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Crowdfunding, Industry 4.0, and Entrepreneurial Success: A Theory of Planned Behavior Approach in Emerging Markets

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Abstract

The main purpose of this study is to probe into the influence of crowdfunding on the entrepreneurial performance of small and medium-sized enterprises (SMEs) in Pakistan and to investigate the influence of Industry 4.0 technologies and the regulatory environment as the mediators and moderator, respectively. Within the context of the Theory of Planned Behavior (TPB), this study investigates how attitude, subjective norm and perceived behavioral control on part of entrepreneurs jointly affect entrepreneurs' intentions to use crowdfunding and Industry 4.0 technologies. Findings, based on data from 250 SME entrepreneurs, show that entrepreneurial performance improves significantly because of crowdfunding, and that the increased adoption of Industry 4.0 technologies reinforces the effect. In addition, the moderating effect of regulatory environment on the relationship between Industry 4.0 technologies and entrepreneurial performance is positive. By highlighting the function of digital finance and technological innovation in encouraging sustainable business practices, this research also has theoretical implications for the research on sustainable entrepreneurship and practical implications for policymakers and managers.

Keywords: crowdfunding, Industry 4.0, Entrepreneurial Performance, Theory of Planned Behavior

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1. Introduction

Given the increasing significance and complexity of major concerns, entrepreneurs must find new ways to organize their activities and handle their challenges (George et al., 2016). It is important to understand how companies are adopting sustainable practices, particularly in regard to technology, business models, and funding (Bocken & Snihur, 2020; Vasileiadou et al., 2016). However, entrepreneurial ventures shouldn't always rely on conventional finance sources (Civera et al., 2019). Introduction of new finance mechanisms such as crowdfunding has significantly changed the world of Entrepreneurship in the last few years (Kumar & Agrawal, 2024). In emerging nation like Pakistan, The crowdfunding is a new ray of hope for most people who were hesitant to take the risk of starting entrepreneurship. Before the introduction of finance methods to developing nations, coping up with development. Entrepreneur in the past face traditional obstacle, primarily due lack of sufficient capital require to start business (Kumar & Agrawal, 2024). So, relying heavily on banks or investors who often demanded high returns or collaterals (Psarrakis & Kaili, 2019). On the other side, crowdfunding has become an increasingly popular way for individuals to raise money and reduced these hurdles. This allows entrepreneurs to turn their ideas into reality by getting public help and raising small amounts from a large number of people (Dushnitsky et al., 2016). Crowdfunding not only provide an alternative route for collecting funds but also act as a catalyst for embracing innovative technologies (Rahman et al., n.d.). Scholar consistently defines crowdfunding as an online request for to fund projects with defined goals (Syafira et al., 2024). Even though crowdfunding was conceived as a means to raise funds for individuals and organizations in the creative or social sectors against nonmonetary rewards, it is only very recently that researchers have started paying attention to the relationship between sustainability orientation and crowdfunding (Psarrakis & Kaili, 2019). But entrepreneur in emerging nation not usually adopt crowdfunding because of their hesitation like lack of trust, lack of regulation, lack of awareness, fear of fraud, privacy issues. Here come the industry 4.0 to overcome these issues. Companies are adopting industry 4.0 integration with Industry 4.0 technologies like AI, the IoT, and big data. So here would more trust to adopt crowdfunding through more transparency and a better understanding of investors, these technologies streamline business operations (Syafira et al., 2024). However, entrepreneur in developing countries are hesitant to use crowdfunding because of problems including privacy, fraud, insufficient regulation, ignorance, and a lack of trust. This is where industry 4.0 to step in to address these challenges. Companies are adopting industry 4.0 with integrated technologies such as IoT, big data and AI. These technologies enable to build trust by offering more transparency and providing investor with better insights. It also streamline business operations, making crowdfunding more reliable and attractive option (Syafira et al., 2024).

Yosipof et al., (2024) highlighted, businesses with adopting industry 4.0 can scale more efficiently, reduce waste, and align their models

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with sustainability goals. This combination of advanced technology and accessible funding fosters ventures that are not only profitable but also contribute to long-term social and environmental impact. Through these advancements, entrepreneurs streamline their processes and create more sustainable business practices. Crowdfunding is a creative finance solution that can help addressing sustainability issues. It is often considered as a complement to the traditional forms of entrepreneurial financing (Wolniak, 2023). The recurrent definition in literature describes crowdfunding as an open call, through the Internet, for the provision of financial resources to support initiatives for specific purposes (Talukder & Lakner, 2023). Crowdfunding has been around for a while, but sustainability-oriented crowdfunding is a relatively new concept (Bargoni et al., 2024). This is despite the fact that crowdfunding was originally designed to facilitate non-monetary rewards for creative and social causes (Tiwari et al., 2023).

Over 80% of Pakistan's non-agricultural workforce is employed by small and medium firms (SMEs), which account for more than 40% of the country's GDP (Tiwari et al., 2023). Sustainable practices and Industry 4.0 technology are being adopted by these businesses, indicating a shift toward more eco-conscious and forward-thinking methods. The use of green certifications and eco-labels is on the rise among Pakistan's SMEs, with over 70% expressing an interest in implementing sustainable practices (KHAN et al., 2023). According to (RAZA et al., 2023), Around 65% of SMEs have introduced automations in their operations, integrated sensor and utilized advance technologies as a part of industry 4.0. Wassan et al., (2024) found that the adoption of these technologies would reduce 20% production cost and 15% increase in productivity. In developing nations, SMEs are particularly focus on operational efficiency while reduction in environmental impact. Both internal operating demands and external regulatory frameworks are pushing this company to adopt more sustainable practices. National and international efforts to reduce environmental effect are being bolstered by these policies, which are putting more pressure on corporations to implement sustainable practices. Businesses are under pressure from these rules to adopt more sustainable practices, such as cutting down on carbon emissions and making better use of energy (Yáñez-Valdés & Guerrero, 2023). Additionally, international sustainability norms are becoming more important in international trade, as both foreign markets and customer place a premium on partnering with ecologically conscious enterprises (Dinh et al., 2024). Utilizing Industry 4.0 technology presents a chance for small and medium-sized enterprises (SMEs) in Pakistan to improve resource efficiency and innovation while still meeting these legal criteria. Businesses are being pushed towards more sustainable and technologically sophisticated practices by both the regulatory landscape and global market expectations. This is helping them to remain competitive on a global scale in the long run (Tan & Reddy, 2024).

There is a growing amount of pressure on firms to implement environmentally friendly practices and fulfill international sustainability

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standards from both domestic rules and demands from global commerce (Amoozad Mahdiraji et al., 2023) . Sustainable, innovative, and creative businesses that use cutting-edge tech every day need more money. Many business owners continue to struggle when trying to secure capital for expansion, even with the prevalence of innovative fundraising strategies like crowdfunding. If the rules of crowdfunding platforms aren't clear and useful, they risk turning off both entrepreneurs and investors. Rules that promote the adoption of Industry 4.0 technology might be a game-changer in addressing these issues (Yáñez-Valdés & Guerrero, 2023). The shift toward transparency and accountability brought by these reforms has the potential to increase confidence in digital platforms and investor involvement. However, there is a severe dearth of evidence demonstrating how the regulatory framework regulates this association (Rizwan et al., 2024). Consequently, there is a dearth of literature in two respects: first, crowdfunding was considered as an independent variable in this study; and second, prior research, particularly in Pakistan, has ignored the role of Industry 4.0 technologies as mediators between crowdfunding and sustainable entrepreneur performance. Second, it seeks to fill a significant gap in the current literature by examining the dynamic interaction between industry 4.0 and the sustainable performance of entrepreneurs by using the moderating effect regulatory environment between industry 4.0 and entrepreneur performance.

This study aims to examine the impact of crowdfunding on the long-term viability of businesses, with a focus on the mediating effect of Industry 4.0 technologies between crowdfunding and entrepreneur performance. The findings of this study contribute both theoretically and practically. Theoretically, this study investigating the relationship between crowdfunding, the adoption of Industry 4.0 technologies, the regulatory environment, and the sustainable performance of entrepreneurs in the setting of small and medium-sized enterprises (SMEs) in Pakistan. The model is based on the Theory of Planned Behavior (TPB) to investigate their collective impact on promoting **sustainable entrepreneurship** in emerging markets. TPB elucidates how entrepreneurs' attitudes towards these funding and technological solutions, shaped by subjective norms and perceived behavioral control, influence their willingness to adopt these approaches. Practically, this study offer the guide line for the manager, may use the study's recommendations on sustainable practices and cutting-edge technology to improve their employees' productivity. In addition, the study gives policymakers valuable information that they can use to create programs and rules that encourage businesses to be more sustainable and to adopt new technologies. These findings help stakeholders, such as NGOs and industry groups, provide better support for sustainability-driven SMEs in the country. This research helps small and medium-sized enterprises (SMEs) in emerging nation embrace sustainable business practices by bringing attention to the issue.

2. Literature

Entrepreneurship, according to most experts increases creativity, generates employment opportunities, and promotes social and economic

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development (Rezaei-Moghaddam et al., 2023). But research has shown that entrepreneurial initiatives and small and medium-sized firms (SMEs) face market inadequacies that limit their contribution and survival (Block et al., 2024). One major issue facing enterprising SMEs, for example, is their limited access to external financing sources, such as bank loans or equity capital, in the early phases of their operations (Coakley & Huang, 2023). This may be because disparity between the demand for financing and financial providers could be the cause of this (Asad et al., 2024). Instead of depending solely on specialized investors to meet their financial needs in such situations, entrepreneurs try to use creative strategies (Rataj et al., 2024). According to Mamaro & Sibindi, (2024) SME founders have recently turned to the "crowd" for funding by involving them in their ventures as either active consumers or funders. In contrast to traditional financing, crowdfunding has emerged as a collaborative entrepreneurial innovation (Bruton et al., 2015; Block et al., 2018).

2.1 Crowdfunding on Entrepreneur Performance

The modern world has become more dynamic and competitive, making it harder to survive in everyday settings, including the economic sector. Because finance is more harder to come by these days and investors are wary of the unknown risks, many small and medium-sized business owners are terrified of this competitive atmosphere. Lack of finance sources for product development is one of the issues that entrepreneurs frequently encounter. As a result, crowdsourcing may be a viable option for investors looking to support the growth of undeveloped enterprises. Thanks to crowdfunding, anyone may launch a business from anywhere in the world. The internet has generated a vast array of applications by establishing a worldwide network of people. Crowdfunding is one such innovative online application (Shneor et al., 2024). Michael Sallivan coined the term "crowdfunding" in 2006 (Meghouar et al., 2023). Since crowdfunding is regarded as a financial seeding mechanism for businesses, it has a lot of promise even though it is still in its infancy (Dehghani et al., 2023). Crowdfunding is a new digital business model that uses the internet as a mediator to raise small amounts of money from a large number of individuals in order to start a business (Gupta et al., 2023). Since everyone has access to the internet these days, certain websites allow investors and entrepreneurs to raise capital (Bachmann et al. 2011). Crowdfunding is a complicated phenomenon since its economic model may be reward-based, equity-based, donation-based, or peer-to-peer (P2P) (Telles et al., 2024). Without the help of conventional money lending organizations, an entrepreneur can raise money from private lenders, according to the P2P principle. Because people without bank accounts could not get bank loans and were therefore compelled to pay exorbitant interest rates to moneylenders, the strategy became popular (Oktaviani & Dewi, 2023).

The idea of equity-based crowdfunding is to replace the money raised with stock (Lukkarinen, 2020). The growth of equity-based crowdfunding accelerated in early 2010. However, due to stringent regulatory scrutiny and unclear legislation governing share issue, there has

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been a steady decline since 2016 (Battisti et al., 2024). The reward-based crowdfunding strategy gives investors non-cash rewards like dinner with the company's CEO or a T-shirt with the logo of the business (Yulandreano & Rita, 2023). Reward-based crowdfunding is also regarded as the most effective marketing strategy (Corsini et al., 2024). Raising money for charitable purposes is the primary objective of donation-based crowdfunding (Brown et al., 2017). There are more benefits to crowdfunding than merely ways to get money (Nucciarelli et al., 2017). Additionally, crowdfunding has been acknowledged for providing awareness and opportunities to attract people or test business ideas in competitive marketplaces (Ramos & Stewart, 2014). While there has been prior research on crowd funding, the majority of that research has focused on its financial benefits (De Luca et al., 2019). Instead of addressing crowdfunding's broader, complex consequences on entrepreneurship, such as strategic help and innovation promotion, much prior research has concentrated on its role in supplying startup capital (Rossi, 2014). The challenges and barriers faced by entrepreneurs while utilizing crowdfunding have not received much attention.

2.2 Adoption of Industry 4.0 Act as an Mediating

Digitization has been widely utilized across various aspects, such as fund facility management and data management (Syafira et al., 2024). In the landscape of contemporary finance, the rise of digital technology has fundamentally changed conventional financing models (Rubanov et al., 2019). Success in crowdfunding requires a thorough and accurate knowledge of projects' innovative and effective drivers. The drivers are the factors that force entrepreneurs to choose crowdfunding as a source of funding and lead them to this approach (Yensu et al., 2024). The resource efficiency, waste reduction opportunities and circular economy enabled by Industry 4.0 technologies such as AI, IoT, and advanced manufacturing can also play an important role in promoting sustainable entrepreneurship (Kazachenok, 2021). These technologies are enabling green businesses and consequently, entrepreneurs are able to use less energy, do less harm to the environment and deliver products that meet sustainability objectives on a greater scale. The adoption of smart and data intelligent systems motivates the entrepreneurs to innovate, which in return addresses present day environmental as well as social issues with great emphasis on sustainable remain development (Kazachenok, 2021). There is no doubt that enhancing the performance of the contributors to entrepreneurship has become the core tenet of recent developments in so many industries and especially those that rely on crowdfunding to fund their operations. Access to capital has been democratized by crowdfunding which means that entrepreneurs can reach out for resources from beyond the confines of formal financial institutions. Still, the use of Industry 4.0 innovations considerably increases the crowdfunding effectiveness in enhancing the output of the entrepreneurship (Strazzullo et al., 2022).

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2.3 Regulatory Environment as an moderating

The development of the link between entrepreneurialism and industry 4.0 technologies relies heavily on the examination of environmental factors. Automation, AI, and big data are at the forefront of the fourth industrial revolution, which has the potential to boost entrepreneurial success by giving businesses opportunity to innovate, grow quickly, and adapt to changing market conditions (Raj et al., 2020). However, the regulatory framework that these technologies are implemented within can either enhance or diminish their effects (Al-Swidi et al., 2023). The successful adoption of Industry 4.0 technologies and enhancement of entrepreneurs' performance can be achieved through the existence of a supportive regulation that defines data protection, intellectual property, and cyber laws (Díaz-Chao et al., 2021). There are such regulations that encourage the adoption of technology and offer tax relief and incentives to business that invest in new technologies (Hassoun et al., 2023). Regulations that are poorly defined may create barriers to creativity, delay the implementation of technology, and reduce the benefits of these technologies. Kiel, (2017) assert that the regulatory environment acts as a contextual variable whereby it may either promote or suppress the positive entrepreneurial gains derived from Industry 4.0 technologies depending on how innovation and transformation agendas of technology are encouraged. Therefore, entrepreneurs who concern themselves with the implementation of Industry 4.0 strategies in the management of their businesses are likely to realize more success when they are within a favorable regulatory environment on the other hand, those operating in a restrictive environment may encounter difficulties in reaping such benefits fully (Alhammad et al., 2021).

2.4 Theoretical framework

Theory of planned behavior (TPB) provide a strong theoretical foundation for understanding decision making process of entrepreneurs within the existing research model that combines the concepts of Industry 4.0, crowdfunding, entrepreneurial performance, and the regulatory framework. TPB postulates that entrepreneurial behavior is contingent upon three variables, namely: attitude, subjective norms, and perceived behavioral control. In this model, favorable attitudes of entrepreneurs toward the adoption of Industry 4.0 and crowdfunding will likely lead to the adoption of these innovations since such individuals evaluate that there will be efficiency and effectiveness in their businesses (Yulandreano & Rita, 2023). Subjective norms, defined as the influence of other people, such as, peers, industries or even stakeholders, for instance, contribute positively to the entrepreneurs' decision on adopting these tools to avoid being outdone. Lastly, an entrepreneur's belief about being able to apply the Industry 4.0 paradigm and run crowdfunding processes is moderated by external issues that relate to the regulator (Shneor & Munim, 2019). When a regulatory framework is established, it can give entrepreneurs more control by supporting faster adoption of technology and boosting innovation, compared to situations where regulations are lacking (Kazaure et al., 2020). Therefore, the Theory of Planned Behavior

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(TPB) helps explain how psychological factors, combined with external regulatory influences, shape entrepreneurs' intentions and actions, which in turn impact their overall performance outcomes (Lee & Park, 2022).

2.5 Conceptual model

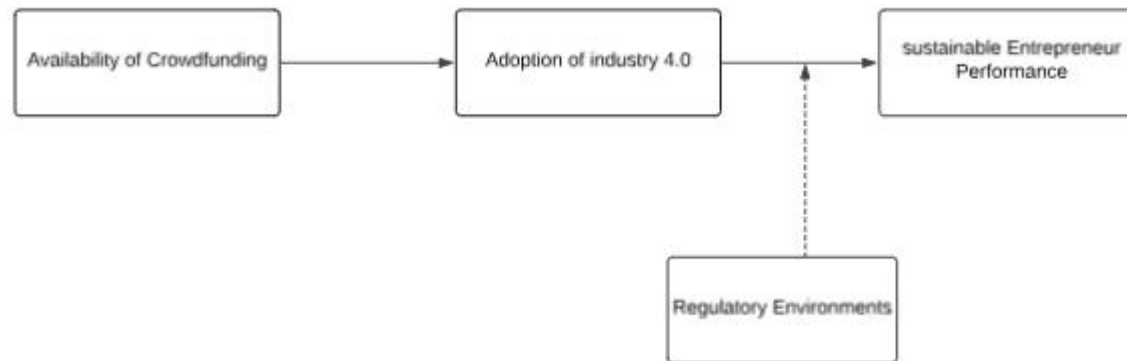


Fig 1. Conceptual framework

3. Methodology

In order to gather the required data and information, a list of registered SMEs enterprises was obtained from Pakistan's Small and Medium Enterprises Development Authority (SMEDA). The list was tailored to manufacturing firms, as they play a crucial role in the country's economy. Similarly, LinkedIn data covering SMEs' top-level managers and Entrepreneur from the Bangladesh. These surveys access the knowledge of crowdsourcing and the fourth industrial revolution. In addition, we wanted to know their thoughts on environmental regulation and how they felt it might affect the success of entrepreneurs. G*Power calculations with an effect size of 0.3 and a power of 0.95 indicated that a minimum sample size of 120 was required; nonetheless, 250 questionnaires were distributed, exceeding this recommendation. Therefore, the sample size was assured to be reliable, and a 95% confidence interval ensure the reliable sample size (Kang et al., 2024).

3.1 Measurement scale

This study's questionnaire consists of two primary parts. Gender, occupation, company age, and company size are some of the demographic

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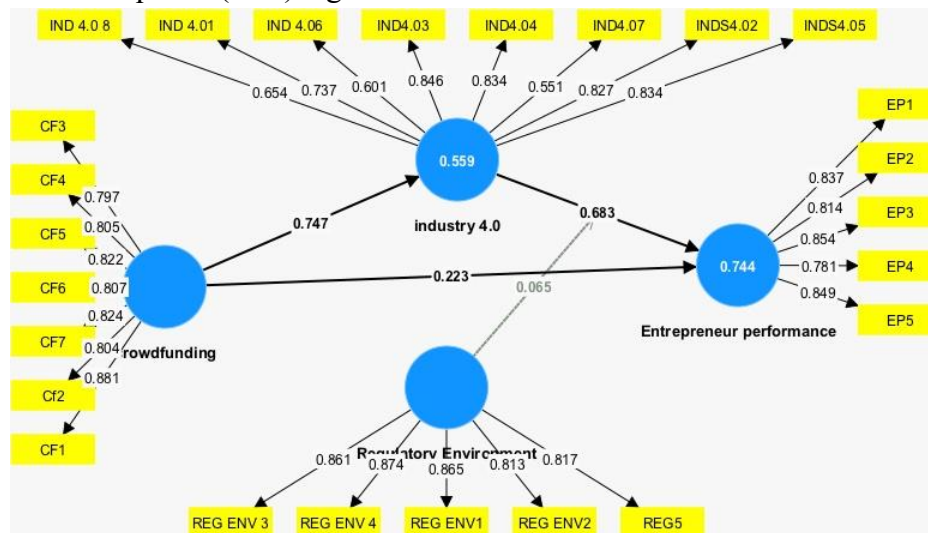
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details collected in the first part. The following part contains research questions that relate to the study's main variables and are based on prior studies. Eight elements from (Tortorella & Fettermann, 2018) have been adapted for the industry 4.0, while seven items from Sahaym et al., (2021) are included in the crowdfunding. One example is that "the crowdfunding campaign heightened awareness regarding the project or product. Five Regulatory Environment items from (Morgan, 2021), The respondents were asked to rate their understanding of Regulatory Environments with industry 4.0 effect on Sustainable Entrepreneur Performance. While five items of entrepreneur performance from (Paulraj, 2011)

3.2 Measurement Model

First we have established multivariate assumptions of normality, linearity, multicollinearity, homoscedasticity, and independence of residuals., this study proceeded to the model evaluation stage (Model Fitness) have aligned with the established standardized frameworks (Dash & Paul, 2021; Hair et al., 2019) where the model achieved all the recommended goodness of fit measures with, $\chi^2 / df = 2.25$, $GFI = 0.910 > 0.9$, $NFI = 0.943 > 0.9$, $CFI = 0.952 > 0.9$, $RMSEA = 0.032 < 0.8$, $SRMR = 0.073 < 0.08$. Construct validity and reliability test of the study was carried out by the use of partial least squares (PLS) algorithm.



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Fig2. Measurement model

Table 1: Reliability & Validity

Variable	Factor Loading	Cronbach Alpha	CR	AVE
CF1	0.881	0.919	0.922	0.673
CF2	0.804			
CF3	0.797			
CF4	0.805			
CF5	0.822			
CF6	0.807			
CF7	0.824			
Ind 4.0 1	0.737	0.882	0.901	0.554
Ind 4.0 2	0.827			
Ind 4.0 3	0.846			
Ind 4.0 4	0.834			
Ind 4.0 5	0.834			
Ind 4.0 6	0.601			
Ind 4.0 7	0.551			
Ind 4.0 8	0.654			
Reg Env1	0.865	0.908	0.930	0.716
Reg Env2	0.813			
Reg Env3	0.861			
Reg Env4	0.874			

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Reg Env5	0.817			
EP1	0.837	0.885	0.887	0.685
EP2	0.814			
EP3	0.854			
EP4	0.781			
EP5	0.849			

The results demonstrated that all constructs have reliability of the Cronbach alpha and composite values more than the threshold of .7, as shown in Table 1 and Figure 2. This provides evidence of construct reliability within the measurement model of Hair et al., (2013). Yet on the AVE regard all of these values were found to be higher than the baseline threshold of 0.50 confirming that all the items were successfully converged with such particular construct endorsing construct convergent validity (Hair et al., 2019). This table further explained items' outer loading on their respective constructs, where the threshold value is 0.7. Table 2 shows the results of Fornell and Larcker's criterion to test for discriminant validity. We found that the intercorrelation coefficients were less than the squared roots of the AVE values. So, Discriminant validity conditions were satisfied according to these results.

(Ab Hamid et al., 2017).

Table 2: Discriminant Validity (Fornell and Larcker)

	Entrepreneur performance	Regulatory Environment	crowdfunding	industry 4.0
Entrepreneur performance	0.828			
Regulatory Environment	0.104	0.846		
crowdfunding	0.732	0.125	0.820	
Adoption of industry 4.0	0.845	0.202	0.747	0.744

3.3 Structural Model

Table 3 and Figure 3 show the results of our study's hypothesis testing, which was done using bootstrapping methodology. This involved creating 5,000 random subsamples and a 95% confidence interval. It analyses the relationship between crowdfunding and entrepreneur performance, the results show that crowdfunding significantly improves entrepreneur performance, supported by a coefficient of $\beta = .221$ and a significance level

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of p value < .05, thus confirming our initial hypothesis (H1).

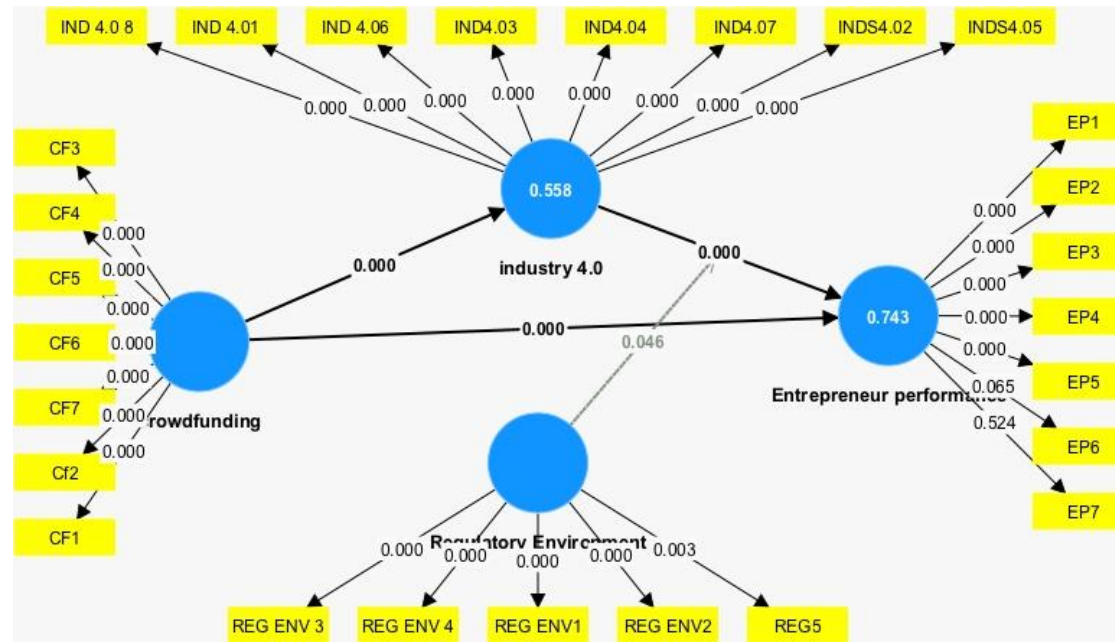


Fig 3. Structural Model

Table 3: Structural Model 1

Hypothesis	Beta	Sample mean	St. Dev	T-state	P-value
CF->EP	0.221	0.222	0.044	5.022	0.000

The adoption of industry 4.0 and its innovative integration with crowdfunding financing solutions leads to greater entrepreneur performance, as shown in Table 4. The results show that there is a strong and positive relationship between the adoption of Industry 4.0 and the performance of entrepreneurs through an indirect path, with a coefficient of $\beta = .511$, t-state = 16.408 and p-value = 0.000. Additionally, their

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direct relationship is still significant, lending support to our third hypothesis (H3). Partial mediation is elucidated by the results.

Table 4: Structural Model 2

Hypothesis	Beta	Sample mean	St. Dev	T-state	P-value
CF->Ind 4.0>EP	0.511	0.512	0.031	16.486	0.000

Table 5: Structural Model 3

Hypothesis	Beta	Sample mean	St. Dev	T-state	P-value
DMC->EP	-0.050	-0.042	0.029	1.741	0.082
MDC*DBM>EP	0.063	0.057	0.031	1.998	0.046

This research assessed the moderating effect of Regulatory Environment in understanding the relationship between Ind 4.0 and their entrepreneur performance. Based on the outcomes presented in the table 5, it can be described that Regulatory Environment positively affected the relationship between Ind 4.0 and Entrepreneur performance at $\beta = .063$, p value < .05. This explains our Hypothesis H5 that Reg Env positively moderate the Ind 4.0 - EP nexus. This relationship further explained through graph in figure 4.

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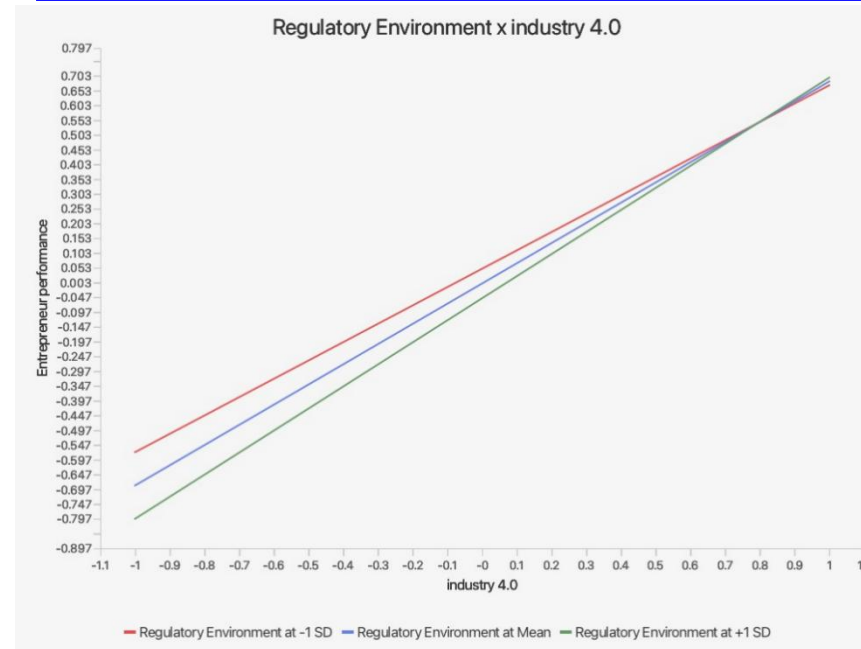


Fig 4. Moderation Analysis

there is an observable distinct pattern of the line corresponding to Env Reg which indicates a steeper increase in the performance of entrepreneurs with to the adoption of Ind 4.0.

4. Discussion

Modern SMEs are putting more emphasis on internal capabilities like capital raising and technology adoption in order to increase their competitiveness and growth. Simultaneously, they are adjusting to outside influences, such as the regulatory landscape. In order for businesses to react quickly to shifting market conditions and grab new opportunities, these dynamic elements are essential drivers of entrepreneurial performance. This research seeks to analyze the impact of digital advancements on entrepreneurial success, specifically in relation to crowdfunding immediacy factors and regulatory environment factors, using the Theory of Planned Behavior as a foundation. Attitudes, subjective standards, and perceived control of behaviors are the three components that TPB assumes originate intents and behavior. All of this

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lines up nicely with the functions of crowdfunding and the effects of regulatory variables. Entrepreneurs' willingness to adopt will be driven by positive sentiments regarding the crowding of digital advances and subjective standards from their professional network. They believe they can manage these advances based on how empowered or constrained they see the regulatory environment to be. This research delves into the mediating function of Industry 4.0, specifically how it improves entrepreneurs' success by increasing operational efficiency and responsiveness to markets, which in turn helps crowdfunding achieve its efficacy. When the regulatory environment was included as a moderator in TPB, it showed that by supporting regulation, subjective norms were enhanced, leading to increased perceived control behavior in technology adoption.

The data for this study were collected through structured questionnaires administered to 250 Entrepreneur and top level management of SMEs. The findings of this study support Hypothesis H1, indicating that crowdfunding has a significant positive impact on entrepreneurial performance with ($\beta = 0.221$, ST.Dev = 0.222, T-value= 5.022 P-value =0.00) consistent with prior research (Bargoni et al., 2024; Ashaal et al., n.d.). This result aligns with previous research (Liu et al., 2023; Amoozad Mahdiraji et al., 2023), that shows crowdfunding provide business with essential financial resources and economic growth as well, Jamil et al., (2023) found that crowdfunding provides an alternative financing option for firms in Pakistan, leading to better performance and business sustainability. Similarly, Rizwan et al., (2024) emphasized that crowdfunding platforms enable small businesses to meet their financial requirements, facilitating growth opportunities and improving their overall competitiveness. Hypothesis H2 demonstrates that the industry 4.0 mediates the relationship between Crowdfunding and Entrepreneurial Performance, confirmed by our study findings ($\beta = 0.511$, ST.Dev= 0.031, T-value= 16.486, P-value= 0.000). Although the literature on this specific mediation is limited, some studies provide initial evidence supporting this relationship. For instance, Díaz-Chao et al., (2021), Naderi et al., (2019), and Lu & Yu, (2022) suggest that adopting an industry 4.0 allows firms to better utilize the funds raised through crowdfunding, optimizing their business strategies to enhance performance. This study further explore Hypothesis H3, demonstrating that Regulatory Environment moderates the relationship between industry 4.0 and Entrepreneurial Performance ($\beta = 0.063$, ST.Dev= 0.031, T-value= 1.998, P-value= 0.046). The finding highlight that Regulatory Environment exert pressure on firm to adopt innovation and evolve green business practices in response to external pressure. By doing so this would increase the performance of firm (Díaz-Chao et al., 2021). The results shows that firms are heavily influenced by external factors, such as competitor innovation, access to financing tools, regulatory changes, evolving technologies, and shifting customer preferences.

5. Conclusion

This article shed light on one facet of how developing-world nations are using crowdfunding and Industry 4.0 technology to boost

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entrepreneurial performance. This study utilizes the Theory of Planned Behavior to demonstrate how elements within an entrepreneur's control, such as their favorable attitude toward digital innovations, interact with those outside their control, such as the regulatory environment, to impact their intents and actions. Given this, the regulatory landscape and Industry 4.0's mediating function provide insight into the ways in which internal strengths and external factors interact to determine an entrepreneur's level of success. Regulatory pressure and practical digital tools work together to help SMEs succeed in ever-changing marketplaces, according to this study's findings.

6. Theoretical and Practical Contribution

The current investigation contributes substantially to the area of entrepreneurial management by investigating, in depth, the connections between crowdfunding and entrepreneurial performance in developing countries. The study examines how industry 4.0 and other new financial innovations and financing tools might significantly improve the effect of crowdfunding on business performance by introducing them as intermediaries. This research makes a valuable contribution to the entrepreneurship management literature by exploring the relationship between crowdfunding, Industry 4.0, and entrepreneurial performance, particularly in the context of developing nations. This study also makes use of the moderating effect of the regulatory environment, drawing attention to the ways in which market dynamics and competitive pressures push entrepreneurs to embrace industry 4.0 in order to boost their success as entrepreneurs. This study adds to the current literature by applying the Theory of Planned Behavior (TPB) to show how crowdfunding and attitudes towards technology are internal factors that influence entrepreneurial intentions and behaviors, and how these factors interact with regulatory conditions and economic shifts as external influences. This theory-practice-based method highlights the role that entrepreneurs' attitudes, subjective norms, and perceived control have in shaping their exploitation of internal resources and external market circumstances, which in turn affects the overall performance of small and medium-sized enterprises (SMEs) in developing nations. The research has important implications for managers and company owners. It would give practical advice on how to increase sustainable performance with the help of industry 4.0 strategy and crowdfunding. By strategically embracing modern technologies, entrepreneurs can improve their understanding of technological methods, allocate funds more efficiently, and reduce environmental impact. This allows them to stay competitive in the marketplaces.

7. Limitations and Direction for Future Research

Although the study's findings are helpful, it's vital to note its limitations so that similar studies in the future can be better addressed. Initially, the majority of the respondents were from Pakistan, and the data was gathered through LinkedIn. The generalizability may be limited and the sample bias increased as a result of this. The varied spectrum of small and medium-sized enterprises (SMEs) in developing nations is underrepresented

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in the second sample of 250 entrepreneurs. Another limitation is that we can't draw any firm conclusions about cause and effect because this study was cross-sectional and data was only taken at one point in time. Using a mix-method strategy that combines standard surveying with in-depth interviews or secondary data sources might help future research overcome these limitations and deliver more thorough findings.

The possible role of sustainability in entrepreneurship may also be the subject of future research. This view examines the relationship between environmental concerns and the effectiveness of a company's sustainable operations. Further research on women's empowerment could provide light on the ways in which gender diversity affects business success and the strategies that emerge from these findings. For instance, studies focusing on women-led enterprises may provide light on the unique possibilities and threats that these companies have when it comes to crowdfunding. These characteristics should be taken into account by future studies since they might provide important details on the long-term viability and prosperity of businesses.

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