy identified two groups with distinct entrepreneurial profiles, as presented in Ryu and Kim (2018). In group C1 (operational performance), we found traits of fund seekers (58%) and social entrepreneurs (42%). Fund seekers demonstrate higher financial motivation, a greater need for funding, more experience, and pursue more attractive projects, raisings larger amounts in their campaigns. Social entrepreneurs, on the other hand, exhibit higher social motivation, are younger, present more visible projects with some social content, and show competitive performance in their campaigns. These entrepreneurs from group C1 (operational performance) were more successful in fundraising campaigns but less efficient in the financial performance of their businesses. They are involved in financial services for debt negotiation, technology (digital solutions and technology development), transportation (air and land), and environmental sectors.

In group C2 (financial performance), startups showed better financial performance but less success in fundraising. We identified distinct profiles among the entrepreneurs, with the daring dreamer profile predominating in about 45% of the startups. This profile is characterized by motivation to achieve something, developing projects with lower and less viable financial goals, but being more reliable and active in their causes. The fund seeker profile accounted for 36% of the startups in group C2 (financial performance). The social entrepreneur profile represented 12% of the startups, and the indie producer profile, with the least incidence, was at 7%. Indie producers primarily aim to build and strengthen relationships, presenting ventures with some artistic content and less social contribution. Entrepreneurs in group C2 (financial performance) are involved in various segments, such as food, financial services for investment and loans, technology (digital solutions and technology development), real estate, aesthetics, and industrial services.

This study differs from the work of Ryu and Kim (2018), which focuses on the ex-ante analysis of entrepreneurs. We offer an ex-post analysis, providing a deep perspective on the consequences of implemented strategies using quantifiable financial and operational metrics such as profitability, debt, liquidity, and the volume of funds raised. In doing so, we advance the literature by offering a taxonomy that classifies startups based on the financial and operational results of their decisions, complementing the work of Ryu and Kim (2018), which focuses on entrepreneurs' profiles before executing strategies. Our study enables an objective analysis of the effectiveness of management decisions, identifying behavioral patterns and market trends of startups, contributing to a more refined understanding of the determinants of business success.

The taxonomy presented here complements and deepens the literature by offering a classification based on the effects of entrepreneurs' strategic decisions, rather than focusing solely on intentions and individual profiles, as in Ryu and Kim (2018). Our approach provides a strategic tool for investors and managers seeking to identify ventures with potential for success and new businesses based on startups, offering an ex-post analysis that enables more informed decisions based on historical results. By introducing a classification focused on the practical consequences of business decisions, we offer a valuable alternative to the existing literature on the subject. In addition to mapping funding and performance trends, the ex-post approach also allows for a deeper understanding of the impact of different strategies on the sustainability and viability of startups in various sectors. This provides practical insights that can guide stakeholders in making informed and concrete performance-based decisions.

CONCLUDING REMARKS

The objective of this paper was to provide a taxonomy of the profiles of startups that raised capital funding via ECF platforms. In addition, we also looked at the financial performance of startups funded by these platforms. The main results of the study show that seven of the indicators used as financial performance characteristics are discriminators of the groups. Startups in the C2 group (financial performance) tend to be more profitable, even though they raise less capital compared to startups in the C1 group (operational performance). In our sample, we observed that there is a 67.5% chance of a startup belonging to the C2 group (financial performance), and if that happens, there is a 40% probability of it being profitable. We noticed that most of the analyzed startups, about 72%, presented poor economic performance, meaning reduced liquidity and profitability, with a high level of debt.

Group C1 (operational performance) exhibited negative profitability indicators but high fundraising values, whereas group C2 displayed positive financial indicators but modest fundraising results. In group C1 (operational performance), 58% were fundraisers and 42% social entrepreneurs, while in group C2 (financial performance), bold dreamers (45%) and fund seekers (36%) were predominant. This study provides an ex-post analysis, evaluating startups based on the consequences of managerial decisions, complementing the ex-ante analysis by Ryu and Kim (2018). Thus, we propose a taxonomy that classifies startups by their financial and operational outcomes, identifying behavior patterns and trends, and contributing to a better understanding of the determinants of business success.

The findings of this study reinforce the need for more accurate knowledge from an accounting and financial perspective. Investors in the ECF market must possess this knowledge in order to avoid investing in businesses that do not present initial economic viability. The CVM itself highlights that there is a possibility of total loss of investments and operations carried out in the ECF market. Based on what has been discussed here, we were able to show (albeit only initially) the current scenario of the economic and financial viability of startups seeking financing in the Brazilian ECF market. The economic information of these ventures can serve to assist in the financial decision-making process of investing in startups. This study also draws the attention of policymakers interested in developing and enhancing crowdfunding markets. It is a pioneer in the use of taxonomy as a strategy for analyzing the financing dynamics of the Brazilian ECF market.

As a limitation of this study, we highlight the impossibility of expanding the research sample. Only 18% of ECF platforms disclosed accounting and financial information on startups that used crowdfunding in Brazil. Furthermore, the lack of financial information on startups within ECF platforms prevented us from conducting other types of analyses, particularly comparative assessments. We also acknowledge that startups choosing to disclose financial data may systematically differ from those that do not, whether in terms of financial stability, transparency, or governance. However, we believe that the lack of disclosure itself may be associated with weaker financial performance, as suggested by Vismara (2018). This information asymmetry can negatively impact investment flows in the sector, a challenge that still requires more effective regulatory measures. The relationship between disclosure and financial performance is not always linear. In the Brazilian context,

CVM Instruction 588 mandates that platforms disclose financial information, yet this requirement is not always effectively enforced. Thus, the low transparency levels identified in our study underscore the need for regulatory improvements, as highlighted in recent literature (Coakley et al., 2024). Despite these limitations, our research provides significant contributions to the understanding of transparency and regulatory challenges in the Brazilian equity crowdfunding market.

Future studies could delve deeper into the information presented about startups that succeeded in raising funds via ECF, aiming to investigate how informational asymmetry impacts the fundraising process. This could reveal more clearly how transparency (or the lack thereof) in financial information affects investor decisions. Longitudinal approaches to track the performance of these startups over time would be particularly useful to identify whether initial success indicators, such as profitability and debt level, remain stable or deteriorate after fundraising. This analysis would also help assess whether disclosure practices and initial financial profiles are good predictors of long-term sustainability, addressing a significant gap in current ECF research.

Finally, we suggest that future studies advance the application of corporate governance mechanisms in the context of ECF, investigating how these mechanisms, such as the participation of institutional investors and boards of directors, influence the success and longevity of fundraising campaigns. Integrating more rigorous governance practices can help mitigate the risks associated with informational asymmetry, providing greater security to investors (Di Pietro & Butticè, 2020; Torabi & Mirakhor, 2018). Comparative research between different jurisdictions, focusing on regulation and corporate governance practices in more developed ECF markets, would also be valuable to understand how these factors can influence market performance in countries like Brazil.

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