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How do working conditions, network relationships, and institutional support offers effect entrepreneurial intentions of German university scientists?

Teita Bijedić [a], Christian Schröder [a,*], Arndt Werner [b], Xiangyu Chen [b]

[a] Institut für Mittelstandsforschung (IfM) Bonn, Maximilianstr. 20, 53111, Bonn, Germany
[b] Universität Siegen, Unteres Schloss 3, 57072, Siegen, Germany

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ABSTRACT

In this paper, we study whether and how (i) working conditions, (ii) network relationships, and (iii) institutional support offers simultaneously relate to entrepreneurial intentions among German university scientists. Using unique, representative data collected from 5992 academic scientists at 73 German universities, we find that *entrepreneurial peers* and *monetary incentives* have a positive effect on university scientists' engagement in entrepreneurship. Moreover, we show that *networks* have a substantial impact on entrepreneurial intentions. We also provide evidence for our hypothesis suggesting that, from a certain network size onwards, the positive effect on the entrepreneurial intentions diminishes. However, although hypothesized, our results do not indicate that the propensity for entrepreneurship rises exponentially with an increasing number of *institutional* support *offers* in universities. That is, a broad range of offers covering all the pre-founding phases does not seem to have a stronger impact on university scientists' intentions to switch into entrepreneurship than individual isolated offers.

1. Introduction

Innovations are essential for sustainable development and economic growth – especially in knowledge-driven economies (Fagerberg and Srholec, 2008; Verspagen, 2006). During the last decades, a strong increase in economic policies could be observed, indicating that universities may play a significant role in strengthening economies' capacity for innovation. In fact, the research outcomes of university scientists are now considered as a primary source of new knowledge and thus of commercially utilizable innovations (Audretsch, 2014; Guerrero et al., 2016). Consequently, scientists' role, position, and function at universities have been subject to a fundamental change, which has led universities to broaden and modify their traditional Humboldtian understanding of the role of universities in society. That is, besides science and teaching, a third task has been introduced, focusing on knowledge transfer from different research fields to the private sector (Van Looy et al., 2011; Visintin and Pittino, 2014).

As a result, universities worldwide have made great efforts to establish an infrastructure that facilitates commercial exploitations of academic inventions (Cunningham and Link, 2015; Meoli and Vismara, 2016). These developments have triggered shifts in university and government policies intending to motivate scientists and universities to commercialize their research output by, for example, incentivizing academic entrepreneurship (for a review of the relevant literature, see Hossinger et al., 2020; Neves and Brito, 2020; Rothaermel et al., 2007). Because starting a new firm is one of the most effective ways to transfer knowledge from academia to the market, it can foster technology development on the macro level (Miranda et al., 2017; Shane, 2004).

The important role that universities play in the transfer of commercializable knowledge is well documented, and the importance and contributions of various academic entrepreneurial activities are recognized globally (Berbegal-Mirabent et al., 2015; Block et al., 2017; Guerrero et al., 2016; Lopes et al., 2020). However, despite the shift in university policies, academic knowledge of promising commercial potential seems to remain – at least to a certain degree – unexploited in universities (Bijedic et al., 2021; Czarnitzki et al., 2014). Most academic scientists discontinue their entrepreneurial venturing process in these institutions due to various university-specific factors (Fritsch and Krabel, 2012; Guerrero et al., 2008; Van Geenhuizen and Soetanto, 2009). Fritsch and Krabel (2012), for example, show that, while 28% of all scientists at universities or research institutions consider entrepreneurship as an attractive alternative, only 3.2% actually start their own

* Corresponding author.
E-mail addresses: bijedic@ifm-bonn.org (T. Bijedić), schroeder@ifm-bonn.org (C. Schröder), arndt.werner@uni-siegen.de (A. Werner).

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business. Indeed, the founding process in academia is a complex issue because the entrepreneurial propensities of academics are simultaneously influenced by various individual factors and determinants derived from the parent organization and the external context (Hossinger et al., 2020; Rasmussen et al., 2014). By identifying especially determinants of the parent organization, like working conditions, supporting infrastructure and entrepreneurial networks, this paper draws the attention potentials to optimize the institutional support for academic entrepreneurs. While singular effects of individual working conditions like entrepreneurial peers (e.g. Moog et al., 2015), supporting infrastructure (e.g. Guerrero et al., 2020) or entrepreneurial networks (e.g. Thomas et al., 2020), are found potentially supportive for founding a business, a more holistic approach taking all three dimensions simultaneously into account is still missing.

Thus, we believe that it is crucial to understand, from a holistic point of view, the specific factors that may influence the intentions of academic scientists to start a new venture. Consequently, the paper at hand intends to add to this line of research by focusing on the antecedents of entrepreneurial academic intention and clustering these into three groups: working conditions, network relationships, and institutional support. Thus, we intent to answer the following research question: *How do working conditions, network relationships and institutional* support *offers effect the university scientists' intention to switch into entrepreneurship?*

This paper fills a critical research gap as the empirical evidence based on a large sample of scientists from numerous universities that take influencing factors on different levels into account is still scarce (Good et al., 2019; Hayter et al., 2018; Hossinger et al., 2020). We adopt a holistic approach to investigate the under-researched joint impacts of different multi-level antecedents of academic entrepreneurship. The previous literature does not provide such a holistic perspective. Specifically, this paper adds to the knowledge transfer literature by testing how entrepreneurial intentions among university scientists is simultaneously related to individual, structural, and institutional factors. We analyse the influence of (a) individual working conditions, that is, income satisfaction and peers, (b) networks, for example market-related networks and networks in private surroundings or among colleagues, and (c) institutional support offers at the university, for example technology transfer offices, entrepreneurship education programs, or founder and idea awards. In addition to this, the comprehensive data set allows us to control for many additional factors of which the influence is already well known through the academic literature published to date.

Using unique, representative data collected from 5992 academic scientists from a wide range of faculties in 73 institutions of higher education in Germany, we find that the working conditions that the researchers are exposed to, as well as most of our network relationship dimensions and institutional offers, are significantly related to the intention of academic scientists to start a new venture.

Our study makes the following contributions to the academic entrepreneurship literature: on the one side, it provides a holistic multi-level view of the potential factors influencing entrepreneurial intentions among university scientists; on the other, to the best of our knowledge, this is the first study to use representative data to test our research question directly. In sum, our findings help us to understand whether, how, and under which conditions these multi-level factors influence scientists' likelihood of intending to start an academic new venture and thus can assist external stakeholders (e.g., university administrators and policymakers) in structuring their entrepreneurship support programmes more efficiently and effectively for this target group.

The remainder of the paper is structured as follows. In the next section, we discuss the theoretical perspectives that may help to explain scientists' intention to become entrepreneurs and derive specific hypotheses for each level that we take into consideration. Section three addresses the methodology of our empirical analysis, and section four presents the regression results. Finally, in section five, we discuss our results, indicate the limitations of our study, and make some concluding remarks.

2. Theory and hypotheses

2.1. Working conditions

Besides individual factors, entrepreneurial behaviours are strongly determined by environmental factors (Rasmussen et al., 2014; Walter et al., 2013). Specifically, the immediate working conditions in which academics are embedded directly affect their intention to become engaged in entrepreneurial activities (Muscio et al., 2016). Within entrepreneurship research, environmental determinants, which foster entrepreneurial intentions, are subdivided into pull factors and push factors. Pull factors constitute the positive causes and expected incentives of an entrepreneurial career, for example self-fulfilment, gaining a broader range of competencies, or commercialization of one's human capital (Antonioli et al., 2016; Lam, 2011), whereas push factors are reactions to insufficient conditions and lead to a desire to escape or avoid dissatisfactory working conditions, such as (impending) unemployment or a dissatisfying workplace culture (Kirkwood, 2009). While pull factors are linked to opportunity entrepreneurship and affect entrepreneurial intentions directly in a positive manner, push factors are rather linked to necessity entrepreneurship and foster entrepreneurial intentions allusively as one possible 'way out' of a (potentially) precarious situation. Based on this distinction, the individual working conditions of academic scientists can be subdivided into monetary and peer-effect motivations that can stimulate or inhibit entrepreneurial activity. In the following, we will analyse in more detail whether and to what extent these two specific motivations, reflecting different working conditions, relate to entrepreneurial intention.

2.1.1. Monetary compensation

Within academic entrepreneurship research, monetary compensation as an incentive is widely discussed and empirically proven to be one of the key motivations for intending to switch into academic entrepreneurship. While entrepreneurial motivations can be classified into intrinsic or extrinsic motivation, extrinsic motivation refers to behaviours that are driven by external rewards that arise from external environmental factors, such as pursuing monetary rewards (Galati and Bigliardi, 2020; Hossinger et al., 2021; Iorio et al., 2017). However, the influence of monetary compensation as an incentive is always context-specific, and its importance depends on the personal concerns and situations of academics (Antonioli et al., 2016; Hossinger et al., 2020; Rizzo, 2014). D'Este and Perkmann (2011), for example, show that such monetary incentives are particularly relevant when academics decide to patent or to start their own businesses. Moreover, Hossinger et al. (2021) show that university scientists' motivations related to greater financial income increase the likelihood of completing venture creation activities. These academics are mostly motivated by financial rewards. However, many scientists would consider them not as the primary goal but rather as collateral compensation for the time and effort that they expend (Goethner et al., 2012; Lam, 2011). As indicated above, on one side, monetary incentives can be interpreted as a typical pull factor to achieve higher earnings and/or to amortize one's own human capital endowment. On the other side, such monetary incentives can function as a push factor as well, for example as a reaction to dissatisfaction with the current compensation and thus the consideration of entrepreneurship as a way out of a current undesirable professional situation (Corolleur et al., 2004). Based on these arguments, the following hypothesis can be stated.

H1a. University scientists who are less satisfied with their current salary will have higher entrepreneurial intentions than university scientists who are more satisfied with their current salary.

2.1.2. Peer effects

Throughout the process of socialization, role models have a high impact on the development of motivations and future career decisions

(Alonso-Galicia et al., 2015; Bercovitz and Feldman, 2008; Johnson et al., 2017; Nelson, 2014; Nicolaou and Souitaris, 2016). Research demonstrates that entrepreneurs' children show a higher entrepreneurial propensity than employees' children (Parker, 2018). However, not only family members but also professional peers affect the entrepreneurial propensity (Feola et al., 2019; Moog et al., 2015; Stuart and Ding, 2006). Such professional peers can affect the entrepreneurial propensity either directly or indirectly through the institutional norms and culture, for example at school, at university, or via the supervisor (Antonioli et al., 2016; Bercovitz and Feldman, 2008; Huyghe and Knockaert, 2015). Therefore, it can be assumed that the entrepreneurial culture at the university as well as the department culture, will affect the entrepreneurial intentions of the scientists working there. This also applies to the entrepreneurial activities and attitudes of co-workers or supervisors. The effect is stronger the more closely the individual is attached to the entrepreneurial role model (e.g., Moog et al., 2015; Stuart and Ding, 2006).

In a related vein, several studies show that the institutional attitude towards entrepreneurship affects the entrepreneurial activity of the academic staff (Feola et al., 2019; Grimm and Jaenicke, 2012; Huyghe and Knockaert, 2015) and PhD entrepreneurship, respectively (Muscio and Ramaciotti, 2019). Bercovitz and Feldman (2008) show that the individual behaviours of academics are strongly affected by the social norms within their departments. The entrepreneurial orientation of department leaders ('role models') and peers ('peer effect') significantly influence the individual entrepreneurial behaviours of academics (Johnson et al., 2017; Nelson, 2014). Similarly, Kenney and Goe (2004) provide evidence that an entrepreneurial culture within the faculty can foster the entrepreneurial propensity of the staff.

Accordingly, Rasmussen et al. (2014) point out that a negative attitude towards entrepreneurial activities among the scientists within the faculty inhibits the entrepreneurial propensity of the employed academics. Importantly, individual role models seem to affect entrepreneurial propensity even more than institutional values. The better the reputation of the role model within the scientific community and the more visible the role model is, the more significant the impact on the entrepreneurial propensity of the academics is (Berggren, 2011; Stuart and Ding, 2006). Consequently, successful role models within the faculty who are involved in entrepreneurial activities are crucial for fostering the entrepreneurial propensity among young academics (Geißler et al., 2010). Building on these research streams, we formulate the following hypothesis.

H1b. University Scientists who work closely with professional peers engaged in entrepreneurial activities will have higher entrepreneurial intentions than their counterparts who do not have such professional peers.

2.2. Network relationships

In the following, we will focus our attention on network relationships among university scientists to gain a deeper insight into the role of networks and their impact on entrepreneurial intentions. Previous studies support the assumption that external relationships have a strong impact on academic entrepreneurship (Bienkowska and Klofsten, 2012; Elfring and Hulsink, 2003; Fernández-Pérez et al., 2014, 2015; Grandi and Grimaldi, 2003; Karlsson and Wigren, 2012; Krabel and Mueller, 2009). According to knowledge spillover theory, the context of the decision-making process affects one's determination to launch one's own business (Acs et al., 2013). This perspective is based on the assumption that profitable opportunities arise from knowledge spillovers. New knowledge, in turn, is regarded as the key driving force for entrepreneurial investments. Knowledge creation processes can therefore be stimulated by intensive forms of the personal interchange (Ahmad and Ingle, 2011). Such social interaction is of high economic value if its use gives the individuals access to scarce and valuable knowledge, which in turn also helps them to improve their entrepreneurial capabilities in terms of entrepreneurial readiness and opportunity identification and exploitation (Acs et al., 2013; Fernández-Pérez et al., 2014; Hayter, 2013). Along those lines, Goethner and Wyrwich (2019) show that business schools and their proximity to university facilities of natural science enhance the level of entrepreneurial ideas through knowledge spillover. Thomas et al. (2020) emphasize that the networks and, thus the existing social capital of successful and experienced scientists help founding teams in spin-off pre-formation.

Davidsson and Honig (2003) are among the first to highlight the importance of social capital in entrepreneurship. They find empirical evidence that social capital is higher among nascent entrepreneurs than in their control group of non-entrepreneurs. They differentiate between bridging and bonding social capital. Bridging social capital is based on weak ties, which are loose relationships to individuals or organizations and are useful for obtaining information that would otherwise not be available or would be costly to locate (Davidsson and Honig, 2003). In earlier work, Granovetter (1973) also highlights the importance of maintaining an extended network of 'weak ties' in obtaining resources. Bonding social capital, on the other hand, is based on strong ties, for example to family and friends. An example of strong ties is a family member helping out 'for free' or providing financial support. Bonding social capital provides secure and consistent access to resources and consists of inward-looking networks while bridging capital comprises open, outward-looking networks (Davidsson and Honig, 2003; Patulny and Svendsen, 2007; Putnam, 1995). Wasdani and Mathew (2014), for example, show the beneficial influence of bridging and bonding social capital on opportunity recognition in the pre-stage of entrepreneurship. Although a clear assignment indicating which kinds of relationships of academics are typical bonding or bridging social capital is difficult to achieve, it can be assumed that market-related contacts, for example potential clients or investors, belong to bridging social capital while contacts in private surroundings are rather attributable to bonding social capital. Job-related contacts can be assigned to both categories of social capital depending on their density and norms of trust in the workplace. Moreover, research-related ties also have a legitimacy effect for innovation activities. The validation and credibility received from research colleagues might be important to overcome resistance from sceptical peers and stakeholders confronted with radical innovations and their commercialization (Llopis et al., 2022). In sum, it can be stated that both types of social capital can be valuable for researchers seeking to become entrepreneurs.

Based on this, Martinez and Aldrich (2011) show that a more diverse network is positively related to a higher degree of entrepreneurial activity because the knowledge transfer will be reinforced by an increasing number of different network partners. This is also why diverse network relations can have a positive impact on the research productivity of scientists. The latter effect will encourage those individuals embedded in networks to use them to commercialize their research output. Guo et al. (2019) indicate that academic entrepreneurs should extend their social networks to experience entrepreneurial narratives. Such communication and storytelling play an important role in promoting entrepreneurship (Smith and Anderson, 2004). Soetanto and van Geenhuizen (2015) found that a well-connected network of university and non-university contacts help university start-ups in finding funders for their innovation activities. Despite this, however, Semrau and Werner (2014) as well as Soetanto and van Geenhuizen (2015) provide empirical evidence that the relationship between the size of a nascent entrepreneur's network and the access to startup-relevant resources follows an inverted U shape because the marginal returns in terms of access to financial capital, knowledge and information, and additional business contacts diminish while the opportunity costs of maintaining rise with growing network relationships. The findings are also in line with the results of Reynolds (1997), who concludes that spin-offs mainly occur in networks of a smaller size. Together, these considerations lead to our next four hypotheses.

H2a. University scientists with more market-related network contacts will have higher entrepreneurial intentions than their counterparts without such contacts.

H2b. University scientists with job-related contacts will have higher entrepreneurial intentions than their counterparts without such contacts.

H2c. University scientists with contacts in their private surroundings will have higher entrepreneurial intentions than their counterparts without such contacts.

H2d. There is an inverted U-shaped relationship between network diversity and higher entrepreneurial intentions among university scientists. The likelihood of higher entrepreneurial intentions first increases with increasing numbers of different network stakeholder partners and then decreases again.

2.3. Institutional support offers

To become more entrepreneurial, universities around the world are currently implementing far-reaching support systems, which are attracting the attention of scientists who are willing to commercialize their inventions through entrepreneurship. Many universities have built up multidimensional support systems because they believe that a well-developed, well-structured, and well-functioning support system for entrepreneurship will significantly promote the entrepreneurial activities of academics (Guerrero et al., 2020; Landry et al., 2006). In addition, such support programmes improve the visibility and reputation of startup enterprises among potential customers (Avnimelech and Feldman, 2015; Gómez Gras et al., 2008). Even though the support offers vary in scope and variety from university to university, specific core support schemes have emerged and are frequently found at universities; these are believed to cover the entire (pre-)foundation process from sensitizing for entrepreneurship and providing specific knowledge and information to offering physical resources (Audretsch and Belitski, 2019; Guerrero et al., 2015; Hossinger et al., 2020; M'Chirgui et al., 2018; Neves and Brito 2020). These are: (a) entrepreneurial education programmes, (b) technology transfer offices (TTOs), (c) consultant services, (d) coaching offers, (e) founder and idea awards, (f) startup camps, and (g) patent exploitation support offers.

2.3.1. Entrepreneurship education programmes

According to Ajzen's (1991) theory of planned behaviour, individual actions, like switching from dependent employment to entrepreneurship, will take place if the individual intends to act (Ajzen and Fishbein, 1980). This intention arises from the individual's attitude towards an action (e.g., entrepreneurship) and subjectively perceived social standards (e.g., university culture). If the intention to act has developed, individuals will act if they are able to control the consequences of their intended action. In the academic entrepreneurship context, this is reflected by the knowledge needed to be able to run a business successfully. Similarly, Shapero (1984) focuses on the components of 'desirability' and 'feasibility' as primary triggers of entrepreneurial intention. Scientists start a new business if this decision appears to be desirable and feasible. In line with these arguments, acquiring the knowledge and skills to run a new venture successfully increases the intention to switch into self-employment. In the context of academic entrepreneurship, education programmes aiming to foster internal mindsets by improving the entrepreneurial self-efficacy and entrepreneurial intention of academics have proven to be effective and successful (Alonso-Galicia et al., 2015; Prodan and Drnovsek, 2010; Shinnar et al., 2014). Guerrero et al. (2020) analyse the impact of educational programmes on the acquisition of specific skills that are relevant for the graduates'career choice. They find that skills achieved during entrepreneurship education programmes e.g., tolerant to intensive work effort, is crucial for the achievement of an academic entrepreneurship career in comparison to other occupational choices. Gurdon and Samsom (2010) demonstrate the significance of personal needs and values and that the success of scientist-started ventures depends strongly on handling the conflicting values between business and science. Entrepreneurship programmes may be helpful for potential academic entrepreneurs to strengthen their resilience in dealing with negative outcomes which will come during their entrepreneurial activities. Thus, in sum, it can be concluded that most empirical studies suggest that entrepreneurial education programmes at universities have a positive impact on the willingness of academics to found new enterprises (e.g. Lüthje and Franke, 2003; Mayhew et al., 2012; Peterman and Kennedy, 2003; Rasmussen and Sørheim, 2006; Schwarz et al., 2009; Souitaris et al., 2007; Turker and Selcuk, 2009; Walter et al., 2013). Thus, we derive the following hypothesis.

H3a. Scientists working at universities offering entrepreneurship education programmes will have higher entrepreneurial intentions than those working at universities that do not provide entrepreneurship education programmes.

2.3.2. Technology transfer offices

Technology transfer offices (TTOs) serve as an 'intermediary' between university scientists and those who can potentially help to commercialize their innovations, that is, firms, entrepreneurs, and venture capitalists (Siegel and Wright, 2015). Their main focus varies from university to university, and thus the strategy and goals of each university have to be taken into account. Most commonly, TTOs facilitate the transfer process either directly by initiating cooperation between the university and a business or indirectly by raising awareness and providing useful networks for entrepreneurship among their academic staff leading to higher entrepreneurial intentions among the university staff. Thus, we formulate the following hypothesis.

H3b. University scientists working at universities with TTOs will have higher entrepreneurial intentions than those working at universities without TTOs.

2.3.3. Consulting

Potential academic entrepreneurs will have a high level of specific knowledge based on their research. However, they often lack market-related knowledge. Mosey and Wright (2007), for example, show that consultants can fill the structural holes that exist between scientific research networks and industry networks. That is, an advisor can bridge these two realms by functioning as a knowledge intermediary and, by doing so, support scientists in building up useful relationships with non-academic contacts, which enable access to knowledge and other resources fostering entrepreneurial behaviour (Hayter, 2016). Thus, our next hypothesis is as follows.

H3c. Scientists working at universities offering consultancy services for entrepreneurship will have higher entrepreneurial intentions than those working at universities that do not have such services.

2.3.4. Coaching

Coaches help potential entrepreneurs identify and solve problems as they arise. Universities often provide valuable longer-term support in the form of tacit knowledge and social capital (Klofsten et al., 2019). Coaches are, for example, alumni entrepreneurs, experienced volunteers, or professors with prior academic entrepreneurship experience (Klofsten et al., 2019). Moreover, coaching addresses the limitations of many other support measures based on the passive absorption of knowledge and ready-made formulas in a lecture-type context. Coaching also encourages entrepreneurs to put their thoughts into action and invites them to think differently rather than simply absorbing advice based on past cognitive schemes (Audet and Couteret, 2012). Brinkley and Le Roux (2018), for example, argue that coaching is also helpful as it can assist entrepreneurs in improving their self-efficacy. Moreover, coaching provides a positive learning environment that facilitates skill development and an effective means of planning, goal setting, and goal achievement. In line with these arguments, we derive the following hypothesis.

H3d. University scientists working at universities offering coaching for entrepreneurship will have higher entrepreneurial intentions than those working at universities that do not provide coaching for entrepreneurs.

2.3.5. *Founder and idea awards*

In addition to direct consulting and support offers, founders' or idea awards are applied by universities as a qualification strategy. The idea behind these competitions is that entrepreneurial opportunities must be built (Marques, 2016). Even though the respective details of such awards can vary (Maack et al., 2011), they are usually targeted at improving the business plan and facilitating the pre-seed phase by evaluating and offering specialized advice related to marketing, sales, and industry-specific aspects, management, accounting, or financial and investment plans. Since the awards are often organized regionally, networking with regional partners is also facilitated, and regional media coverage increases the visibility of future businesses (Parente et al., 2015). Finally, the motivating atmosphere of such competitions provides a fertile setting for entrepreneurship (Marques, 2016). Thus, we derive the following hypothesis.

H3e. Scientists working at universities offering founder and idea awards will have higher entrepreneurial intentions than those working at universities that do not offer such awards.

2.3.6. *Startup camps*

Translating new research results into market-ready products or services is a particular challenge in the process of founding a new venture (Wright et al., 2004). Basic research – which is common in universities – is often unpredictable regarding its commercial relevance for the industry. Founders' workshops can therefore be helpful by giving potential founders a chance to test their product ideas. Startup camps at universities especially provide an infrastructure for the pre-seed phase, such as equipped office rooms, special devices, and lab facilities. The latter often require high investments that founders cannot provide by themselves. Therefore, potential capital-intensive startups can be greatly supported by startup camps, while new enterprises with low capital intensity will consider these to be somewhat less critical. However, due to the fact that scientific spin-offs are usually innovative and capital-intensive (Backes-Gellner and Werner, 2007), we propose that access to this infrastructure will reduce the capital bottleneck, especially for academic entrepreneurship (Fini et al., 2017). In addition to the infrastructure, start-up camps encompass services, such as mentoring and coaching offers. Guerrero et al. (2020), for example, show that such business incubators reinforce graduates' risk tolerance, leading to a higher entrepreneurial intention. Soetanto and Jack (2016) focus on the incubator's role in finding an adequate innovation strategy for academic spin-offs and show that such incubators provide networking and entrepreneurial assistance for a successful implementation. Thus, we state the following hypothesis.

H3f. Scientists working at universities with startup camps will have higher entrepreneurial intentions than those working at universities without such incubation support.

2.3.7. *Patent exploitation support offers*

The role of universities in the patent utilization process in Germany changed substantially with the amendment of '§ 42 Gesetz über Arbeitnehmererfindungen (ArbnErfG)'. Before this, university professors, for example, had an unrestricted right to use and commercialize the inventions that they developed as part of their research duties. With the amendment, the property rights of university research results switched from the individuals to the institutions. The legally protected (e.g., as patents) and commercially exploited research outputs belong to the institution, and the inventor receives 30% of the gross income. In exchange, the institution will bear all the costs of applying for the patent and commercialization. For this purpose, at least one patent and exploitation agency has been established in each federal state in Germany to handle the commercialization of university patents for all universities in the respective state. These patent exploitation agencies have the function of evaluating the commercial potential of such inventions and – based on this evaluation – deciding whether they should be patented. The agencies also, among other things, offer consulting services for founding projects, establish and administrate contacts and cooperation with market partners, negotiate and supervise contracts, and offer courses and training events for inventors. Thomas et al. (2020), for example, highlight the critical role of the entrepreneurial capability of claiming and protecting intellectual property in the preformation process of academic spin-offs. Even though every inventor who is also a university member has access to the services of the patent exploitation agencies through the regional assignment to each university, these agencies are little known among university members. Therefore, many universities offer support services on-site at the university to inform about the existence and the services of patent exploitation agencies. Thus, we hypothesize the following.

H3g. Scientists working at universities that provide patent exploitation support will have higher entrepreneurial intentions than those working at universities without such patent exploitation support offers.

2.3.8. *Variety of support offers*

The support services offered by universities, described below, have often been the subject of studies to analyse their influence on the propensity of academics to set up their own businesses or the subsequent success of startups (Hayter et al., 2018). However, very often, only the influence of one or a very few support measures is included in the analysis due to the available data on which these studies are based. We propose that it is important to include a broad range of existing support measures in the analysis simultaneously. We argue that potential founders have different skills and resources available to them. Therefore, with an increasing scope of various support measures, the probability that the potential founder's lack of resources will be addressed should also increase exponentially, triggering or reinforcing a scientist's intention to start a new business. In addition, the wide variety of startup offers reflects the university's commitment to supporting business startups. Thus, the diversity of offers expresses the extent of the commitment of the respective university to establishing a sustainable startup culture. We, therefore, state the following hypothesis.

H3h. The likelihood of higher entrepreneurial intentions of university scientists will increase exponentially with the number of different support offers (i.e. with increasing rates for each additional support offer).

Our conceptual framework of the individual, structural, and institutional antecedents of entrepreneurial intention among university scientists is illustrated in Fig. 1.

3. Methodology

3.1. *Data collection and sample*

To shed more light on whether and how individual and structural factors affect scientists' entrepreneurial intentions, we collected data on German university scientists. We first selected all the state universities that existed in Germany in 2013. In the next step, we excluded those universities that offered only a few or none of the courses from the following fields: STEM subjects (e.g., mathematics, computer science, natural sciences, or technology); economics (e.g., economics, business administration, or industrial engineering); creative subjects (e.g., architecture, music, design, or art); and the health field (e.g., medicine or health management). We defined these fields by following the

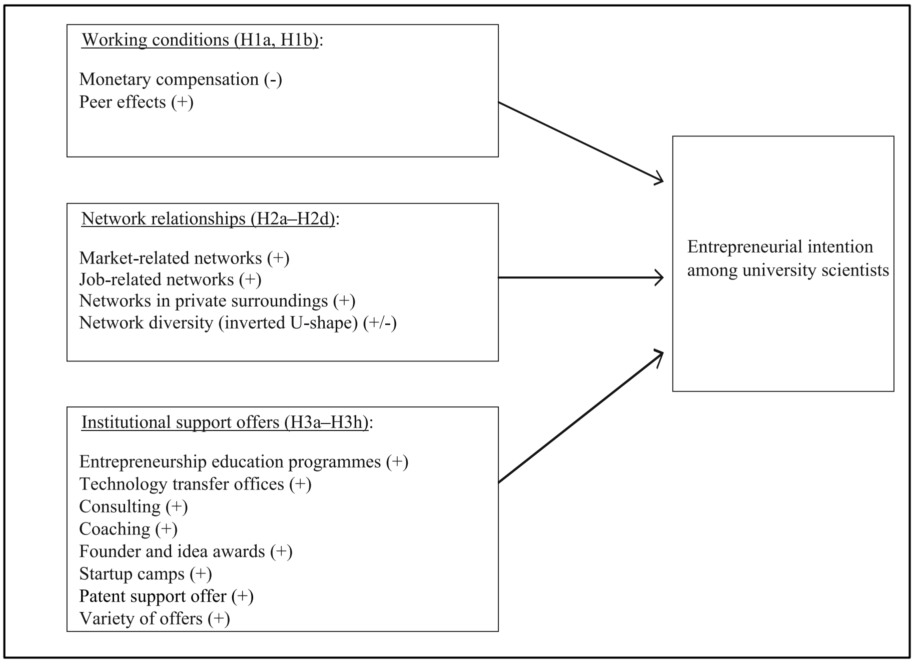

Fig. 1. Conceptual model and hypothesized relationships.

classification of the German Federal Statistical Office (Destatis, 2012). This left us with 175 state universities. We then selected 73 of those 175 universities randomly and screened each departmental home page of the 73 selected universities. Originally, we wanted to ask the universities for email distribution lists to contact their scientists. However, these lists turned out to be very outdated and incomplete. Therefore, we decided to collect the email addresses manually by applying a bottom-up approach (i.e. by examining each home page separately). Based on the information gathered from the websites, an email distribution list of 36,918 scientists was created. This whole process took about six months. Then, in November and December 2013, we sent a questionnaire to these 36, 918 scientists in the 73 randomly sampled universities as a cross-sectional survey. This standardized online survey contained questions about the employment history of the academics in general, their current occupational situation, and their occupational aspirations in the near future. The questions also covered the scientists' perception of entrepreneurial activities and intentions, their working conditions, and their individual networks. Furthermore, we asked them about the institutional infrastructure facilitating entrepreneurship and the entrepreneurial culture within the university for which they work. In total, 10,199 scientists responded to the survey. This sample was further adjusted by excluding all the respondents who were already self-employed in 2013 (n = 1322) and/or did not provide information for some of the variables of interest (n = 2885). These steps of data selection and data cleaning led to a final sample of 5998 university scientists to test our hypotheses.

With respect to the suitability and representativeness of our data, we compared the final sample with information obtained from the Federal Statistical Office in Germany (Destatis, 2022). We find that the proportion of female university scientists in Germany in 2013 was 37.8%. In the adjusted data set, 26.5% of the questionnaires were ultimately completed by women. The proportion between professors in comparison to the rest of the scientific staff was 9.2% in Germany in 2013 versus 13.5% in the survey.

3.2. Dependent variable

Academic entrepreneurial intention – Our dependent variable is an ordinal variable with three values. First, the scientists were asked whether they have a business idea to start a new venture, regardless of its level of elaboration. We interpret this answer as an indication of their 'latent entrepreneurial intentions'. If the answer was 'no', we operationalize this answer as 'no entrepreneurial intentions'. Second, we checked if those university scientists with a business idea have already started to invest time and/or other resources in their business foundation. If this was the case, we interpret this answer as an indication of their 'strong entrepreneurial intentions'. These gestation activities are, for example, having developed a business plan or having negotiated with debt and/or equity investors (see Table 1 for all the items). According to research literature "individuals who have taken discrete steps towards starting a new venture, such as writing a business plan, developing product prototypes, and so on (…) are known as 'nascent entrepreneurs'" (Reynolds et al., 2004; cited from Douglas, 2021: p. 62). However, only a few studies (e.g. Semrau and Werner 2014) adopt Davidsson and Honig's (2003) operational definition for nascent entrepreneurs by drawing on the same gestation activities as indications of entrepreneurial intentions. Bearing the heterogenetic nature of entrepreneurial behaviour in mind, we therefore feel more comfortable talking about strong entrepreneurial intentions instead of nascent entrepreneurship. We are aware that this may be considered as a limitation of our study.

The distribution of the entrepreneurial intention variable shows that about one-third of all the scientists in our sample have a business idea. Within this group of 2033 (33.9%) scientists with a business idea, 1060 (17.7%) scientists have taken no gestation steps to start a new venture. However, 973 (16.2%) scientists have a business idea and have initiated at least one typical gestation activity. We consider these 973 scientists to be university scientists with strong entrepreneurial intentions.

Table 1
Gestation activities.

'What steps did you take to advance your research-based startup idea?'	
	Yes = 1/no = 0
(1) I negotiated with debt and/or equity investors	
(2) I have a business plan	
(3) I took care of the exploitation rights	
(4) I introduced myself to (potential) clients	
(5) I acquired/contacted essential business partners	

3.3. Independent variable

Working conditions – Our sample includes information on a variety of specific working conditions. Following the theoretical explanations above, these experiences should be conducive to either switching to entrepreneurship or keeping the paid employment position at the university. In particular, we collected data on monetary compensation; specifically, we asked the respondents how satisfied they are with their current salary as a university scientist (a set of dummy variables ranging from 1 = very unsatisfied to 3 = neither satisfied nor dissatisfied and 5 = very unsatisfied). The reference category is 3 = neither satisfied nor dissatisfied. Moreover, we used data on peer effects by drawing on the following three binary variables: (a) the respondents have colleagues who have engaged in entrepreneurial activities; (b) conversations among colleagues about the entrepreneurial activity of other colleagues within the faculty exist; and (c) conversations about the entrepreneurial activities of students and/or other university members among colleagues exist.

Networks – With regard to the analysed network ties, we included in our regression models a set of binary variables reflecting contacts evaluated by the respondents as potentially helpful for realizing a business idea. These contacts are (1) potential investors; (2) potential clients; (3) potential other business partners; (4) (trade) associations; (5) individuals in the private sphere; (6) scientists in the workplace (university); or (7) scientists at other research entities. Based on this, we created (8) a metric network variable capturing the variety of these different network variables. This variable takes the value '0′ if the respondents have none of the above-mentioned contacts and '7′ if they have all of these potential contacts.

Institutional support *offers* – Concerning the institutional influences, we asked the respondents whether they were aware of specific support offers supporting entrepreneurship at their university. Specifically, we included information on the following support offers as a set of binary variables in our regression models: (1) entrepreneurship education; (2) a technology transfer office; (3) consulting; (4) coaching; (5) a founder or idea award; (6) a startup camp; and (7) a patent exploitation support offer. Again, we included an additive metric scale variable reflecting the number of different offers known to the scientists to capture the variety of these offers to which the scientists are exposed (ranging from '0' = none of these offers are known to '7' = all the offers are known).

3.4. Control variables

Following the contextualized research approach outlined by Welter (2011), we controlled for several variables that may relate to our dependent variable and the individual, structural, and institutional antecedents that we analyse in this paper. The individual controls include important factors that emanate from the individuals themselves and/or can be directly influenced by them (Iorio et al., 2017; Lee et al., 2011). They are regarded as central factors for entrepreneurial activity (Shane et al., 2012).

The scientist's *age* (in years) was included because age can be considered as an indicator for a variety of factors that influence an individual's startup behaviour. Parker (2018), for example, identifies several factors showing why it is advantageous to start a business as the age of the person increases. First, self-employment requires skills and abilities that are not available at a young age but only emerge with increasing work experience. Increasing age goes hand in hand with greater industry-specific knowledge and, at the same time, favours the recognition and exploitation of entrepreneurial opportunities (Rasmussen et al., 2011). Second, older people can draw on better networks and financial reserves for their self-employment (Werner and Faulenbach, 2008). Third, offsetting these positive effects, people's attitudes towards risk change with increasing age. Older people are generally said to have a lower-risk attitude than younger people (Wickstrøm et al., 2022). Finally, the time span in which startup investments have to pay off is shorter in old age, which leads to an age-related increase in the opportunity costs of switching to self-employment (Levesque and Minniti, 2006). Together, it can be deduced from these arguments that the middle age groups should therefore be the most entrepreneurial group. Therefore, we control for non-linear age effects by including age and age^2 in the regression models.

Gender (1 = the scientist is female, 0 = the scientist is male) differences in startup behaviour are also the focus of numerous studies (see, e.g., Maes et al., 2014). On average, women show fewer entrepreneurial intentions, become entrepreneurs less often, and work part-time more often than men (Díaz-García and Jiménez-Moreno, 2010).

Nationality (1 = foreign, 0 = German) can also influence entrepreneurship. According to recent studies, the share of foreign business founders in Germany has increased continuously. For example, one in six business founders is a migrant (Bijedić and Piper, 2019). Similar results can be observed in the context of academic entrepreneurship, which explains the higher propensity to start a business with cultural particularities (Tolciu and Schaland, 2008) and/or prevailing framework conditions in the host country, for example legal barriers (Leicht et al., 2001).

Entrepreneurial experience and skills (i.e. human capital) can be conveyed through the individual's professional experience and social background. Consequently, several studies examine the effect of *self-employed parents* (1 = parent(s) are self-employed, 0 = parent(s) are not self-employed) and/or the fact that the *life partner is self-employed* (1 = yes, 0 = no) (Parker, 2018). The argument is that children of self-employed parents or those with a self-employed life partner can observe these self-employed people directly and, by doing so, can acquire entrepreneurial skills and abilities. In addition, self-employed parents or partners can act as role models, which should positively influence the propensity to start a business.

Moreover, occupation-related factors, like professional experience, help individuals to acquire startup-specific human capital and, consequently, positively influence their propensity to set up a company (Davidsson and Honig, 2003). For example, such human capital endowments increase the individuals' productivity for entrepreneurship through a better assessment of market opportunities. In addition, future customers, suppliers, and investors generally attribute a higher level of competence to potential founders if they have such experience (Backes-Gellner and Werner, 2007). Especially in the university context, intensive research activities should also help scientists to discover or create new entrepreneurial opportunities. In line with these arguments, occupation-related factors like *working hours* (1 = full time, 0 = part time), and a *side job or professional business activity* (1 = yes, 0 = no) outside the university sector should positively affect the propensity to start a new venture.

Furthermore, scientists at universities of applied sciences (1 = yes, 0 = no) should have a higher propensity to find a company than those at regular universities due to the stronger applied research focus of the former *type of university*. In line with this argument, scientists who generally focus more on *applied and/or multidisciplinary research* (two 5-point Likert scale variables measuring the extent of basic, applied, and multidisciplinary research) should also show a significantly higher propensity to set up a company than those primarily focusing on basic research.

Scientists who have made *inventions* (1 = yes, 0 = no) within the scope of their university activities should also be more inclined to start a new company. Moreover, in line with existing research (Aldridge and Audretsch, 2011; Antonioli et al., 2016), we expect *scientists' position* (1 = professor, 0 = otherwise), their *field of study* (1 = science/technology/engineering/maths, 0 = otherwise), and whether they have a *second job* in paid employment (1 = yes, 0 = no) to influence their propensity to start a new venture.

Please refer to Table 2 for the operationalization of all the variables.

Table 2
Operationalization of the variables and descriptive statistics.

Binary Variables	Description	Frequencies
Gender	1 if a scientist is female; 0 otherwise	.336
Migration background	1 if a scientist has a migration background; 0 otherwise	.111
Self-employed parents	1 if a scientist's parents are self-employed or had similar experience; 0 otherwise	.281
Self-employed partner	1 if a scientist's partner is self-employed or had similar experience; 0 otherwise	.122
Type of university	1 if a scientist works at a university; 0 if a scientist works at an applied science university	.848
STEM disciplines	1 if a scientist works at the faculty of STEM as well as physics and other natural sciences; 0 otherwise	.756
Professor	1 if a scientist is a full professor; 0 otherwise	.135
Full-time job	1 if a scientist works as a full-time employee; 0 otherwise	.637
Second job	1 if a scientist has a second job in paid employment; 0 otherwise	.142
Basic research	1 if a scientist works in basic research; 0 otherwise	.449
Applied research	1 if a scientist works in applied research; 0 otherwise	.548
Multidisciplinary research	1 if a scientist works in multidisciplinary research; 0 otherwise	.425
Invention at university	1 if a scientist has made an invention based on a research project at the university; 0 otherwise	.179
Monetary compensation		
Very unsatisfied	1 if a scientist is very unsatisfied with the salary; 0 otherwise	.047
Unsatisfied	1 if a scientist is unsatisfied with the salary; 0 otherwise	.135
Medium	1 if a scientist is neither unsatisfied nor satisfied with the salary; 0 otherwise	.318
Satisfied	1 if a scientist is satisfied with the salary; 0 otherwise	.425
Very satisfied	1 if a scientist is very satisfied with the salary; 0 otherwise	.075
Entrepreneurial activities among colleagues	1 if a scientist has colleagues who have engaged in entrepreneurial activities; 0 otherwise	.295
Conversations about entrepreneurial activities of colleagues	1 if conversations about the entrepreneurial activities of colleagues exist; 0 otherwise	.069
Conversations about entrepreneurial activities of students and/or other members of the university	1 if conversations about the entrepreneurial activities of other faculty members among colleagues exist; 0 otherwise	.073
Networks/contacts		
With investors	1 if an academic has contact that is helpful for business foundation; 0 otherwise	.046
With potential clients	1 if an academic has contact that is helpful for business foundation; 0 otherwise	.138
With potential business partners	1 if an academic has contact (e.g. suppliers) that is helpful for business foundation; 0 otherwise	.17
With associations	1 if an academic has contact that is helpful for business foundation; 0 otherwise	.093
In private surroundings	1 if an academic has contact that is helpful for business foundation; 0 otherwise	.284
With colleagues at the same workplace	1 if an academic has contact that is helpful for business foundation; 0 otherwise	.252
With scientists at other research entities	1 if an academic has contact that is helpful for business foundation; 0 otherwise	.184
Institutional support offers		
Startup camp	1 if a startup camp is familiar to scientists	.04
Idea award competition	1 if an idea award competition is familiar to scientists	.028
Consulting	1 if a consulting service is familiar to scientists	.033
Coaching	1 if a coaching service is familiar to scientists	.017
Entrepreneurship education	1 if entrepreneurship education is familiar to scientists	.046
TTO	1 if a TTO is familiar to scientists	.049
Support offer in the patent exploitation process	1 if a patent exploitation support offer is familiar to scientists	.046

Non-binary Variables	Description	Mean	Std dev.	Min.	Max.
Dependent variable					
Entrepreneurial Intention	3-point Likert scale variable: 0 = no entrepreneurial intentions, 1 = latent entrepreneurial intention, 2 = strong entrepreneurial intention	.502	.758	0	3
Control variables					
Age	Metric variable in years	36.026	10.355	23	67
Networks/contacts					
Network diversity	Metric variable, generated additive scale of the above-mentioned partners	1.178	1.593	0	7
Institutional support offers					
Variety of offers used	Metric variable, generated additive scale of the above-mentioned offers	.258	.85	0	7

Source: Individual scientists' data collected by the Institut für Mittelstandsforschung Bonn in 2013, N = 5992 (for more details to the data see Schlömer-Laufen and Schneck (2020) and https://www.ifm-bonn.org/en/index/about-us/data-of-the-ifm-bonn-1

3.5. Analytical approach

We tested all our hypotheses by applying multiple regression analysis and followed a separate stepwise procedure. We entered first the control variables discussed above (Table 3, Model 1) and then – stepwise – our independent variables of interest reflecting working conditions (Table 3, Models 2 and 3); network contacts (Table 4, Models 4–7); and institutional factors (Table 5, Models 8–9). As our dependent variable is a three-item ordinal scale variable, the appropriate econometric model to use is a regression model for ordinal outcome variables (ordered probit). In the cases in which we comment on our results, we refer to the predictive probability that the university scientist has strong entrepreneurial intentions (Likert scale value = 3) compared with the situation in which the scientist has no business idea at all (Likert scale value = 1). Please note that the empirical models discussed below all have robust standard errors with correction for heteroscedasticity. To test for potential multicollinearity, we assessed the variance inflation factors and found that they did not exceed a certain value, being clearly above the commonly applied threshold of 3 (Hair et al., 2010). The correlations for all the variables used in our study are presented in the appendix (Table 6). Table 2 depicts the frequencies (in the case of the binary variables) as well as the means, standard deviations, and descriptions of

Table 3
Regression results – working conditions (monetary compensation and peer effects).

DV: Strong Entrepreneurial Intention	Model 1 *Base model*			Model 2 *Monetary compensation*			Model 3 *Peer effects*		
Variables	Coef.	St. err.	Sig.	Coef.	St. err.	Sig.	Coef.	St. err.	Sig.
Gender (female)	−.597	.064	***	−.592	.064	***	−.557	.064	***
Age	.085	.023	***	.07	.023	***	.086	.023	***
Age^2	−.001	0	***	−.001	0	***	−.001	0	***
Nationality	.179	.088	**	.174	.088	**	.204	.089	**
Self-employed parents (yes)	.252	.061	***	.258	.061	***	.244	.061	***
Self-employed partner (yes)	.28	.084	***	.306	.084	***	.225	.085	***
University (yes)	−.177	.086	**	−.153	.087	*	−.227	.088	***
STEM disciplines	−.204	.067	***	−.221	.068	***	−.149	.068	**
Professor (yes)	−.21	.097	**	−.207	.097	**	−.231	.098	**
Full-time job (yes)	−.011	.062		.108	.064	*	−.062	.063	
Second job (yes)	.624	.078	***	.627	.078	***	.549	.079	***
Basic research	−.316	.062	***	−.324	.062	***	−.283	.062	***
Applied research	.228	.063	***	.252	.064	***	.189	.064	***
Multidisciplinary research	.438	.06	***	.425	.06	***	.394	.061	***
Invention at university (yes)	.588	.071	***	.56	.072	***	.545	.072	***
Monetary compensation *(ref. 'neither satisfied nor dissatisfied')*									
Very dissatisfied				.454	.13	***			
Dissatisfied				.299	.085	***			
Satisfied				−.243	.066	***			
Very satisfied				−.366	.118	***			
Peer effects									
Entrepreneurial activities among colleagues (yes)							.417	.062	***
Conversation among colleagues about their entrepreneurial activities (yes)							.822	.108	***
Conversation among colleagues about the entrepreneurial activities of students and/or other members of the university (yes)							.451	.107	***
Mean dependent variable	0.502			0.502			0.502		
Pseudo r-squared	0.050			0.057			0.069		
Chi-square	528.828			594.239			721.677		
Akaike criterion (AIC)	9996.262			9938.851			9809.413		
N	5992			5992			5992		
Significance chi^2	0.000			0.000			0.000		
Bayesian criterion (BIC)	10110.131			10079.513			9943.376		

****p < .01, **p < .05, *p < .1.*

all metric variables in our study.

4. Results

Hypotheses 1a and 1b – proposing a positive relationship between *monetary compensation*, *peer effects*, and strong entrepreneurial intentions among university scientists – are supported (see Table 3). When compared with those scientists who are neither satisfied nor dissatisfied with their compensation, those who are satisfied (Model 2, $\beta = -0.243$; $p < .01$) or very satisfied (Model 2, $\beta = -0.366$; $p < .01$) are more likely, and those who are dissatisfied (Model 2, $\beta = 0.299$; $p < .01$) or very dissatisfied (Model 2, $\beta = 0.454$; $p < .01$) are less likely to have strong entrepreneurial intentions. Moreover, those who experience entrepreneurial activity among their colleagues (Model 3, $\beta = 0.417$; $p < .01$), have conversations with colleagues about their own entrepreneurial activities (Model 3, $\beta = 0.822$; $p < .01$), and/or have conversations with colleagues about the entrepreneurial activities of other faculty members (Model 3, $\beta = 0.107$; $p < .01$) have strong entrepreneurial intentions. Satisfaction with the current salary and role models can therefore be considered important factors that positively impact the entrepreneurial activities of university scientists. Specifically, closer and more visible role models, in the form of conversations with colleagues within the faculty, seem to exercise a stronger effect on entrepreneurial intentions than more distant role models.

As shown in Table 4, hypothesis 2a (*market-related networks*) is supported as three out of the four variables are positive and highly statistically significant. For example, the likelihood of having strong entrepreneurial intentions increases significantly by 13 percentage points if a scientist is able to make use of contact with potential clients beforehand (Model 4, $\beta = 1.368$; $p < .01$). Furthermore, being a scientist with strong entrepreneurial intentions increases by 20 percentage points if contact with potential business partners (e.g. suppliers or service providers), which would be helpful for the implementation of the project, exists (Model 4, $\beta = 0.975$; $p < .01$). Contact with investors, such as banks and public and private investors, improves the probability of strong entrepreneurial intentions by 7 percentage points (Model 4, $\beta = 0.62$; $p < .01$). However, no statistically significant impact was found in the case of contact with (trade) associations.

Moreover, the positive network effects are not restricted to external business relations. We found significant support for Hypothesis H2b. The findings indicate that *contacts with other scientists at the same university* (Model 5, $\beta = 0.361$; $p < .01$) and outside one's own university (Model 5, $\beta = 0.486$; $p < .01$) are of great importance as well. This was also the case for the Hypothesis H2c, as our analyses also lead to the conclusion that scientists with strong entrepreneurial intentions depend strongly on *private contacts* (Model 6, $\beta = 1.286$; $p < .01$). This result underlines the importance of the support that founders receive from their family members and friends.

Finally, we also find strong empirical evidence supporting Hypothesis H2d, which focuses on *network diversity*. Having strong entrepreneurial intentions increases on average by 8 percentage points when network relations are gradually expanded (Model 7, $\beta = 0.825$; $p < .01$). As Fig. 2 shows with increasing numbers of different contacts, the effect levels off (Model 7, $\beta = -0.079$; $p < .01$). This finding confirms the research results documented by Reynolds (1997) and Semrau and Werner (2014) for academic entrepreneurship.

With respect to the impact of the *institutional* support *offers* on the entrepreneurial intentions of academic scientists, five of the eight

Table 4
Regression results – network relationships.

DV: Strong Entrepreneurial Intention	Model 4 *Market-related networks*			Model 5 *Academic networks*			Model 6 *Private networks*			Model 7 *Network diversity*		
Variables	Coef.	St. err.	Sig.	Coef.	St. err.	Sig.	Coef.	St. err.	Sig.	Coef.	St. err.	Sig.
Gender (female)	−.494	.066	***	−.536	.064	***	−.53	.065	***	−.441	.067	***
Age	.079	.024	***	−.001	0	***	−.001	0	***	.078	.024	***
Age^2	−.001	0	***	.182	.089	**	.258	.09	***	−.001	0	***
Nationality	.321	.091	***	.239	.061	***	.14	.063	**	.285	.092	***
Self-employed parents (yes)	.239	.063	***	.278	.085	***	.18	.086	**	.171	.063	***
Self-employed partner (yes)	.183	.088	**	−.191	.087	**	−.185	.089	**	.187	.088	**
University (yes)	−.138	.091		−.189	.068	***	−.078	.069		−.16	.09	*
STEM disciplines	−.134	.071	*	−.272	.098	***	−.277	.1	***	−.091	.07	
Professor (yes)	−.443	.104	***	−.022	.062		.025	.064		−.422	.102	***
Full-time job (yes)	−.036	.065		.586	.079	***	.568	.08	***	−.017	.065	
Second job (yes)	.37	.083	***	−.319	.062	***	−.28	.063	***	.434	.082	***
Basic research	−.185	.064	***	.178	.064	***	.215	.065	***	−.258	.064	***
Applied research	.121	.066	*	.371	.061	***	.406	.062	***	.091	.066	
Multidisciplinary research	.333	.063	***	.512	.072	***	.586	.073	***	.29	.063	***
Invention at university (yes)	.403	.076	***	−.536	.064	***	−.53	.065	***	.425	.075	***
Networks/contacts												
With investors	.62	.137	***									
With potential clients	1.368	.089	***									
With potential business partners	.975	.082	***									
With (trade or business) associations	.037	.103										
Networks/contacts												
With academics in own university				.361	.075	***						
With academics in other institutions				.486	.082	***						
Networks/contacts												
In private surrounding							1.286	.06	***			
Networks/contacts												
Network diversity										.825	.047	***
Quad. network $diversity^2$										−.079	.009	***
Mean dependent variable	0.502			0.502			0.502			0.502		
Pseudo r-squared	0.123			0.063			0.094			0.122		
Chi-square	1289.766			655.839			989.088			1274.822		
Akaike criterion (AIC)	9243.324			9873.251			9538.002			9254.268		
N	5992			5992			5992			5992		
Significance chi^2	0.000			0.000			0.000			0.000		
Bayesian criterion (BIC)	9383.985			10000.516			9658.569			9381.533		

***p < .01, **p < .05, *p < .1.

hypotheses are confirmed (see Table 5). However, we find no empirical support for the assertion that *entrepreneurship education* (H3a), *technology transfer offices* (H3b), and *startup camps* (H3f) are related to the entrepreneurial intentions of university scientists.

We find no empirical support for the idea that a broader number of different support offers fosters the intention to switch into entrepreneurship exponentially (i.e. with increasing rates) among academic scientists. While we hypothesized that the effect should to increase exponentially with each additional offer; we find that the coefficient of our variety of support offers variable is not significantly different from zero (Model 3, $\beta = 0.065$; $p = .105$).

5. Discussion and contributions

Many studies analyse the antecedents influencing the academic entrepreneurship of scientists (Hossinger et al., 2020), significantly increasing our understanding of the drivers of and barriers to academic entrepreneurship. However, most of these studies are based on a comparatively small number of observations, focus on scientists in one specific field, and/or consider only a very few influencing factors in their empirical analysis. Therefore, this study aimed to provide a more comprehensive and holistic picture of the drivers of entrepreneurial intentions among university scientists. Accordingly, we drew on several acknowledged theoretical approaches to explain the possible effect of each driver. Based on 5998 scientists from 73 universities, we identified several significant factors, both at the individual and university level.

Based on our results, we can draw the following profile of university scientists with strong entrepreneurial intentions: These are more likely to be male and in their middle years. They relatively often come from abroad and are more likely to have self-employed parents and/or a self-employed life partner. In addition, they have probably made inventions during their university career, are focused on multidisciplinary research, and are more likely to work in universities of applied science.

Essentially, this profile is consistent with what we know from research literature. However, our results for example point to an inverted U-shaped relationship between age and strong entrepreneurial intentions. While some studies suggest a positive relationship, few others indicate a negative relationship or find no correlation (Abreu and Grinevich, 2013; Hayter et al., 2018; Neves and Brito, 2020). Having said that, different studies confirm our results that female academics show lower academic engagement and are less likely to start their own business (e.g. Abreu and Grinevich, 2013; Haeussler and Colyvas, 2011; Iorio et al., 2017). Liñán et al. (2015) provide evidence that cultural background matters for entrepreneurial intentions. In line with this, Constant and Zimmermann (2006) support our finding that foreign academics are more likely self-employed than native Germans. Research

Table 5
Regression results – institutional support offers.

DV: Strong Entrepreneurial Intention	Model 8 *Institutional support offers*			Model 9 *Variety of support offers*		
Variables	Coef.	St. err.	Sig.	Coef.	St. err.	Sig.
Gender (female)	−.569	.065	***	−.561	.064	***
Age	.09	.023	***	.086	.023	***
Age^2	−.001	0	***	−.001	0	***
Nationality	.289	.089	***	.253	.089	***
Self-employed parents (yes)	.246	.061	***	.255	.061	***
Self-employed partner (yes)	.24	.085	***	.298	.085	***
University (yes)	−.262	.088	***	−.235	.088	***
STEM disciplines	−.216	.068	***	−.229	.068	***
Professor (yes)	−.309	.099	***	−.337	.099	***
Full-time job (yes)	−.054	.063		−.044	.063	
Second job (yes)	.597	.078	***	.549	.079	***
Basic research	−.298	.062	***	−.281	.062	***
Applied research	.208	.064	***	.195	.064	***
Multidisciplinary research	.39	.061	***	.413	.061	***
Invention at university (yes)	.476	.073	***	.396	.074	***
Institutional support offers						
Startup camp	−.031	.068				
Founder and idea awards	.313	.073	***			
Consulting	.243	.074	***			
Coaching	.152	.081	*			
Entrepreneurship education	−.103	.075				
TTO	.023	.078				
Patenting support	.353	.082	***			
Institutional support offers						
Variety of support offers				.065	.039	
Variety of support offers^2				.012	.006	*
Mean dependent variable	0.502			0.502		
Pseudo r-squared	0.062			0.060		
Chi-square	648.918			626.200		
Akaike criterion (AIC)	9890.172			9902.890		
N	5992			5992		
Significance chi^2	0.000			0.000		
Bayesian criterion (BIC)	10050.929			10030.156		

***$p < .01$, **$p < .05$, *$p < .1$.

literature has also documented that the family background influences entrepreneurial behaviour (Foo et al., 2016; Georgescu and Herman, 2020). Entrepreneurial self-identity of spouses, for example, is found to be positively related to a self-employed occupation of their parents, which can trigger entrepreneurial behaviour (Obschonka et al., 2014). Moreover, Meyer (2006) highlights the role of inventions made by academics in the context of new venture creation in academia. Last, but not least, universities of applied sciences are said to be more engaged in regional knowledge transfer activities than regular universities, which, in turn, may trigger entrepreneurial behaviour of scientists (Arvanitis et al., 2008; Jaeger and Kopper, 2014).

Moreover, we found that working conditions that incentivise research, entrepreneurial peers as well as entrepreneurial network ties spark entrepreneurial intentions among university scientists. Regarding the institutional support system, we found that especially support offers aimed at scientists with elaborated business ideas (e.g. founder and idea awards, consulting and exploitation support offers) relate to strong entrepreneurial intentions. Contrary to that, non-specific offers focusing on a broader audience, like entrepreneurship education, show no short-term effects on entrepreneurial intentions. This result will be discussed further below.

We conducted the university survey in Germany in 2013. Since then, working conditions and employment contracts for university staff have not changed significantly. In contrast, there have been significant improvements in the financial resources available to support start-ups. The largest public support program at the federal level is EXIST, which promotes the founding of academics at universities through appropriate infrastructure measures and scholarships, and was expanded in 2014 (BMWK, 2022). This has led to increased availability of institutional support offers. In addition, compared to 2013, the percentage of universities with a codified transfer strategy has increased from 42% to 72% in 2019 (Frank and Schröder, 2020; Grave et al., 2014). The research results of our paper highlight the high importance of infrastructure for start-up projects. Therefore, our results show that the expansion of start-up infrastructure likely contributed to doubling the number of university spin-offs in Germany between 2012 and 2019 (Frank and Schröder, 2021).

5.1. Contributions to the theory

Universities can promote academic entrepreneurship and thus generate new knowledge that is economically and socially useful. In this context, we find that – if appropriate framework conditions and incentives exist – universities can transfer knowledge to society via academic entrepreneurship (Audretsch, 2014; Mueller, 2006). However, the drivers of academic entrepreneurship are complex and operate at

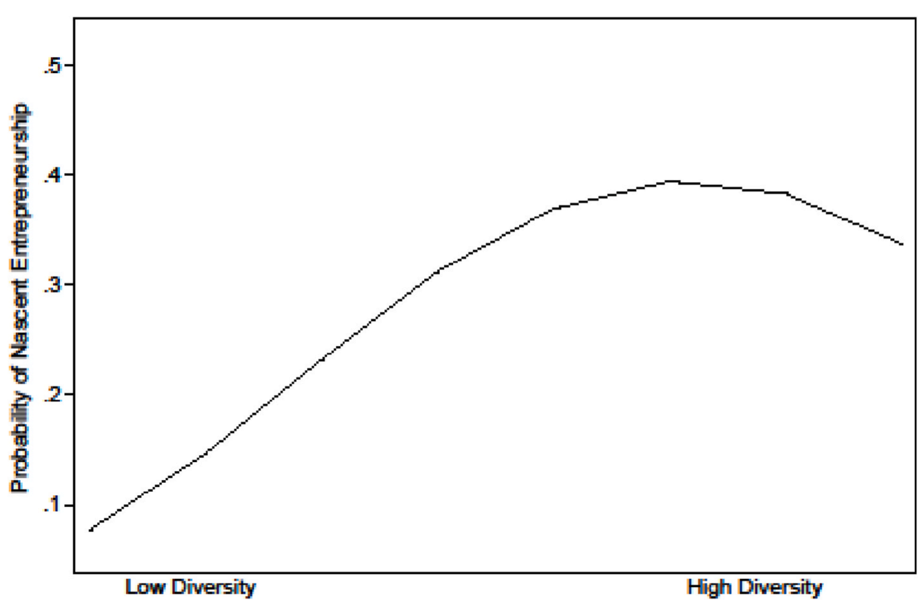

Fig. 2. Network diversity.

various levels. These include the personal characteristics of the scientists, the workplace environment and network relationships, and the concrete support offered by the respective institution. These different levels do not act in isolation but are intertwined and ideally reinforce each other to create a breeding ground to increase the quality and quantity of entrepreneurial behaviour.

In this context, and by adopting a holistic approach, we took a closer look at the individual, structural, and institutional antecedents of the intention among university scientists to start a new venture. First, we find that satisfaction with the current salary has an inhibitory effect on entrepreneurial intentions. This factor can therefore be considered to be an important push factor of academic entrepreneurship. Moreover, this result is consistent with the findings of previous empirical studies, which confirm that the influence of monetary incentives is strongly context-specific (Antonioli et al., 2016; Hayter, 2011; Lam, 2011; Rizzo, 2014). In our case, this means that – to a certain degree – scientists' dissatisfaction with their current work situation can provide motivation for entrepreneurship. At German universities, scientific staff members are predominantly employed on a temporary basis. While professors at German universities are very often employed on a permanent basis and have a secure employment relationship due to their civil servant status, most other researchers have temporary contracts with a maximum duration of 6 years before their doctorate and six years after their doctorate. This means that the majority of academic scientists at German universities are forced to look for alternative employment at some point. Widespread temporary contracts are therefore likely to be a relevant push factor, along with salaries that are perceived to be too low. The economic exploitation of research results through self-employment is one such alternative.

Several studies provide evidence that Ajzen's theory of planned behaviour (1991) is relevant for predicting entrepreneurial intentions (e.g. Feola et al., 2019; Liñán and Chen, 2009). According to the theory of planned behaviour, intentions are determined by personal attitudes, subjective norms and perceived behavioural control. This study shows that peers around the workplace also have a positive effect. Thus our results support Karimi et al. (2013) finding that role model influence entrepreneurial intention through its antecedents in the theory of planned behaviour. It seems that role models influence, e.g. subjective norms and personal attitudes towards entrepreneurial intentions. As soon as colleagues take the step to entrepreneurship more frequently, positive role models emerge, which can additionally strengthen their own motivation as well as their confidence in following this path (Guo et al., 2019). A self-reinforcing effect occurs with an increasing number of successful startups, and an entrepreneurial culture emerges. The university can support this process by offering support services that cover the entire startup process.

Concerning the network effects, the regression results largely confirm our hypotheses. Network relationships turn out to be a key feature in explaining the entrepreneurial intention to generate academic spin-offs. Potential startups are clearly influenced in the first place by private relationships but also by market-related business contacts. Potential founders strongly rely on these relationships. Moreover, we show that, from a certain network size onwards, the positive effect on entrepreneurial activity diminishes. Therefore, the results indicate that networks that are too broad are not used effectively for putting the knowledge spillovers to use, which also suggests that academics should find a balance between diversity and quality when they implement their social capital. Our results complement the findings of Diánez-González and Camelo-Ordaz (2019), which have highlighted the positive influence of market networks and university support networks on the enhancement of academic spin-offs' entrepreneurial orientation and that family and friends have not a strong impact on entrepreneurial orientation. However, our findings show that private networks seem critical for academics' entrepreneurial intention.

The fact that entrepreneurship education does not show a significant effect on entrepreneurial intentions does not mean that such lectures do not play an important role. Entrepreneurship education programmes are often designed for groups with hardly any knowledge about entrepreneurship. Training them fosters their awareness, enabling them to make an informed decision about this occupational choice rather than intending to switch blindly to self-employment (Fayolle and Gailly, 2009). This also means that individuals who – based on what they learned in the entrepreneurship education programme – recognize that being an entrepreneur may not suit their personal characteristics and needs. This is also a wanted and important result of entrepreneurship education in universities (Walter and Block, 2016). Moreover, entrepreneurship education as means to raise awareness for entrepreneurship as a career may not have immediate effects. Rather, the effects may be delayed and come to fruition years later, which can only be captured by longitudinal studies. Interestingly, we do not find that TTOs facilitate the entrepreneurial intentions of scientists. This result is, however, is in line with several other empirical findings. TTOs face problems of awareness and receptiveness among academics (Huyghe et al., 2016; Muscio, 2010). Tedious and complicated application procedures and bureaucracy make scholars –especially highly productive scientists – choose a 'back-door route' to bypass TTOs and form contracts directly with external industrial partners or investors to commercialize their research results (Aldridge and Audretsch, 2010; Fini et al., 2009).

5.2. Contributions to practice

The findings of our paper highlight the importance of having role models within departments and universities. Such role models are often seen as entrepreneurial champions and thus possess more prestige and are more persuasive in convincing their peers to engage in commercialization activities (Johnson et al., 2017). University administrators should therefore attempt to enhance the influence of role models among their colleagues. Role models are also crucial for entrepreneurship education which aims to raise awareness for entrepreneurship in general (Bosma et al., 2011). The effects of such entrepreneurship education may be delayed and not visible right away but is crucial for raising the entrepreneurial spirit in the long run. Since attitudes towards career choices are already based in adolescence, entrepreneurship education should already be implemented in school curricula in order to raise entrepreneurial spirit within the adult population. This is especially crucial for Germany, where - according to GEM – the entrepreneurial spirit and the entrepreneurial activity level is still relatively weak despite an elaborate supporting infrastructure for entrepreneurs. This entrepreneurial underperformance may be caused by a lack of representation of entrepreneurship within the educational system, especially in schools as well as the cultural perspective on entrepreneurship (Sternberg et al., 2019).

In addition, given the distinct conditions of each university and each individual, the outcomes of general policies vary depending on the university and individual settings (Sternberg, 2014). Our study shows that, for example, field of study, basic or applied research, and inventions affect the entrepreneurial intentions of university scientists. Hence, policymakers and university administrators who intend to facilitate academic entrepreneurship should first have a clear understanding of the heterogeneity of academics before starting to design policies and support mechanisms (Hayter, 2015). Differentiated and customized policies and support offers are required to adapt to the different regional contexts and to meet the diverse needs of academics (Rizzo, 2014).

The role of commercialization units, such as university TTOs, in linking scientists to external stakeholders, needs to be more visible and their focus reconsidered. TTOs often concentrate their activities on knowledge transfer via cooperation, and the stimulation of academic entrepreneurship is not considered as one of their core activities. To ensure a broad and professional entrepreneurship-facilitating infrastructure overall, smaller institutions of higher education should collaborate, for example by building clusters for entrepreneurial support and extending their networks to supportive institutions, such as chambers of industry, science parks, and universities in the region.

5.3. Limitations and future research avenues

As with any empirical work, this paper is not without its limitations, most of which, however, point to fruitful avenues for future research. For example, we included a rather small range of entrepreneurship education programmes in our analyses, and many of these offers are required courses for university members who have studied economics. Additionally, as our proxy, we did not use attendance at an entrepreneurship education programme but whether the interviewed scientist knows that such a course is offered by the university. Concerning the potential support of TTOs, for which we find no empirical support, we acknowledge that their impact depends to a great extent on their size, experience, and quality (Caldera and Debande, 2010; Gómez Gras et al., 2008; O'Shea et al., 2005; Ramaciotti and Rizzo, 2015). TTOs can consist of one single person or a large team with individual project managers and specialists as consultants, for example for legal matters, influencing the performance differently (Hülsbeck et al., 2013). Due to the data availability issues, we were not able to control for these factors, which in turn could be the reason why TTOs have no significant influence in our model.

In addition, due to the cross-level design of the study, the reverse causality of the results is an issue. Future research should therefore draw on longitudinal data to retest our hypothesized relationships. Moreover, future research could conduct a more thorough multi-level investigation into the determinants and outcomes of academic entrepreneurship, considering the heterogeneity of founders, firms, and regional and national contexts. In line with this, the interactions of various determinants among stakeholders at different levels would be particularly interesting to address. Therefore, future research should focus more on the meso- and macro-level factors that may influence academic entrepreneurship. For example, prior studies show that support infrastructures provided by universities help the development of academic spin-offs in early phases. However, the questions of whether the effectiveness and efficiency of the support are constant in the early and later phases and, if not, what the consequences are in terms of ASO performance deserve further analysis. Similarly, using longitudinal data to conduct further multilevel analysis on the collaboration channels through universities as well as investigating new knowledge transfer channels, would be very interesting. Understanding how different types of external stakeholders, along with scientists and universities, can shape individuals' decision to engage in firm creation and the ability to find the optimal combinations would benefit both academic entrepreneurs and external stakeholders. However, the results for German Universities cannot be transferred from one to one to other countries, as other contextual factors play a role there. Finally, the results should be tested across different institutional and cultural environments and across developing and developed countries.

Another limitation is that we conduct the survey before the COVID-19 pandemic, as well as the before the war in Ukraine caused by Russia's invasion. Their negative impact on global economic conditions changed the environment in recent months and years. For example, current studies provide evidence for an increased uncertainty in the context academic entrepreneurship intentions of due to global crises influences (Clark et al., 2022; Gomes et al., 2021; Sheng and Chen, 2022). Moreover, Bergenholtz et al. (2021) can show that such context variations affect self-efficacy. The entrepreneurial orientation disposition and, subsequently, the entrepreneurial intention are affected by exogenous shocks like COVID-19, but the effect differs between individuals. For resilient entrepreneurs new opportunities arise when exogenous shocks occur while the others fail (Clark et al., 2022; Krichen and Chaabouni, 2022). However, more research is needed to understand whether these effects are short- or medium- or long-term and to what extent it is necessary to align entrepreneurial education to create a conducive environment for academic entrepreneurship despite increased uncertainty.

6. Conclusions

We study whether and how working conditions, network relationships, and institutional support offers simultaneously relate to entrepreneurial intentions among German university scientists. Using unique, representative data, we find that entrepreneurial peers and monetary incentives positively affect university scientists' engagement in entrepreneurship. For practice, we emphasize that universities should create a framework that encourages exchange among colleagues on their experiences with start-ups in an academic context. We also show that networks have a substantial impact on entrepreneurial intentions. and provide evidence that the positive effect on entrepreneurial intentions diminishes from a certain network size onward. However, our results do not indicate that the propensity for entrepreneurship rises exponentially with increasing institutional support offers in universities. That is, a broad range of offers covering all the pre-founding phases does not seem to have a stronger impact on university scientists' intentions to switch into entrepreneurship than individual isolated offers. Thus, support infrastructure should be tailored to the needs of academics at each university to enhance entrepreneurial intentions.

Notes: This study is based on the Survey on Potential Drivers of Entrepreneurial Activities of Academics in Germany (Hochschulbefragung des IfM Bonn) from the Institut für Mittelstandsforschung (IfM) Bonn. All the results have been reviewed to ensure that no confidential information is disclosed. The authors' program codes will be provided upon request. Any errors are our own. This paper reflects the opinions of the authors and not necessarily those of the Institut für Mittelstandsforschung (IfM) Bonn. The authors declare that they have no conflict of interest. The authors received no financial support for the research, authorship, and publication of this article.

Data availability

Data will be made available on request.

Appendix

Table 6
Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Gender	1															
2	Age	−0.1065	1														
3	Nationality	0.0055	−0.0764	1													
4	Self-employed parents	0.0476	−0.0629	0.0622	1												
5	Self-employed partner	0.0487	0.2137	0.0322	0.0457	1											
6	Type of university	0.0063	−0.3439	0.0968	0.0312	−0.091	1										
7	STEM disciplines	−0.1707	−0.0485	0.0505	−0.026	−0.0689	0.1301	1									
8	Professor	−0.1086	0.512	−0.0685	−0.032	0.1306	−0.3189	−0.0582	1								
9	Full-time job	−0.196	0.1666	0.0397	−0.0374	−0.0027	0.0407	0.1173	0.1613	1							
10	Second job	−0.0006	0.1606	0.0912	0.0451	0.0982	−0.1558	−0.1242	0.0415	−0.1187	1						
11	Basic research	−0.0043	−0.1091	0.0666	0.0173	−0.0425	0.2864	0.1711	−0.041	−0.0326	−0.1047	1					
12	Applied research	−0.069	−0.1096	0.036	0.0085	−0.0227	0.0284	−0.039	0.025	0.1077	0.022	−0.2491	1				
13	Multidisciplinary research	−0.0212	−0.068	0.0631	0.0311	0.0036	0.1327	−0.0455	0.0208	0.0751	0.0018	0.0282	0.3378	1			
14	Invention at university	−0.1462	0.1186	0.0802	0.0053	0.0424	0.0423	0.1534	0.0986	0.1189	0.0507	0.0267	0.1393	0.1082	1		
15	Monetary compensation	−0.013	−0.039	−0.0039	0.0077	0.0108	0.0564	−0.0033	−0.0003	0.2199	−0.0513	−0.0224	0.0673	−0.0019	−0.0415	1	
16	Entrepreneurial activities among colleagues	−0.0805	0.1347	−0.0114	0.0012	0.076	0.0164	−0.0318	0.0738	0.1084	0.0862	−0.0677	0.0764	0.0773	0.1073	0.0207	1
17	Conversations among colleagues	−0.0448	−0.049	0.0236	0.0082	0.0182	0.0286	−0.0302	−0.03	0.0427	0.0538	−0.0379	0.0835	0.0822	0.0476	0.0004	0.224
18	Conversation about others	−0.0363	0.1213	0.0041	0.0276	0.0655	−0.0855	−0.0872	0.1301	0.0421	0.0721	−0.078	0.0772	0.0714	0.0458	−0.0016	0.1756
19	Networks with investors	−0.0644	0.019	0.014	0.0267	0.0138	−0.0007	−0.0244	0.063	0.0289	0.0686	−0.0226	0.0529	0.069	0.0732	−0.0223	0.1036
20	Networks with potential clients	−0.0803	0.1255	−0.0281	0.0034	0.0801	−0.098	−0.0693	0.1158	0.037	0.148	−0.1286	0.1195	0.091	0.1274	−0.0408	0.1435
21	Networks with potential business partners	−0.1051	0.0612	−0.0158	0.032	0.0629	−0.0733	−0.04	0.106	0.0573	0.1377	−0.1204	0.1395	0.1063	0.1456	−0.0256	0.1744
22	Networks with associations	−0.0455	0.1569	0.0144	0.0029	0.067	−0.1216	−0.1026	0.1521	0.0161	0.1226	−0.0873	0.0986	0.071	0.08	−0.0348	0.115
23	Networks with the private sector	−0.0599	−0.0019	−0.0169	0.0916	0.0691	−0.0331	−0.1074	0.0293	−0.0153	0.0793	−0.0781	0.0674	0.0665	0.0273	−0.0489	0.1673
24	Networks with academics in own organization	−0.1163	−0.0242	−0.0199	0.0199	0.0071	0.0183	−0.0106	0.0456	0.0604	0.0283	−0.0294	0.1475	0.1493	0.1354	0.0188	0.1667
25	Networks with academics in other institutions	−0.1047	0.0509	0.0494	0.0181	0.0259	0.0024	0.0096	0.0841	0.0659	0.0688	−0.0275	0.1232	0.1457	0.1448	−0.0208	0.1437
26	Network diversity	−0.1337	0.08	−0.0046	0.049	0.075	−0.064	−0.0771	0.1277	0.0563	0.1454	−0.1124	0.1737	0.1627	0.167	−0.0375	0.2368
27	Startup camp	−0.1005	0.024	−0.1169	−0.0131	0.0204	0.0495	0.0094	0.0712	0.0838	−0.0133	−0.0325	0.0797	0.0897	0.0839	0.0495	0.1406
28	Founder and idea awards	−0.0479	0.0067	−0.063	0.0071	0.0383	0.0424	−0.0217	0.056	0.0753	0.0112	−0.0586	0.0985	0.0935	0.0984	0.0588	0.1489
29	Consulting	−0.0859	0.0398	−0.1121	−0.0063	0.0413	0.0053	−0.0219	0.074	0.054	0.0235	−0.0351	0.0687	0.0797	0.0843	0.0363	0.1405
30	Coaching	−0.0436	0.0173	−0.0552	0.0151	0.0191	0.0378	−0.0361	0.0492	0.06	0.0394	−0.0386	0.0787	0.0956	0.0974	0.027	0.1534
31	Entrepreneurship education	−0.0657	0.0394	−0.0785	0.0172	0.0131	−0.0087	−0.0661	0.0668	0.0318	0.0326	−0.0497	0.0895	0.0751	0.0602	0.0286	0.1288
32	TTO	−0.1422	0.2764	−0.0728	−0.0133	0.056	−0.1105	0.0428	0.254	0.1443	0.0432	−0.0837	0.0775	0.0822	0.1759	0.0339	0.1473
33	Patenting support	−0.1208	0.1306	−0.0258	−0.0077	0.0375	0.0443	0.1068	0.1472	0.124	0.0311	0.0037	0.0825	0.1	0.2329	0.0192	0.1457
34	Variety of known support offers	−0.1279	0.1107	−0.114	−0.0007	0.0477	0.013	−0.0002	0.15	0.1195	0.0347	−0.0627	0.1209	0.1296	0.1712	0.0543	0.2129

		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
17	Conversations about entrepreneurial activities among colleagues	1																	
18	Conversations about entrepreneurial activities of other faculty members among colleagues	0.3463	1																
19	Networks with investors	0.0986	0.1436	1															
20	Networks with potential clients	0.1112	0.1374	0.2154	1														
21	Networks with potential business partners	0.1429	0.1676	0.2841	0.5038	1													
22	Networks with associations	0.0721	0.1366	0.1745	0.3273	0.2773	1												
23	Networks with the private sector	0.1425	0.1491	0.1935	0.2816	0.305	0.2135	1											

(*continued on next page*)

Table 6 (*continued*)

		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
24	Networks with academics in own organization	0.1464	0.1473	0.1653	0.2658	0.3064	0.2806	0.3219	1										
25	Networks with academics in other institutions	0.1061	0.122	0.1556	0.2883	0.3092	0.3114	0.2555	0.5693	1									
26	Network diversity	0.191	0.228	0.4164	0.6471	0.6774	0.5548	0.6333	0.7062	0.6839	1								
27	Startup camp	0.0969	0.1442	0.0967	0.0937	0.1247	0.0991	0.1102	0.211	0.1141	0.1994	1							
28	Founder and idea awards	0.1057	0.1574	0.1118	0.1376	0.1665	0.1317	0.1506	0.2123	0.1319	0.2443	0.4136	1						
29	Consulting	0.0855	0.1611	0.1461	0.1766	0.1693	0.1312	0.1351	0.2266	0.1476	0.2624	0.4486	0.4406	1					
30	Coaching	0.1039	0.1523	0.1499	0.158	0.1676	0.1511	0.1349	0.1986	0.1431	0.2521	0.3653	0.406	0.4393	1				
31	Entrepreneurship education	0.0886	0.1443	0.107	0.1278	0.1205	0.1438	0.107	0.2041	0.1158	0.2133	0.3726	0.3829	0.421	0.3765	1			
32	TTO	0.0579	0.1513	0.13	0.1661	0.1717	0.1637	0.1055	0.2128	0.1692	0.2548	0.3441	0.3426	0.3678	0.301	0.3157	1		
33	Patenting support	0.059	0.1385	0.1288	0.1692	0.1594	0.1375	0.078	0.189	0.1783	0.2358	0.298	0.3052	0.3231	0.2841	0.2788	0.4715	1	
34	Variety of known support offers	0.128	0.2229	0.1835	0.2151	0.2276	0.201	0.1747	0.3076	0.2093	0.3503	0.7017	0.7008	0.7343	0.6582	0.6632	0.6598	0.6073	1

Table 7
Summary of results for all hypotheses

Hypotheses	Results
H1a: University scientists who are less satisfied with their current salary will have higher entrepreneurial intentions than university scientists who are more satisfied with their current salary.	Supported
H1b: University Scientists who work closely with professional peers engaged in entrepreneurial activities will have higher entrepreneurial intentions than their counterparts who do not have such professional peers.	Supported
H2a: University scientists with more market-related network contacts will have higher entrepreneurial intentions than their counterparts without such contacts.	Supported except for contacts with business associations
H2b: University scientists with job-related contacts will have higher entrepreneurial intentions than their counterparts without such contacts.	Supported
H2c: University scientists with contacts in their private surroundings will have higher entrepreneurial intentions than their counterparts without such contacts.	Supported
H2d: There is an inverted U-shaped relationship between network diversity and higher entrepreneurial intentions among university scientists. The likelihood of higher entrepreneurial intentions first increases with increasing numbers of different network stakeholder partners and then decreases again.	Supported
H3a: Scientists working at universities offering entrepreneurship education programmes will have higher entrepreneurial intentions than those working at universities that do not provide entrepreneurship education programmes.	Not supported
H3b: University scientists working at universities with TTOs will have higher entrepreneurial intentions than those working at universities without TTOs.	Not supported
H3c: Scientists working at universities offering consultancy services for entrepreneurship will have higher entrepreneurial intentions than those working at universities that do not have such services.	Supported
H3d: University scientists working at universities offering coaching for entrepreneurship will have higher entrepreneurial intentions than those working at universities that do not provide coaching for entrepreneurs.	Supported
H3e: Scientists working at universities offering founder and idea awards will have higher entrepreneurial intentions than those working at universities that do not offer such awards.	Supported
H3f: Scientists working at universities with startup camps will have higher entrepreneurial intentions than those working at universities without such incubation support.	Not supported
H3g: Scientists working at universities that provide patent exploitation support will have higher entrepreneurial intentions than those working at universities without such patent exploitation support offers.	Supported
H3h: The likelihood of higher entrepreneurial intentions of university scientists will increase exponentially with the numbers of different support offers (i.e. with increasing rates for each additional support offer).	Not supported

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