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**SIGNALLING TO REDUCE AGENCY PROBLEM: THE CASE OF BUSINESS
ACCELERATORS**

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Abstract

Signals have proved to be relevant for reducing information asymmetry and eliminating agency problems in the context of entrepreneurial financing. Specifically, scholars have been focused on individual signals that could confirm the project's legitimacy and founders' credibility to potential investors in developed countries. However, the literature lacks understanding of signals' interconnections and differences in their influence in various regions. Signalling research in the context of accelerators is also limited due to the relative newness of this source of alternative financing. This study examines how interplays of an entrepreneur's credibility and project quality signals can increase the possibility of acceptance to accelerators in North America and Sub-Saharan Africa, which can expand the knowledge about signals in the context of accelerators, developing countries and signals' interconnections and offer practical implications to entrepreneurs who are looking for earning the trust of prospective investors and to managers who try to estimate venture's quality and legitimacy more precisely.

Keywords: entrepreneurship, entrepreneurial finance, signals, signalling theory, information asymmetry, agency problem, accelerators, qualitative comparative analysis

Introduction

Obtaining financing is the leading challenge entrepreneurs have to overcome when going through the early stages of the new venture creation (Ko & McKelvie, 2018). Many new ventures report lacking access to external resources for their business growth: 75% of emerging businesses rely on financing from outside (SBA, Office of Advocacy, 2014). The information asymmetries between the founders and potential investors are often the reason that prevents projects from getting the required funding (Amit et al., 1990). When searching for investors, entrepreneurs might not have objective measures for their venture evaluation as soon as the product might not be fully developed and the market demand cannot be proven (Murray & Marriott, 1998; Nagy et al., 2012). At the same time, investors are stuck in a situation where the only reference is entrepreneurs' personal judgment (Maxwell et al., 2014) until some reliable and confirmable information comes out (Elsbach & Kramer, 2003). In these circumstances, agency problems develop: while investors look for the most promising start-ups, founders might distort or hide some characteristics and shortcomings of the project and team in order to increase chances of obtaining financing. Signals can be used to convey ventures' legitimacy and qualities (Ahlers et al., 2015; Arthurs et al., 2009; Connelly et al., 2011) and thus, to provide investors with insight into the true state and potential of the start-up and entrepreneurs with the most valuable parameters to be underlined in their application or during the pitch. Typically, investors underline individual signals of a venture's economic activities and founders' capabilities to execute these activities (Courtney et al., 2017; Steigenberger & Wilhelm, 2018).

Despite an increasing body of literature assessing signals in the entrepreneurship context over the past three decades, little review has been done in terms of signal interconnections (Drover et al., 2018). The reason consider them is that multiple signals often operate simultaneously (Connelly et al., 2011; Courtney et al., 2017; Drover et al., 2018) and the effectiveness of one signal can depend on another (Plummer et al., 2016). Hence, individual signals might complement each other to strengthen the signalling effect. In support, an IPO-based research, conducted by Colombo et al, 2019, has underpinned that multiple diverse signals are likely to produce a more positive IPO valuation. It is also possible that the presence of some signals might compensate for the absence of others. For example, if prior managerial experience influences the success of the project (Zheng et al., 2021), entrepreneurs with no such experience might put emphasis on other qualities for compensation.

There is also limited understanding about signals in diverse environments as previous studies' focus was clearly on the developed countries only (Drover et al., 2018; Huang et al., 2021). However, it is crucial to distinguish signals obtained in different environments as they

are reported to have a diverse impact (Connelly et al., 2011; Colombo, 2020). The distinction is clearly seen between developed and developing countries. North America - the region with the largest number of accelerators - 102 by 2021 (Gali, 2021) - provides a flourishing entrepreneurship environment: its opportunity-driven nature implies easier access to finance, entrepreneurship education, technologies and capital markets (De Soto, 2001). Government policies there are aimed to make the entrepreneur's journey less challenging (Kravchenko et al, 2015) and entrepreneurship culture indicates high tolerance to risk and failures. Sub-Saharan Africa represents quite the opposite environment. Despite its high entrepreneurship potential illustrated by the highest Total Early-Stage Entrepreneurship Activity (TEA) rate (GEM, 17), this region faces all the entrepreneurship problems typical for developing countries: theory-focused business education (Abdurazzakov, 2016), poor entrepreneurship ecosystems, lacking finance and other supportive activities (GEM,2017). Consequently, it is crucial to study the signals in different regions separately, as the results obtained for developed countries might not be convincing for the developing ones. As an illustration, North American investors might be less concerned with signals of the founders' previous experience and do not count bankruptcy as an unacceptable failure like in Sub-Saharan Africa would do (Hoecklin, 1995). They might also be more tolerant to the project's shortcomings due to the fact that it is relatively easy to obtain all the necessary training and technology.

Finally, while remarkable insights are made into signals relevant for crowdfunding and venture capitalists, accelerators are still a poorly investigated source of entrepreneurship financing. Accelerators are relatively new representatives of alternative financing, and are of particular interest for researchers (Fowle, 2017; Yang et al., 2019). Compared to their counterparts, start-ups accelerators are not limited to working out the financial struggles. They simultaneously solve two of the most pressing problems of entrepreneurs: resource constraints and the liability of newness (Yin & Luo, 2018). Not only do accelerators provide the developing businesses with financing, administrative and legal backup and facilities, but also with networking and mentorship opportunities (Luo, 2018). Start-ups that went through accelerators raised 47% to 171% more investment funding in the 2 to 3 years, got more traffic to their website and more employees and subsequently, had a higher chance of surviving the critical first years of a new venture (Cohen et.al., 2019). They are clearly subject to the information asymmetry and agency problems due to the challenging acceptance rates being around 4% (LinkedIn, 2020) and thus, strong competition.

To begin to fill this gap, this study aims to identify the combinations of existing signals that are most likely to lead to start-up's successful selection and how they might differ in developed and developing countries. The research questions to be answered are as follows:

What signals' configurations result in a start-up's acceptance to the accelerator? How are they different for accelerators in developing and developed countries?

Our research contributes to the entrepreneurship literature in several ways. First, we distinguish between an entrepreneur's credibility signals, including level of education, managerial and entrepreneurial experience, and project quality signals, involving prior financing and social media presence. Second, we differentiate between two regions - North America and Sub-Saharan Africa, representing developed and developing countries accordingly. As the result of the research, we expect to identify signal sets that lead to the successful outcome - the acceptance to the accelerator - for North America and Sub-Saharan Africa.

We approach the research question by applying the crisp-set qualitative comparative analysis (QCA) on accelerators in North America and Sub-Saharan Africa in the fields of health and education. Examining 596 start-ups that participated in the survey of the Aspen Network of Development Entrepreneurs (ANDE), we found that both project quality and entrepreneur's credibility signals jointly influence the final decision of managers. Specifically, we revealed that managerial experience is the most informative signal for accelerators in both North America and Sub-Saharan Africa. Comparing chosen regions, Africa tends to be more sensitive to the absence of any of the signals, while North American accelerators might rely on the only one of them. Additionally, we identified that entrepreneur's credibility signals can substitute absent project quality signals.

Our results are highly relevant to the management field. First, applied in strategic management, the assessment of a wide range of different information signals and their interconnection helps investors understand a venture's quality and legitimacy more precisely, which is crucial for estimating risks. Second, from the point of view of entrepreneurs, research results can be implemented in finding effective ways of communicating the project's value and potential to the prospective investors. Specifically, founders might adapt their pitch and emphasize the features that are considered as significant signals of legitimacy for accelerators in a specific region. Those who will be able to overcome this liability of venture's novelty, will have a higher chance of receiving investment funding (Baron & Markman, 2003).

The research paper is structured as follows. First, we review the relevant literature and set out our research propositions. Second, we present the research method and our findings. Third, we conclude by discussing the results of our analysis and outlining the contributions, limitations and directions for future research.

Literature review

In the following section of our paper we examine the theoretical background of the agency problem in entrepreneurial finance in economies of different types. The objectives of the literature review are, first, to examine start-up assistance organizations and accelerators which are one of the most common types of them. Second, clarify the way information asymmetry leads to the agency problem and how it can be solved by applying the signalling theory. Third, identify the most common signals, their influence on the selection process and classify them. Finally, analyze the environmental differences that can also affect the decision of accelerators' managers.

Financing start-up initiatives

In recent years, the amount of entrepreneurial initiatives was growing all over the world and start-ups can be found in almost any country. According to the recent statistics presented by Start-up Ranking, in the United States alone there are over 70, 000 new ventures in operation. However, 90% of the emerging businesses fail and 10% of them do it in the first year (Failory, 2022). Researchers have identified a bunch of factors that are crucial for a new venture to survive. Human and social capital of founders (Shane & Venkataraman 2000; Colombo & Grilli 2010; Unger et al. 2011) as well as sufficient financing of the initiatives (Binks & Ennew, 1996; Ebben & Johnson, 2006) are among the most frequently mentioned ones. Consequently, the lack of business sense and knowledge combined with unwise application of funds can prevent a newly born start-up from growing and prospering in the market.

Due to the high risks associated with start-up investments, including uncertainty of success, absence of a sufficient track record and unavailability of assets, it is often challenging for entrepreneurs to obtain financing in the seed and early start-up stage from traditional institutions such as banks (Jeng & Wells, 2000; Knockaert & Vanacker, 2011). That is why, the first option most entrepreneurs first resort to is the combination of personal savings and the 3Fs — “family, friends and fools” (Kotha & George, 2012). In 75% of cases these investments are insufficient to cover all the costs and outside financing is needed (SBA, Office of Advocacy, 2014).

In these circumstances, start-up assistance organizations (SAOs) are one of the options. These institutions represent all types of organizations and programs which support entrepreneurs to develop their projects. Incubators and accelerators are particularly notable here. The concept of a business accelerator is relatively new and first came up in 2005 with

the launch of Y Combinator by Paul Graham in Cambridge, Massachusetts, and later moved to Silicon Valley. The formal concept of a business incubator was applied in 1959 by Joseph L. Mancuso. Unlike any other type of SAOs, they work out both entrepreneurs' financial struggles and the liability of newness. The latter refers to the lack of ability to obtain resources necessary for survival on the market as the consequence of the small experience of the start-up founders (Dibrell et al., 2007).

Despite sharing a similar purpose of funding promising projects, business accelerators can be more beneficial for start-ups as they provide faster boost and higher level of investments (Ceacuc et al., 2017). Firstly, there is a difference in the duration of the supporting program. Accelerators support no longer than 6 months, while incubators are ready to help for 5 years. It sets certain time frames for accelerators and implies intense work to achieve results in a short period. Secondly, incubators do not invest in the projects directly, while accelerators offer a certain amount of money and equity. Additionally, accelerators provide a wider range of services to help in the development process including the assistance in preparing investor pitches or negotiations. Incubators are more focused on operational tasks such as intellectual property consulting and facilitation of external financing. Among other differences, accelerators are more focused on technology-based projects, while incubators support all types. To get access to the wider range of higher quality start-ups, accelerators select projects on a global level, but the scope of incubators is less spread as they focus mostly on local ventures.

Signalling theory

While choosing the start-up to participate in the accelerator, managers of accelerators face severe information asymmetry problems that affect their choice and might result in possible adverse selection (Connelly et al., 2011). The phenomenon of information asymmetry is defined as the knowledge imbalance between two parties while performing negotiations (Arrow, 1963). In the case of accelerators, entrepreneurs might not reveal some private information about their project to increase the possibility of being chosen for the program. This information includes the technical feasibility of the product or the entrepreneur's personal intention toward the venture's development. It makes estimating the real value of an investment in the suggested business challenging for accelerator managers. Obtaining only limited information, managers might choose the wrong applicant and become a subject to the agency problem, the conflict of interests between two parties (Richard et al., 2002).

To reduce information asymmetry and work out the agency program, the signaling theory is often applied. The reason is that signals can demonstrate unobservable characteristics and establish legitimacy in the situation of information asymmetry (Kirmani & Rao, 2000; Frydrych et al., 2014). It works in the following way: the accelerator's applicant sends signals about its current capabilities and an accelerator receives and interprets these signals. Signals are necessary to reduce the information asymmetry between two parties and play an important role as a part of a firm's strategy (Connelly et al., 2011).

Types of signals in entrepreneurial finance: scoping the framework for analysis

Both social and economic signals influence the investment decision. Moreover, these signals can be divided into those that represent the entrepreneur's credibility and those that demonstrate the project quality. Table 1 provides a summary of previously identified signals that can send positive or negative signals to accelerators.

Table 1 Types of signals

	Description	Author(s) and Title	Previous findings
<i>Entrepreneur's credibility signals</i>			
Higher education	Higher education refers to the academic degree that an entrepreneur was awarded: bachelor, master and Doctor of Philosophy (PhD). The level of the degree that the founder holds can be a positive signal for investors as it proves that he has certain qualities that can help the project to succeed.	Gokdeniz, Jami (2020) <i>The Role of Universities in the Development of Entrepreneurship</i>	The aim of higher education is not just getting knowledge but to develop students in a diverse way such as developing business skills such as working in teams and presenting pitches that are valuable for entrepreneurs as well as building an environment for net working. Main goals of universities in the XXI century is the support of the different activities acting simultaneously: conducting research projects, learning and training of individuals and firms to create new jobs.
		Ermilina, Farrell, Askarzadeh (2021) <i>Digging Into Selection Criteria for Accelerator Acceptance: What Kind of Owners Are More Attractive?</i>	The level of education is connected with the start-up success as founders are able to recognize opportunities, are more creative and innovative and achieve better results at raising capital from investors.

Entrepreneurial experience	The experience of gaining finance for the project as well as the success/failure history. If a project was successful, meaning it justified the investment by showing returns and rising number of clients, this fact demonstrates the entrepreneur's credibility.	Huang, Pickernell, Battisti, Nguyen (2021) <i>Signalling entrepreneurs' credibility and project quality for crowdfunding success: cases from the Kickstarter and Indiegogo environments</i>	Failure in entrepreneurial project can be perceived in two ways — both positive and negative.
		Gaskill, Van Auken, Manning (1993) <i>A Factor analytic study of the perceived causes of small business failure</i>	The crowd connects the fact of failure with the lack of entrepreneurial skills.
		Cope, Watts (2000) <i>Learning by doing: An exploration of experience, critical incidents and reflection in entrepreneurial learning</i>	The crowd may count negative experience as the source of knowledge hoping that an entrepreneur would not repeat the mistakes.
Managerial experience	The ability of an individual to work in a team, take responsibility, to hold himself accountable for the actions and manage business processes. This experience can be gained while working on managerial positions at companies, namely CEOs, senior directors and executive directors.	Certo, Daily, Dalton (2001) <i>Signalling Firm Value through Board Structure: An Investigation of Initial Public Offerings</i>	Status of CEO is a valuable signal for equity investors. The activity of CEOs and their involvement in daily operations is highly influential as they take the biggest part of the responsibility for the future of the company.
		Zheng, Piao, Park (2021) <i>The Role of Founder-CEO, Human Capital and Legitimacy in Venture Capital Financing in China's P2P Lending Industry</i>	CEOs organize working teams in accordance with both employees' talents and abilities and business goals of the company. Hence, the human capital tendencies send signals about management and leadership skills of entrepreneurs.
		Wasserman (2003) <i>Founder-CEO Succession and the Paradox of Entrepreneurial Success</i>	The CEO's experience is crucial as it signals the capability to successfully manage the venture.
<i>Project quality signals</i>			

Prior financing	The successful obtaining of investments from equity, debts or other sources of entrepreneurial financing. It can mean that the project has at least once showed its credibility to the investors.	Kleinert, Volkmann, Grünhagen (2018) Third-party signals in equity crowdfunding: the role of prior financing	When an investor, which could be an angel, venture capital firm or bank, decides to invest in an emerging project, he puts at stake two assets: reputation and money, as start-ups are associated with high risks. While reputation is used for the deal flow generation and in case the project demonstrates the low quality investors discredit themselves, finance spent on such a project would result in no return.
		Benzouai, Djeflal (2021) A Bibliometric Review of Research on Venture Capital	VC institutions are highly attentive to the selection of start-up projects, that is why if a project was already funded by either VC firm or angel investor, it is a positive signal for current investors.
		Kleinert, Volkmann, Grünhagen, (2018) Third-party signals in equity crowdfunding: the role of prior financing	This signal can also be applied to crowdfunders for whom VC funding and grants received for the development of the project in the past show the proxy for the future success of the start-up.
Social media presence	If the project has a media presence on social platforms such as Twitter, Facebook, TikTok, Instagram, it can be a useful tool to attract new customers and public attention.	Teten, Fattah, Bremer, Busling (2013) The Lower-Risk Start-up: How Venture Capitalists Increase the Odds of Start-up Success	Since start-ups have no brand image at their early stages, social networks make a great contribution to the building of connections and attracting the audience to a new product or service.
		Kadam Ayarekar (2014) Impact of social media on entrepreneurship and entrepreneurial performance: Special reference to small and medium scale enterprises	Social media represents a powerful platform for direct demonstration of the brand value, vision and mission by open communication with clients.
		Ellison, Steinfield, Lample (2007) The Benefits of Facebook “Friends:” Social Capital and College Students’ Use of Online Social Network Sites	Social media connects companies with each other for more efficient work.

		Liang, Yuan (2016) Predicting investor funding behavior using crunchbase social network features	Entrepreneurs who pay much attention to the social media profiles of their projects and who are interested in establishing new connections have better chances to get funding for the business development.
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Entrepreneur’s credibility signals

Entrepreneur’s credibility signals are personal characteristics of the entrepreneur that help to estimate the success of the emerging business and establish trust between parties. During the early stages of the development of a new venture, personal traits of an entrepreneur play a central role in transferring information about the project to the investors (Colombo, 2021). Recent research on entrepreneurial finance highlighted the following signals that boost the chances of projects to be selected for the financial support: education level (Yin & Luo, 2018), entrepreneurial experience (Cope et al., 2000; Zhang, 2007; Mitteness et al., 2012) and managerial experience (Zheng et al., 2021). The understanding of an entrepreneur's credibility signals is especially important if there is a lack of project quality signals.

Project quality signals

Project quality signals are technical indicators of the start-up itself. Previous research on crowdfunding and VC revealed that prior financing (Kleinert et al., 2018) and social media presence (Yang et al., 2019) can be identified as signals demonstrating the project quality. In our research, we discuss the role of these signals in the start-up selection by accelerators.

Linking the signals

As discussed earlier, whether the project is chosen for an accelerator or not is likely to be influenced by signals of entrepreneurs’ credibility and project quality. One might argue that each of these signals can influence managers’ decisions in isolation, however, we suggest that signals operating individually are not sufficient to make a well-balanced decision and one signal might not be strong enough to mitigate information asymmetry (Huang et al., 2021). Previous studies confirm that several signals are likely to operate at the same time (Drover et al., 2018; Bapna, 2019), thus the effectiveness of one signal depends on another (Plummer et al., 2016). Also, Colombo et al. (2018) made a research dedicated to the IPO

and identified that signals, transmitting diverse information, could add up to result in a more positive IPO valuation. In line with this view, we expect that an applicant's success can be a consequence of different signals working together and suggest the following hypothesis:

Hypothesis 1: Successful selection into an accelerator requires multiple signals to work together so that the presence of one signal alone might be not sufficient.

Signals in different environments

Another proposition that we have developed is that the decision by accelerator's managers is likely to depend not only on the interaction of signals but also the signalling environment. Under the signalling environment we understand internal and external factors that influence a particular industry such as geopolitical, social and economic challenges. Environment can influence the perception of the project in several ways. Firstly, it can be a signal itself, as the start-up is affected by the situation on the market, the government's influence with direct and indirect methods (Callagher et al., 2015). It can be assumed that start-ups from developed countries are more credible as the conditions are more favorable. Secondly, the environment can influence all other factors explained above by providing support for entrepreneurs and their initiatives with relevant education, financial and legal help. Studies that use different types of entrepreneurial activity data, such as OECD self-employment data, Global Entrepreneurship Monitor (GEM), and Venture Capital Profiles, find a positive correlation between the size of government, quality of fiscal and monetary policy, and levels of entrepreneurial activity (Bjornskov & Foss, 2008; Hall et al., 2013; Hall & Sobel, 2008; Kreft & Sobel, 2005; Nyström, 2008).

According to GEM Global Report conducted in 2017, the African economy has one of the highest rates of necessity-driven entrepreneurship in the world, having 30% of all entrepreneurial initiatives with this kind of motivation. Necessity entrepreneurs are those who start their project as means of survival due high unemployment rates, while opportunity-driven entrepreneurs tend to start projects because they have found promising opportunities of an untaken niche in the market (Brewer & Gibson, 2014). The second type is more common in countries with developed economies, having 88% projects of this kind. These differences can reflect the overall situation in the economy of the regions, sending positive signals for projects from developed countries. Access to finance is also a crucial part of entrepreneurship, and it was indicated as one of the challenges that African entrepreneurs face (Adekola et al., 2018). In contrast, in America the ecosystem is more effective due to financial support from angel investors, venture capital firms and other ways of financing (De Soto, 2001). So, developed

countries such as states of Europe and North America demonstrate high entrepreneurial activity with good economic performance which forms a favorable environment with stable legislature and economy for the business development. In contrast, countries of Africa, which are developing, are examples of less stable business environments which bring high risks to emerging entrepreneurs.

Previous research identified core differences in these two environments. As for entrepreneurial education, the American educational system is more concerned about teaching how to act as an entrepreneur, while in Africa it is focused on theoretical knowledge and not how to actually start and run the business (Abdurazzakov, 2016). Moreover, cultural differences also exist in these two environments. In the US the entrepreneurs are characterized as risk-takers with such a mindset promoted in films, social media and by famous people. Risk is always associated with the possibility of failure which society is tolerant to. The situation is opposite in Sub-Saharan Africa, where people do not tend to risk as they do not have a forbearance for failure (Akinseye & Adebawale, 2016). Thus, due to these big environmental differences, the results obtained for the developed countries might not be applicable for the developing ones. Accordingly, we state that:

Hypothesis 2a: Signals of entrepreneurs' credibility can substitute absent project quality signals

Hypothesis 2b: Developing countries' accelerators are more sensitive to the absence of one or more entrepreneur's credibility signals than those of developed countries.

Methodology

To test our hypotheses, we use the crisp-set qualitative comparative analysis (QCA), which has proved to be a tool in demand for management research in recent years (Greckhamer et al., 2018; Douglas et al., 2020). As an approach, QCA allows a better reflection of complex cases via applying its core principles of multiple and conjunctural causation, identification of necessary and sufficient conditions and their combinations (Sehring et al., 2013). As a method, QCA can process a larger number of cases and via the truth tables turn complex causal relationships to a list of configurations. Consequently, researchers are provided with a clear visualization to systematically compare the results (Blatter et al., 2007). Additionally, QCA combines the features of both qualitative and quantitative analysis (Berg-Schlosser et al., 2008). While remaining a case-oriented approach, where every individual case is viewed as a complex entity to be comprehended, it allows to process a larger number of cases and produce generalizations, leaving room for replication (De Meur & Rihoux, 2009).

Our motivation to use QCA is driven by the fit of the method characteristics with our research question. First, it is the configurational perspective of this method that makes it possible to identify combinations of conditions that are able to lead to a specific result. Our hypothesis fits this precondition: certain combinations of entrepreneur's credibility and project quality signals are expected to lead to successful selection to the accelerator. Second, QCA method allows to work out the causal equifinality, which means identifying not just a universal configuration but multiple ones that reach an identical result (Fiss, 2007; Schneider & Wagemann, 2012).

QCA analysis

In our research analysis, we followed the study conducted by Huang et al. (2021) and two guidelines for the QCA analysis in the software fs/QCA 3.0 (Ragin & Davey, 2016) provided by Lio et al. (2015) and Pappas and Woodside (2021).

The QCA analysis requires the performance of three main steps: data calibration, analysis of necessary conditions and the sufficiency analysis (Schneider & Wagemann, 2012). In our study, the first step is the transformation of variables into dummies (1 and 0) depending on the presence or absence of the particular signal. The second step, which is the necessity analysis, estimates the conditions (presence or absence of certain project quality and entrepreneur's credibility signals) that are important for the outcome (project's final acceptance by the accelerator). The third step - the sufficiency analysis - estimates signals that are sufficient for the acceptance based on the truth table created in the second step.

Data collection and description

The data for our analysis was drawn from the Global Accelerator Learning Initiative of the Aspen Network of Development Entrepreneurs (ANDE), which focuses on promoting entrepreneurship in developing markets. From 2013 to 2019, the organization surveyed entrepreneurs doing business in emerging markets across the globe. The data used in this study is from the initial survey administered during the application process. Although at the end of 2019 the database contained 23,364 observations, we restricted our sample in several ways. First, because 2016 was the first year data on acceptance/rejection to accelerator programs was documented, we limit our sample to responses from 2016 to 2019. Second, in order not to double-count any start-ups that applied to accelerators several times during the chosen time period, we limit our sample to start-ups that were founded in the same year they applied to accelerators. Third, using ventures' IDs we checked if ventures applied to multiple programs and eliminated duplicates. The reason behind these restrictions is that QCA does not allow us to choose control variables that might have an effect on the outcome, hence, we need to narrow down the sample in order to get more precise results.

Furthermore, to account for additional effects that could influence accelerators' selection decisions, we narrow down the sample further as follows. We will only focus on the projects in the "Education" and "Health" category. Since our sample shows that signals sent by these two categories are close to each other, it allows us for the combined analysis of these two sectors. Additionally, we take only two sectors for the sake of enhancing ventures' comparability since EdTech and Healthcare sectors tend to be the most promising ones, according to the recent data and socio-political situation. As for the education sector, COVID-19 impacted the growth of the industry, reporting a 233.91% increase in organic traffic and a 335.08% increase in revenue (Rootstrap, 2020). Speaking about HealthEd start-ups, the pandemic has accelerated the adoption of digital healthcare tools. As of March 2021, investments in digital health topped \$1 billion (Forbes, 2021). We also applied a restriction regarding the legal status of the venture and chose intrinsic differences in structures, policies, and strategies that exist in organizations with different legal status that make the projects incomparable (Hull & Lio, 2006; O'Connor & Raber, 2001). After applying these restrictions, our sample consists of 219 unique start-ups, 146 are in North America and 73 in Africa. Among them, 30 start-ups in North America and 13 in Sub-Saharan Africa were finally accepted. The overview of the sample after implementing listed restrictions is presented in Table 2.

		All startups		North America		Sub-Saharan Africa	
Full Sample	Accepted	43	20%	30	21%	13	18%
	Rejected	176	80%	116	79%	60	82%
Neither Signal	Accepted	26	23%	19	26%	7	18%
	Rejected	88	77%	55	74%	33	83%
Only project's quality signals	Accepted	8	17%	5	14%	3	25%
	Rejected	39	83%	30	86%	9	75%
Only entrepreneur's credibility signals	Accepted	1	3%	1	5%	0	0%
	Rejected	38	97%	21	95%	17	100%
Both signals	Accepted	8	42%	5	33%	3	75%
	Rejected	11	58%	10	67%	1	25%

Measures and data calibration

As we apply a crisp-set type of QCA, all our variables should be converted to the dummies, so that they only take in a value of 1 (presence of the signal) or 0 (absence of the signal). Table 3 represents the summary of all variables we will use in our research.

Signals	All startups		North America		Sub-Saharan Africa	
	Number of cases	Share of cases	Number of cases	Share of cases	Number of cases	Share of cases
<i>Signals of entrepreneurs' credibility</i>						
Higher education	190	87%	130	89%	60	82%
Previous entrepreneurial experience	95	43%	56	38%	39	53%
Previous managerial experience	120	55%	82	56%	38	52%
<i>Project's quality signals</i>						
Prior Financing	72	33%	53	36%	19	26%
Social media presence	157	72%	112	77%	45	62%

Outcome of interest

The dependent variable in this study is the initial acceptance to the program. If the project was selected for the accelerator, it is coded as 1 (30 out of 146 projects in North America and 13 out of 73 in Sub-Saharan Africa). Otherwise, it was coded as 0.

Causal conditions

Signals of entrepreneurs' credibility

- Higher education

In the sample we have information about the founder's highest level of education obtained. We coded it as 1 if the founder had either Bachelors/Honors Degree, Masters Degree or PhD and 0 if the level of education was lower, namely Technical/Vocational Degree, Associate Degree or

High and Middle School, we coded it as 0. In this way, we figure out the importance of gaining higher education by the founder to be successfully selected to the program.

- Previous entrepreneurial experience

Having information of whether the founder had launched either for-profits, non-profits or any other kind of organizations, we form a dummy variable, where 1 accounts for the cases when the founder has been involved in any type of the entrepreneurial initiative before and 0 if he/she did not. This might give us an insight into if it is possible to succeed without previous similar experience in entrepreneurship.

- Previous managerial experience

Our dataset includes the information on the two most recent paid full time jobs of the founder. If the founder's role was either CEO/Executive Director or a Senior Manager, it is coded as 1, if the position was Support Staff or other - 0. In this case, we test if working for an organization before starting your own business helps to create a more competitive venture.

Project's quality signals

- Prior Financing

Previous research has proved that prior financing is a significant signal for investors when choosing crowdfunding projects (Kleinert et al., 2018), thus we assumed it would become a significant signal for accelerators as well. If the venture previously obtained at least one of the three types of financing - equity, debt or philanthropic ones - we coded it as 1, otherwise - 0.

- Social media presence

Social media presence is something that can now show the ability of business to communicate with the audience and generate new customers (Polańska, 2014), thus it could indicate the venture's potential for growth and influence positively the accelerators' managers' choice. We formed a dummy variable for the presence or absence of the venture's Facebook, Twitter or LinkedIn page, which equals 1 if the company indeed is present online and 0 otherwise.

The necessity analysis

Following the data calibration, the necessity analysis takes place. The software we are planning to use for it is fs/QCA 3.0 software (Ragin & Davey, 2016). The goal at this stage is to assess if the presence or absence of any of the chosen entrepreneur's credibility (level of

education, entrepreneurial experience and managerial experience) or project quality signals (social media and prior financing) are individually necessary for being successfully selected to the accelerator. The signal can be named as necessary for reaching the result (acceptance to the program) only when all the selected projects exhibit this signal (Huang et al., 2021).

Signals	North America		Sub-Saharan Africa	
	Consistency	Coverage	Consistency	Coverage
<i>Entrepreneurs' credibility</i>				
Higher education	0.80	0.18	0.77	0.17
~Higher education	0.20	0.38	0.23	0.23
Entrepreneurial experience	0.37	0.20	0.31	0.10
~Entrepreneurial experience	0.63	0.21	0.69	0.26
Managerial experience	0.57	0.21	0.62	0.21
~Managerial experience	0.43	0.20	0.38	0.14
<i>Project quality</i>				
Social media	0.73	0.20	0.85	0.24
~Social media	0.27	0.24	0.15	0.07
Prior financing	0.33	0.19	0.54	0.37
~Prior financing	0.67	0.22	0.46	0.11

Note: ~ indicates the absence of the signal.

Table 4 demonstrates the results of the necessity analysis based on 219 observations. According to the data obtained, level of education and social media in both regions were necessary signals for the success at accelerators based on the consistency threshold of 0.75. It means that either the presence or absence of these two signals influenced the outcome.

The sufficiency analysis

Sufficiency analysis expands the findings made at the previous step: it helps to identify the set of signals (configurations) that might guarantee acceptance to the accelerator. First step is to identify all the possible combinations using five signals. To identify configurations, we constructed truth tables for North America and Sub-Saharan Africa which computed all possible combinations that may occur, providing 2^k rows, where k represents the number of conditions. Hence, truth tables in our research contained 32 (2^5) possible configurations based on five causal conditions (signals). Next, we removed those conditions that contained zero empirical cases. The data set contained configurations with at least one empirical case and the minimum consistency threshold of 0.75 (Ragin, 2008). Third, the results of individual configurations were

coded as 1 if they fit the criteria. Otherwise, the configuration was coded as 0. Truth tables for both regions (Table 6 and Table 7) can be found in Appendix 1. Finally, the model for the sufficiency analysis contains 5 conditions:

Acceptance to the accelerator = f (level of education, entrepreneurial experience, managerial experience, social media and prior financing)

Obtaining solutions

FsQCA computes three solutions also known as combinations based on the Quine-McCluskey algorithm: complex, parsimonious and intermediate (Fiss, 2007). The type of the solution depends on whether and how configurations with no empirical cases are included in the analysis. In particular, complex solutions show all possible configurations of conditions when general logical operations are applied (Pappas & Woodside, 2021). Since in our research configurations with zero empirical cases were removed and we want to observe the relationship of multiple signals working together, results of the research are based on complex solutions (Schneider & Wagemann, 2012).

Results

The sufficiency analysis

Table 5 represents the sufficiency analysis results for two regions - North America and Sub-Saharan Africa. While N1, N2 and N3 refer to signals' configurations that might guarantee acceptance to accelerators in North America, S1 and S2 might lead to success in Sub-Saharan Africa. Since the consistency of all configurations and overall solutions is above the threshold of 0.75 for both regions, the acceptance to the accelerator is consistently explained by the generated combinations (Ragin, 2008). The overall solution coverage is 0.10 for North America and 0.31 for Sub-Saharan Africa. It means that only 10% of the outcome in North America is explained by configurations N1, N2 and N3, while three times more - 31% of the outcome - is explained by configurations S1 and S2 in Sub-Saharan Africa.

Causal conditions	North America			Sub-Saharan Africa	
	N1	N2	N3	S1	S2
<i>Entrepreneurs' credibility</i>					
Higher education	○	○	○	○	●
Entrepreneurial experience	○	○	●	●	●
Managerial experience	●	●	●	●	●
<i>Project quality</i>					
Social media	○	●	●	○	●
Prior financing	○	●	○	○	●
Consistency	1	1	1	1	0.75
Raw coverage	0.03	0.03	0.03	0.08	0.23
Unique coverage	0.03	0.03	0.03	0.08	0.23
Overall solution consistency	1			0.8	
Overall solution coverage	0.10			0.31	

Note: ● (○) represents the presence or absence of the causal condition

In our analysis, we can make inferences based on these 5 combinations only where all of the signals played a role for the final decision. For North America, combination N1 suggests that the presence of the only one signal - managerial experience - might be sufficient to lead to start-up's acceptance when a start-up demonstrates the absence of four other signals. Combination N2 shows that the joint presence of managerial experience, social media and prior financing sends enough positive signals to guarantee the successful selection when other two signals are absent. Similarly to N2, N3 indicates that managerial experience and social media

presence are important for being accepted, but also adds the entrepreneurial experience to the combination.

For Sub-Saharan Africa, the combination of two entrepreneur's credibility signals - managerial and entrepreneurial experience - might lead to the successful selection, as configuration S1 shows. Unlike any other configuration presented previously, S2 suggests that all five signals are necessary to work together to end up in start-up acceptance.

Collectively, the results of the overall sufficiency analysis demonstrate that in most cases, the presence of at least 2 signals are needed. Managerial experience has proved to be the most sufficient signal, being present in all 5 models, while the level of education appeared only once in combination for Sub-Saharan countries. Comparing the two regions, the Sub-Saharan region puts more emphasis on entrepreneur's credibility signals, requiring at least managerial and entrepreneurial experience for both models, while for North America only managerial experience is sufficient. In terms of project quality signals, both regions indicated mixed findings, obtaining models requiring either all such signals or none of them.

Robustness check

Following An et al. (2020), in order to find out how the results of sufficiency analysis would differ in case of any changes in model specifications, two types of robustness tests were performed.

The first check is done by increasing the consistency threshold from 0.75 to 0.9, where 1 is the maximum. The results were similar to the ones presented in Table 5: combinations N1, N2, N3 and S1 remained unchanged, while S2 was eliminated.

The second check is produced via the sufficiency analysis of negative outcome, which is the rejection from an accelerator in our case. The goal is to identify combinations that lead to the negative outcome and compare them to those that guarantee acceptance for both regions. Table 6 (Sub-Saharan Africa) and Table 7 (North America) in Appendix II demonstrate configurations resulting in the negative outcome. Overall solution consistency in both regions is higher than 0.75 (Ragin, 2008). Moreover, since new configurations do not contradict with the main result presented in Table 5, the results obtained from the robustness checks provide support for the main findings.

Discussion

The basic finding of this research is that in most cases the translation of multiple signals leads to success, entrepreneur's credibility signals can substitute project quality signals and developing countries are more strict in identifying signals during the selection process.

First, our results revealed that signals alone may produce successful outcomes, however, combinations of multiple signals increase the chances of being selected by an accelerator. Since 4 out of 5 combinations contain multiple signals so that the presence of one signal is insufficient, the partial support of the first hypothesis is provided. This finding complements the results obtained in the previous research of signals for accelerators that identified the positive influence of economic and social signals on the selection decision (Yang et al., 2019). Additionally, the results of our study expand the research on accelerator criteria. Previously, it was found out that such signals as gender, country of birth and level of education increase the chances of acceptance (Ermilina et al., 2021 ; Yin & Luo, 2018). While our study does not allow us to make inferences about the necessity of higher education in the selection process, we identified other signals that are crucial as well: managerial and entrepreneurial experience and signals related to start-ups themselves.

Second, consistent with hypothesis 2a, presence of signals of entrepreneur's credibility can substitute the absence of signals of project quality. In addition, we found out that an entrepreneur's credibility and project quality signals can also complement each other leading to positive answers from accelerators. This study expands prior research provided by Huang et al. (2021) by showing that lack of project quality signals does not necessarily impedes the acceptance as it can be substituted by entrepreneur's credibility signals suggesting that the success of start-ups depends on signals' configurations. Results of our study also let us compare signals for different entrepreneurial financing tools. In the context of crowdfunding, entrepreneur's credibility and project quality signals were analyzed (Huang et al., 2021). The results of this research showed that success/failure and industry experience are essential for start-up founders, while third party endorsements and project preparedness are effective signals of start-ups. Compared with the results of our study for accelerators, third party endorsements (in our case, prior financing) were also identified as an effective signal. Furthermore, research on venture capital firms selection criteria also paid attention to such signals as the management team and business related factors and revealed that the importance of these signals depends on the stage of a start-up pretending to get funding from VCs (Gompers et al., 2020), while signals identified in our research are relevant at the early stage of the start-up development. In contrast,

specifics of signals angel investors pay attention to are limited to personal ones. The interaction between angel investors and entrepreneurs differs from those mentioned above as it provides the highest level of information asymmetry (Colombo, 2021). The communication of these two parties is direct, hence, particularly subjective (Maxwell et al., 2011). Based on this assumption, past research identified that the most effective messages are to be sent through such signals as motivation, capabilities, skills, and personality (Colombo, 2021).

Third, the results let us compare combinations of signals in two economically, politically and socially different environments - North America and Sub-Saharan Africa. According to the analysis, entrepreneurial and managerial experience are the most essential for African accelerators as they are presented in both combinations of this region. This finding supports the idea revealed in the previous research that people in Sub-Saharan Africa demonstrate a fear of business failure (Adekola et al., 2018) which leads accelerator's managers to pay more attention to the experience of founders as it sends information whether the collaboration with entrepreneurs would be prosperous. In contrast, Americans are more tolerant to failures (Adekola et al., 2018) that is why they can ignore the absence of experience. Additionally, African managers also take into account higher education, while it played no role for American accelerators. This finding is well associated with the lack of entrepreneurial education in Africa compared with North America which provides entrepreneurs with various opportunities and networks for the development through education and training (De Soto, 2001; GEM, 2017). Since educational opportunities in Africa are relatively poor, they are more valuable for managers. After the comparison of two regions, it can be concluded that accelerator programs of Sub-Saharan Africa are stricter to the absence of signals since four start-ups were selected by showing the combination of five signals (S2) and only one start-up showing the combination of two signals (S1). In contrast, North American accelerators accept projects demonstrating two or three signals, and the number of cases in all combinations is equal, which supports hypothesis 2b.

Conclusion

Most entrepreneurs are in need of external financing to create a successful venture. Accelerators are such a new supporting tool, selection to which, however, involves significant information asymmetry. That is why relevant signals are needed for entrepreneurs to win accelerators' managers' trust and for the managers to notice the most promising projects. Based on signalling theory, this research brings new insights about interconnections of entrepreneurs' credibility and projects' quality signals that might result in successful acceptance to the accelerator in different environments. In the paper we answered the research questions stated in the beginning —*What signals' configurations result in a start-up's acceptance to the accelerator? How are they different for accelerators in developing and developed countries?* Using QCA, we identified 5 combinations of signals that are most effective in North America and Sub-Saharan Africa as well as found out that African accelerators require more signals to be present.

Implications for theory

Our research reveals important insights about signalling theory in the entrepreneurial environment by highlighting specific factors that play a role in the selection to accelerator programs.

Colombo (2021) pointed out that a positive image of an entrepreneur as a leader and innovator results in crowdfunding success. By highlighting the fact that entrepreneur's credibility signals, namely managerial and entrepreneurial experience, are essential to get funding from accelerators, our research supports Colombo's finding and proves that entrepreneur's characteristics affect the decision not only in the crowdfunding context, but also for accelerators. This finding also addresses calls to consider such signals as start-up experience and managerial experience that were suggested to be informative (Yang et al., 2019). However, in contrast to previous research that pointed out that signals alone are insufficient to lead to positive outcomes (Huang et al., 2021), our study revealed that there might be cases that one signal can send enough information.

Additionally, we expand accelerator research based on signalling theory by using a sample of applied start-ups in two different regions, addressing the recommendation for the future research on the role of signals for gaining funds in different contexts (Colombo, 2020; Connelly et al., 2021). By analyzing developed and developing countries, we provide evidence showing the dependence of the number of signals presented and programs' environment. Based

on the results, we claim that developing countries are looking for as many signals as possible because of their resource-poor entrepreneurship environment and intolerant to risks culture.

Although previous studies have considered the role of entrepreneur's credibility and project quality (Gaskill et al., 1993; Mollick, 2014; Courtney et al., 2017; Yin & Luo, 2018) as well as the interplay between these types of signals (Huang et al., 2021), many signals still remain underexplored. Our study presents new insights to this stream of research. We extend the literature by examining social media presence, level of education, managerial and entrepreneurial experience. Not only do we uncover the complementary relationship between signals but also the compensating one by adopting a configurational approach. Hence, our study also addresses Drover's call (2018) to analyze interactions of multiple signals working simultaneously. Our research is based on Huang et al. (2021) analysis of accelerator funding, focused on how different signal sets convey different information and create positive outcomes.

Implications for practice

In addition to contributing to the theoretical understanding of the role of different signals and their interactions, we believe our results may also have important implications for accelerators and entrepreneurs themselves. Our study has specified signals that are on demand and suggests using them by start-up founders who are seeking for accelerators' help. From the information obtained in our research, the most important factors that influence the acceptance of the project into accelerators were specified. More importantly, as we made a division between countries with developed and emerging economies, entrepreneurs and managers can understand more precisely what factors are important for them depending on the region the program is located.

Entrepreneurs who plan to apply to the accelerator program in the developing country should take into account that more signals are needed for acceptance. In this case, entrepreneurs need to be prepared to demonstrate not only their own competence that would assure accelerator managers but also understand how to signal the potential of the project using social media and prior financing. In the situation when a project lacks quality signals, founders can leverage strong entrepreneur's credibility signals, namely entrepreneurial and managerial experience, to prove the project's potential as these signals feature most prominently amongst all configurations. Specifically, founders can underline the reliability of the overall project by focusing on their own accomplishments and previous experience as managers and CEOs. Similarly, social media presence was a frequent signal of project quality. Since both entrepreneur's personal traits and project's indicators are controlled by founders, we suggest

investing time and effort in the development of both types of signals to increase chances of success.

Limitations and directions for future research

In the presented study there are several limitations that provide opportunities for future research. First, the QCA method is a convenient tool for testing our hypotheses as it allows us to discover causal relationships between various combinations of factors and the dependent variable of acceptance into accelerators (Ragin, 2008; Greckhameret al., 2018). However, it is not possible to include the strength of the signals and actual measurements as the model works with dummy variables only. To illustrate, the research did not take into account the field in which the founders got the degree, whether it was business-related or not. Entrepreneurial experience does not illustrate if the previous experience was successful or not and if the business goals were achieved. Managerial experience does not include the time that the person has spent on the position as well as the company's size and number of employees, which can give the information about the credibility of the experience. As for the project's qualities, social media presence does not take into account the number of followers and the levels of involvement, just the existence of them. All of these factors and the level of their influence can be considered separately in future research.

Second, we focused only on projects from the "Education" and "Health" categories, meaning that the results are not uniform and can differ from industry to industry. We also analyzed for-profit ventures only, meaning that the signals can be of different importance for non-profit projects. By doing so, we demonstrate signal sets relevant for these two sectors. However, it remains unclear whether similar signals would work for other industries. Future researchers can fill these gaps by exploring projects of other categories and other financial goals.

Third, the accelerator's commission and features of people who make the decision on whether to accept the project or not were not considered, however, it may be biased (Yang et al., 2019). It leaves a space for individual preferences to make an influence on the outcomes, such as background and previous experience with entrepreneurial initiatives (Vismara, 2019).

Finally, our study presents the combinations that led to the successful outcome based on a particular sample. During the data calibration, we did not consider combinations that showed 0 cases. However, it does not necessarily mean that they do not result in the start-up acceptance. In the future research, we suggest using the extended sample to reduce this gap.

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Appendices

Appendix I. Truth Tables

Table 6 Truth table for Sub-Saharan Africa accelerators

Rows	Conditions						
	Higher education	Entrepreneurial experience	Managerial experience	Social media	Prior financing	Number of cases	Accepted projects
1	0	1	1	0	0	1	1
2	1	1	1	1	1	4	1
3	0	0	0	1	0	4	0
4	1	0	1	0	1	2	0
5	1	0	1	1	1	2	0
6	1	0	0	1	1	5	0
7	1	0	1	1	0	5	0
8	1	0	0	1	0	5	0
9	1	1	1	0	0	9	0
10	1	1	1	1	0	8	0
11	1	1	0	0	0	6	0
12	1	0	0	0	0	4	0
13	0	1	1	1	0	4	0
14	1	1	0	1	0	3	0
15	1	1	0	1	1	3	0
16	1	0	1	0	0	3	0
17	0	0	0	1	1	2	0
18	0	0	0	0	0	1	0
19	1	0	0	0	1	1	0
20	0	1	0	0	0	1	0

Note: 12 rows contain 0 cases and are not displayed in the table.

Table 7 Truth table for North American accelerators

Rows	Conditions						
	Higher education	Entrepreneurial experience	Managerial experience	Social media	Prior financing	Number of cases	Accepted projects
1	0	0	1	0	0	1	1
2	0	0	1	1	1	1	1
3	0	1	1	1	0	1	1
4	1	1	0	1	0	6	0
5	0	0	0	0	0	4	0
6	0	1	0	0	0	2	0
7	1	1	1	1	1	15	0
8	1	0	0	0	0	6	0
9	1	0	1	1	0	16	0
10	1	0	1	1	1	14	0
11	1	0	0	1	0	20	0
12	1	1	1	0	0	5	0
13	1	0	1	0	0	8	0
14	1	0	0	1	1	14	0
15	1	1	1	1	0	16	0
16	1	1	0	0	0	4	0
17	1	1	0	1	1	3	0
18	0	0	1	1	0	3	0
19	1	0	0	0	1	2	0
20	0	1	0	1	1	2	0
21	0	0	0	1	1	1	0
22	0	1	1	0	0	1	0
23	1	1	1	0	1	1	0

Note: 9 rows contain 0 cases and are not displayed in the table.

Appendix II. Robustness Test

Table 8 Sufficiency analysis for the rejection from the accelerator in Sub-Saharan Africa

Causal conditions	AS1	AS2	AS3	AS4	AS5	AS6	AS7
<i>Entrepreneurs' credibility</i>							
Higher education		●	●	●	●		○
Entrepreneurial experience				○	●	●	○
Managerial experience	○	○		○	○	●	○
<i>Project quality</i>							
Social media	○		○	○	●	●	●
Prior financing	○	○	○			○	●
Consistency	1	0.94	1	1	1	1	1
Raw coverage	0.20	0.28	0.37	0.08	0.10	0.20	0.03
Unique coverage	0.03	0.07	0.20	0.07	0.05	0.20	0.03
Overall solution consistency	0.98						
Overall solution coverage	0.82						

Note: ● (○) represents the presence or absence of the signal, blank cells represent irrelevant conditions

Table 9 Sufficiency analysis for the rejection from the accelerator in North America

Causal conditions	AN1	AN2	AN3	AN4	AN5	AN6	AN7	AN8
<i>Entrepreneurs' credibility</i>								
Higher education		●	●	●				●
Entrepreneurial experience		○		○	●	○	●	●
Managerial experience	○		●	○	●	●	●	●
<i>Project quality</i>								
Social media	●	●	○		○	●	○	○
Prior financing	●			●	○	○	○	
Consistency	0.95	0.81	0.87	0.94	0.89	0.79	0.83	0.83
Raw coverage	0.16	0.45	0.34	0.13	0.07	0.13	0.04	0.04
Unique coverage	0.05	0.23	0.20	0.08	0.03	0.03	0.01	0.01
Overall solution consistency	0.87							
Overall solution coverage	0.83							

Note: ● (○) represents the presence or absence of the signal, blank cells represent irrelevant conditions